FOURTH NATIONAL REPORT OF THE REPUBLIC OF KAZAKHSTAN

ON

COMPLIANCE WITH THE OBLIGATIONS OF THE JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Nur-Sultan, 2020

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List of Acronyms

BN	Fast Reactor
Branch IAE NNC	Branch Institute of Atomic Energy of National Nuclear Center of the
RK	Republic of Kazakhstan
CA	Critical Assembly
CAESC ME	Committee of Atomic and Energy Supervision and Control of the Ministry of Energy
CES MIA RK	Committee of Emergency Situations of the Ministry of Internal Affairs
CERC MEGNR RK	Committee for Environmental Regulation and Control of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan
CQCSGS MH RK	Committee of Quality Control and Safety of Goods and Services of the Ministry of Health of the Republic of Kazakhstan
CIDIS MIID RK	Committee for Industrial Development and Industrial Safety of the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan
Ci	Curie (activity measurement unit)
CMP	Chemical and Metallurgical Plant
CP	Cooling pond
DF	Disposal Facility
Dual-use cask	DUC
EDR	Exposure Dose Rate
EKR	East-Kazakhstan Region
FTP	Fission-Type Propulsion
FE	Fuel Element
FA	Fuel Assembly
Gy	Gray (absorbed dose measurement unit)
IR	Ionization Radiation
ILRW	Intermediate Level Radioactive Waste
HP	Household Plumbing
HLRW	High Level Radioactive Waste
HLRWDF	High Level Radioactive Waste Disposal Facility
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
INP	Institute of Nuclear physics
IRS	Ionizing Radiation Sources
JSC	Joint Stock Company
JV	Joint Venture

LLRW	Low Level Radioactive Waste
LMC	Liquid Metal Coolant
LRW	Liquid radioactive waste
LLRWDF	Low Radioactive Waste Disposal Facility
LRWSF	Liquid Radioactive Waste Storage Facility
MMP	Mining-and-Metallurgical Complex
MCC	Mining and Chemical Complex
MOC	Mining and Ore Complex
MIA RK	Ministry of Internal Affairs of the Republic of Kazakhstan
NFC	Nuclear Fuel Cycle
NM	Nuclear Materials
NPP	Nuclear Power Plant
NREI	Nuclear Radiation Electro physical Installation
PC	Processing Complex
PVA_{pop}	Permissible Volumetric Activity
RD	Regulation Document
RITEG	Radioisotope thermal electric generator
RF	Reactor Facility
RK	Republic of Kazakhstan
RNM	Radioactive non-nuclear materials
RR	Research Reactor
RRC	Research Reactor Complex
RS	Radioactive substances
RW	Radioactive Waste
RWA	Radiological Warfare Agents
SCS	Safety Control System
SPZ	Sanitary Protection Zone
Sv	Sievert (equivalent dose measurement unit)
SRDW	Scientific research and development work
SA	Supervised Area
SAR	Safety Analysis Report
SF	Spent Fuel
SFA	Spent Fuel Assembly
SNF	Spent Nuclear Fuel
SNF CSF	Spent Nuclear Fuel Cask Storage Facility
SPF	Sodium Processing Facility

SRW	Solid Radioactive Waste
SRW SF	Solid Radioactive Waste Storage Facility
SMCC	Stepnogorsk Mining and Chemical Complex
SSCR	Self-Sustaining Chain Reaction
STR	Special Technical Requirements
STS	Semipalatinsk Testing Site
SWT	Special Water Treatment
TR	Technical Regulations
WWR	Water-Water Reactor

PREFACE

In 1997, the Republic of Kazakhstan (further – RK) joined the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (further – Joint Convention). RK Law # 246-IV of the Convention ratification was signed on February 3, 2010. Therefore, the Republic of Kazakhstan undertook a commitment to perform the certain actions in order to adjust its national strategy in the area of spent fuel and radioactive waste management in accordance with IAEA recommendations.

This National Report is the Fourth National Report of the Republic of Kazakhstan and has been prepared in accordance with Article 32 of the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management.

The National Report on compliance with the obligations of the Joint Convention covers the activities and cases for the period beginning from 2017 up to current time.

Certain issues of the implementation of the articles of the Convention, detailed in the three previous National Reports of the Republic of Kazakhstan and which have not undergone changes over the past period, are just summarized in this report.

The report was prepared by the Committee of Atomic and Energy Supervision and Control of the Ministry of Energy of the Republic of Kazakhstan (CAESC ME RK) with the participation of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan (environmental protection functions), the Committee for Quality Control and Safety of Goods and Services of the Ministry of Health of the Republic of Kazakhstan (functions of a state body in the field of sanitary and epidemiological welfare of the population), the Ministry of Internal Affairs of the Republic of Kazakhstan (issuance of permits and protection of facilities), the Committee for Industrial Development and Industrial Safety of the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan (functions of control and supervision in the field of industrial safety), the Committee for Emergency Situations of the Ministry of Internal Affairs of the Republic of Kazakhstan (functions of elimination of man-caused accidents). Currently, the process of creating the Ministry of Emergency Situations is underway, it is expected that it will be fully completed after the National Report is posted on the IAEA website, therefore the related changes will be considered in the Presentation from the country.

Over the past period, the following changes have occurred in the legislative framework of the Republic of Kazakhstan related to the use of atomic energy:

The Draft Law "On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on the Use of Atomic Energy" was developed and in November 2019 was submitted to the Mazhilis of the Parliament of the Republic of Kazakhstan, and in October 2020 it will be submitted to the Senate of the Parliament of the Republic of Kazakhstan.

The Law provides for the introduction of amendments and additions to the following legislative acts of the Republic of Kazakhstan:

1. The Law of the Republic of Kazakhstan "On radiation safety of the population";

2. The Law of the Republic of Kazakhstan "On the Use of Atomic Energy";

3. The Law of the Republic of Kazakhstan "On Permits and Notifications".

The Republic of Kazakhstan continues the process of improving regulation in the field of atomic energy use to eliminate legal conflicts and gaps.

In particular, a number of definitions and terms have been clarified in order to avoid double interpretation in the application of the Laws provisions, for example, such definitions as

“exemption level”, “storage site”, “management of atomic energy use objects”, “nuclear facility”, “nuclear materials "," “principle of emergency optimization", etc.

Attention was paid to the specification of necessary design documents for nuclear facilities and disposal sites, which must undergo state environmental and health review, and the types of nuclear facility documents changes, which must be reported to regulator.

In 2019, a draft law "On the Semipalatinsk nuclear safety zone" was developed to ensure radiation and environmental safety in the contaminated territories of the former Semipalatinsk test site and adjacent lands, to rehabilitate the territory and strengthen state control over the use of former test site.

Draft law "On the Semipalatinsk nuclear safety zone" provides for:

1) creation of a special zone - "Semipalatinsk nuclear safety zone" on the lands of the former Semipalatinsk test site and adjacent territories, exposed to radioactive contamination;

2) limiting the spread of radioactive contamination;

3) remediation of the territory of the Semipalatinsk nuclear safety zone by collection, storage and disposal of historically generated radioactive waste on the territory of former test site;

4) continuous monitoring of the level of radioactive contamination on the territory of the Semipalatinsk nuclear safety zone.

At the moment, work is underway in Kazakhstan to introduce amendments and additions to the draft Environmental Code, including the part that deals with radioactive waste management.

INTRODUCTION

A.1. Purpose of the report

The Republic of Kazakhstan submits this National Report for review of Contracting Parties of the Convention. The purpose of the National Report is to inform on the compliance with the obligations undertaken by the Republic of Kazakhstan in accordance with the Convention.

National Report contains a description of main policy and practice, related to safety of spent fuel and radioactive waste management in the Republic of Kazakhstan.

A.2. Report Structure

This fourth Report is updating the third National Report on the compliance with the obligations in accordance with the Joint Convention. It summarizes the approach of the Republic of Kazakhstan to the safety of spent fuel and radioactive waste management. The format and structure of the Report meets the recommendations of the "Guidelines Regarding the Form and Structure of National Reports" (INFCIRC/604/Rev.3).

According to the recommendations of these guidelines, this Report considers an implementation of the Joint Convention obligations article by article. Each section is started with the corresponding articles of the Joint Convention. The National report content is as follows:

Section	Section Title	Article of the Joint Convention
A	Introduction	
B	Policies and Practices	32.1
C	Scope of Application	3
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SECTION B. POLICIES AND PRACTICES (ARTICLE 32)

Article 32. Reporting

1. In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention.

For each Contracting Party the report shall also address its

i. spent fuel management policy

ii spent fuel management practices

iii. radioactive waste management policy

iv. radioactive waste management practices

v. criteria used to define and categorize radioactive waste

B.1. Spent Fuel Management Policy

Decision has not been made yet in the Republic of Kazakhstan if a spent nuclear fuel is the valuable resource or waste.

Spent fuel (SF) management in the Republic of Kazakhstan is represented currently by long-term storage under surveillance at the specialized sites (storages), in compliance with government decisions in this area.

Nevertheless, the long-term storage is not considered as an “end point” in spent fuel management, it is only temporary decision. The real “end point” may be spent fuel utilization (processing) or disposal, that is the actions excluding possibility for further spent fuel management. In order to realize it, it is planned to develop a strategy of future spent fuel management at the example of BN-350 nuclear power plant hereinafter referred to as BN-350 NPP and research reactor spent fuel, which allows achieving the end point. To develop this strategy, RK will consider all the possible management options of further usage aimed to choose the optimal variant meeting different criteria, such as political acceptance, technical and economical feasibility, etc.

B.2. Spent Fuel Management Practices

Spent Fuel of BN-350 NPP

The only commercial power reactor in the Republic of Kazakhstan – fast breeder reactor BN-350 NPP, was in operation from 1973 to 1999. During the reactor operation spent fuel was routinely transported to Russian Federation for reprocessing. After the collapse of the Soviet Union in 1991 all the remaining spent fuel was stored in the reactor on-site pool-type storage.

Since 1995 the BN-350 NPP is under IAEA safeguards in accordance with "Agreement of 26 July 1994 Between the Republic of Kazakhstan and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons”. To comply with the Agreement requirements, computerized system of nuclear materials accounting and control was established at the BN-350 NPP to allow nuclear materials accounting and control. The system allows realizing control and accounting of nuclear materials on the reactor from the IAEA’s point of view and lead accounting of nuclear material quantity in each recorded unit.

In the area of spent fuel management the Republic of Kazakhstan has recently performed a number of several very important and practical steps.

In the field of spent fuel management, the Republic of Kazakhstan has taken a number of important practical steps in recent years. During the operation of the BN-350 reactor plant, the unloaded spent fuel was stored under water in the spent fuel pools, and then was sent to Russia for reprocessing. After the collapse of the USSR, the transportation of spent fuel ceased, and the remaining fuel continued to be stored in the spent fuel pools. Then, with financial and technical support from the United States, the spent fuel was packaged in sealed stainless steel canisters. After that, all the fuel was loaded into specially made two-purpose metal-concrete containers (transportation and long-term storage) and transported to the Baikal-1 site, located on the territory of the former Semipalatinsk test site, where the spent fuel is currently placed for long-term storage under IAEA guarantees. The storage is equipped with all the necessary physical protection systems. The estimated service life of the storage containers is 50 years, taking into account certification every 5 years of storage. Before the expiration of the storage period, it is necessary to make a decision on the final option for management of this fuel.

Spent Fuel of Research Reactors

In the Republic of Kazakhstan there are four research reactors (RR): RA, IVG-1M, and IGR reactors of the Institute of Atomic Energy of National Nuclear Center RK (IAE NNC RK), and WWR-K reactor of the Institute of Nuclear Physics (INP). The first three are located within the territory of former Semipalatinsk Nuclear Test Site near Kurchatov, and WWR-K reactor is located near Alatau settlement, close to Almaty.

Current strategy of RR spent fuel management consists of its unloading from the reactor, transportation into on-site storage and long-term storage under surveillance. The spent fuel of WWR-K reactor has been sent for reprocessing to Russian Federation with further return of high active processing wastes to the Republic of Kazakhstan. Return of high active wastes to RK is planned for 2028-2029, so a decision should be made for selection of disposal site by this time.

B.3. Radioactive Waste Management Policy

According to Article 17 of RK Law “On the Use of Atomic Energy”, the policy for radioactive waste management in RK is the following:

- Radioactive waste generated on the territory of the Republic of Kazakhstan should be disposed in such a way as to ensure radiation protection of the population and the environment for the entire period of time during which they may pose a potential hazard.
- The individuals and legal entities realizing the activities in the field of atomic energy use, which resulted in radioactive waste generation, shall take measures to minimize the wastes.
- The safe placement of spent nuclear fuel and radioactive wastes shall be provided for by design and operational documentation as an obligatory stage of any activity leading to the formation of radioactive waste.
- Only legal entities are allowed to handle SNF.
- The activities related to the management of radioactive waste and SNF are carried out on the basis of a license.
- Management of radioactive waste and (or) SNF should ensure compliance with the requirements of nuclear, radiation and nuclear physical security in accordance with the legislation of the Republic of Kazakhstan in the field of nuclear energy use, as well as international treaties ratified by the Republic of Kazakhstan.

- Management of radioactive waste and spent nuclear fuel shall be realized with compliance to the requirements established by the Environmental Code of the Republic of Kazakhstan.

A complete list of regulatory and legal acts currently in force in the Republic of Kazakhstan applicable to the regulation of the atomic energy use, including the safety of spent fuel and radioactive waste management, is given in Appendix E to this Report.

B.4. Radioactive Waste Management Practices

An approach to radioactive waste management of nuclear reactors, commercial and research ones, includes long-term storage in the SRW storage facilities of research reactor complex "Baikal-1" site (for SRW of IGR, IVG.1M and RA research reactors, IAE NNC RK). For the BN-350 NPP reactor, being decommissioned, SRW is also stored in-site and LRW volume is minimized by evaporation followed by on-site storage. Reduction of liquid and solid radioactive waste share and construction of facilities for their conditioning is the main task for the forthcoming years. At the WWR-K research reactor of the Institute of Nuclear Physics, low- and intermediate solid and solidified wastes are cemented and disposed together in the on-site RW storage facility.

Waste of enterprises that use the isotope products such as sealed IRS with the expired lifetime, or if found to be defective shall be placed for the long-term storage in specialized facilities. Appendix D2.3 includes list of such storages.

Waste of former and operating uranium mining and production enterprises in a form of dump piles, sludge of tail pits, contaminated equipment, located in Mangistau (Caspian mining and smelting complex), North Kazakhstan, Akmolinsk (Stepnogorsk mining and smelting complex), Karaganda, Zhambyl, South Kazakhstan, Kyzyl-Orda regions (mine administration of former Kyrgyz mining and smelting complex), and Esat Kazakhstan region (Ulba metallurgical Plant and Irtysh chemical& Metallurgical Plant) are mothballed in accordance with the budget program "Conservation of uranium mining enterprises and elimination of consequences of uranium mining for 2001-2010. Local executive bodies (regions, cities of republican significance, the capital) determine the organization (enterprise) responsible for the implementation of radiation control and maintenance of the mothballed objects in a safe state.

The mothballing of uranium mining waste, contaminated soil and equipment is accomplished. RW was disposed into four available disposal facilities: Joint Enterprise Inkay, Taukent Ore&Chemical Enterprise, "RU-6" Ltd, and "Stepnoe mining administration" Ltd.

The practice of RW management at the territory of former Semipalatinsk nuclear test site (STS) after destruction of nuclear testing infrastructure consists of thorough bordering of areas with radioactive contamination and improvement of barriers created in 1995-2000 on the trilateral basis (RK-RF-USA) to prevent unauthorized access to the nuclear testing waste and contaminated areas. To bring the legal framework in line with the works to be carried out at the STS, a draft Law of the Republic of Kazakhstan "On the Semipalatinsk nuclear safety zone" has been developed.

Non-uranium mining and processing industry radioactive waste is represented by coal, polymetal, rare earth and phosphorites deposits, some of them contain uranium contamination, which is stored after extraction as dump piles and tail pits. Only small part of them is now rehabilitated as RW. Upper oxidized layers of coal beds are also contaminated with uranium, which is stored as RW up to the moment. Currently the designs of uranium contaminated coal extraction, provide for a storage and following disposal of RW.

At the oil deposits of West Kazakhstan there are storages of radioactive scrap metal, sludge and oil contaminated soils. At present in Zhanaozen area the facilities were constructed for equipment deactivation using the technologies of high pressure water cleaning, sandblasting, vibration one and melting with removal of radioactive slag. At oil deposits of Zhetybay and Zhanaozen in

Mangystau region, the storage facilities were commissioned into operation to store the waste of pipe and equipment cleaning.

B.5. Radioactive waste identification and classification criteria

In accordance with the RK Law "On the atomic energy use" radioactive waste is determined as radioactive substances, nuclear materials or radionuclide sources with radionuclide content above the exemption level the further use of which is not provided for. The exemption levels are established in Hygienic Standards "Sanitary requirements for radiation safety".

RK Ecology Code (chapter 44, article 307) gives more detailed definition of radioactive waste and its classification:

1. Radioactive waste is the following radioactive substances in any aggregative state, which are not a subject for the further use:

- Materials, items, equipment, objects of biological origin, with radionuclides content, exceeding the levels, established by RK legislation;
- Spent nuclear fuel, which is not a subject for the following reprocessing;
- Spent and failed radionuclide sources;
- Extracted from subsoil and placed into dump piles and tail pits rocks, ores and waste of ore enrichment and extraction, with radionuclides content, exceeding the levels, established by RK legislation.

2. The basis for radioactive waste classification is its aggregative state, origin, activity level, half decay period.

3. By aggregative state radioactive waste is divided on liquid and solid ones. Non-organic solutions, filtering materials sludge, organic liquids are related to liquid radioactive waste.

Items, components of machines and mechanisms, materials, biological objects, spent radiation sources are related to solid radioactive waste.

4. The waste is considered as radioactive waste if specific activity of containing radionuclides is more than the values, established by the Hygienic Standards "Sanitary requirements for radiation safety", and if radionuclide composition is not known, if its specific activity is more than:

- One hundred kilo Becquerel per kilogram – for beta-emitting nuclides;
- Ten kilo Becquerel per kilogram– for alpha emitting nuclides (excluding transuranium);
- One kilo Becquerel per kilogram – for transuranium nuclides.

5. By the origin radioactive waste is classified as follows:

- Metal mining industry waste;
- Waste of research and commercial nuclear facilities;
- Waste of nuclear explosions;
- Disused and spent radioactive sources.

6. By the activity level, the solid radioactive waste is classified as follows:

- Low level waste – a waste with specific activity (kilo Becquerel per kilogram): less than one thousand – for beta-emitting nuclides, less than one hundred – for alpha emitting nuclides (excluding transuranium), less than ten – for transuranium nuclides;
- Intermediate waste– a waste with specific activity (kilo Becquerel per kilogram): from one thousand to ten million – for beta-emitting nuclides, from one hundred to one million – for alpha emitting nuclides (excluding transuranium), for ten to one hundred thousand – for transuranium nuclides;

- High level waste – a waste with specific activity (kilo Becquerel per kilogram): more than ten million – for beta-emitting nuclides, more than one million – for alpha emitting nuclides (excluding transuranium), more than one hundred thousand – for transuranium nuclides;

It shall be noted that current version of Ecological Code does not contain the term and definition for gaseous wastes.

SECTION C. SCOPE OF APPLICATION (ARTICLE 3)

Article 3. Scope of Application

1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.

2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.

3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defense programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defense programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.

4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

C.1. Reprocessing of spent fuel

Currently, the Republic of Kazakhstan does not have the capacities to reprocess spent fuel. All the spent fuel from the WWR-K research reactor was moved for reprocessing to the Russian Federation due to a change in the design of the fuel elements; in exchange, fresh fuel was supplied in the new design assemblies. The spent fuel of the BN-350 reactor, which is being decommissioned, was transported to a specialized container storage outside the site. Fuel from other research reactors is stored in on-site storage facilities.

C.2. Radioactive waste which contains only naturally occurring radionuclides

Republic of Kazakhstan declares that for the purposes of the Convention, the waste which contains only naturally occurred radionuclides and does not originate from nuclear fuel cycle is considered as radioactive waste according to Article 3.2 of the Convention, This waste is described in Section D of this document.

C.3. Radioactive waste produced within military or defense programs

Republic of Kazakhstan declares that radioactive waste produced within military or defense programs transferred finally to civilian programs and is considered as radioactive waste according to Article 3.3 of the Convention. This waste is described in Section D of this document.

C.4. Discharges

Republic of Kazakhstan declares that it will consider the discharges as provided for in Articles 4, 7, 11, 14, 24 и 26 of Joint Convention.

Section D. Inventories and Lists (Article 32)

Article 32. Reporting

32-2. This report shall also include:

i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

iv) an inventory of radioactive waste that is subject to this Convention that:

a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

b) has been disposed of; or

c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D1. Spent Nuclear Fuel

List of the activities for spent fuel management and their main characteristics and inventory quantities of spent fuel is given in Appendix D1.

BN-350 Nuclear Power Reactor

The BN-350spent fuel was packed into dual use metal concrete casks and transported to specially constructed long-term storage site of open type located at “Baikal-1” the branch of IAE NNC RK near Kurchatov City for long-term storage.

WWR-K Reactor

Since 2016, WWR-KN fuel assemblies have been used as fuel at the WWR-K reactor. The fuel composition is uranium dioxide dispersed in an aluminum matrix (UO2-Al). Fuel enrichment by uranium-235: 19.7%, uranium density: 2.8 g/cm^3. The maximum permissible burnup is 60% for uranium-235.

In the WWR-K reactor core, two types of WWR-KN fuel assemblies are used: eight-pipe (type 1 fuel assemblies) and five-pipe (type 2 fuel assemblies).

From 05/18/2016 to 05/15/2020, during 774 effective days of reactor operation, 38 LEU spent fuel assemblies were produced, thus the rate of spent fuel production of the WWR-KN type averages 9-10 fuel assemblies per year.

The amount of accumulated spent fuel (number of assemblies, total activity)

Year	Number of spent FA	Total activity1, TBq
2017	1	4182
2018	25	72094
2019	5	14406
As for 14.05.2020	7	19050
Total	38	109732

The spent nuclear fuel (SNF) storage system of the research reactor WWR-K is intended for temporary water storage of spent fuel assemblies (SFAs) removed from the WWR-K core. The storage system consists of two storage areas: wet storage and storage tank. Both storage facilities are located in the central hall of the reactor.

During the first four years after being removed from the core, spent fuel assemblies are stored in a wet storage facility, and then they are transferred to a storage pool. The minimum total storage time of spent fuel assemblies is determined by the need to reduce the residual energy release to a value that allows safe transportation from the reactor site to the processing facility in a special container of the processing organization.

IGR Reactor

The rate of accumulation of spent fuel at the IGR is determined by the amount of fuel in the experimental devices tested (irradiated) in the IGR reactor. Defueling is not performed since 1968.

Experimental devices with fuel tested in IGR reactor are placed in the nuclear materials storage facility in premise 0101 of building 1 for aging (3...5 months) and then transported to the radiation-protective chamber (RPC) on "Baikal-1" for the post-reactor examination. After research activities, the fuel is placed for long-term storage. Amount of spent fuel accumulated in 24 experimental devices of IGR reactor makes 94.8 kg of uranium. The total activity as of May 1, 2020 is 7450 GBq.

Two storage facilities are used at IGR for storing the spent fuel. One storage facility is located in premise 0101 of building 1 and second one, which houses the graphite elements of IGR first reactor core, is in premise 25 of building 20.

IVG.1M Reactor

During the period of operation of IVG.1M reactor (1990 -2020) three fuel assemblies were unloaded from the reactor core: one fuel assembly in 2004 and other two – in 2017. During the period from 2017 to 2019 two LEU fuel assemblies were loaded, tested and unloaded from the reactor. In 2019, two fuel assemblies (which were unloaded in 2017) were returned into IVG.1M reactor.

Three fuel assemblies are placed for a long term storage into IVG reactor storage facility. Amount of spent fuel accumulated in the assemblies is 530 grams of uranium. The total activity as of May 1, 2020 is 1380 GBq.

[1] Activity for the moment of unloading from the reactor core

Spent fuel from IVG-1M reactor is stored in a container in a specially designed storage facility (premise 140 of building 101) supplied with biological protection and reloading mechanisms.

RA reactor

In 1998, in accordance with intergovernmental agreements fuel from the reactor was unloaded and transported to Russia.

D.2. Radioactive Waste

D.2.1. Radioactive Waste Production in RK

Radioactive waste in RK represented by the waste of uranium mining, oil&gas production, and metallurgical industry in a form of dump piles and tail pits, contaminated soils, pipes, equipment, liquid and solid waste of decommissioning BN-350 NPP, operating research reactors in Alatau town and in Kurchatov town, sealed sources, used in different industry, medicine and agriculture, which are not used anymore and should be disposed, and territories and equipment, contaminated in the result of nuclear testing in RK.

At the present time RK has comparatively comprehensive and centralized information for spent sealed sources (logged by CAESC ME RK), operational and decommissioning waste of reactors (logged by the operators, submitted to CAESC ME RK), uranium mining and processing industry (logged by the enterprises, submitted to CAESC ME RK).

Information on the waste, produced in the result of nuclear and "dirty bombs" testing and from mining, coal, and oil industry is not complete and requires implementing additional investigations and developing of RW Inventory Cadastre.

Attempts to gather information from regions and to create national radioactive waste cadastre were made several times. The first and the most comprehensive inventory of radioactive waste storage and disposal sites were carried out in 1993. In the course of this activity, 529 sites of radioactive waste storage and disposal were identified, including:

- 127 related to uranium mining and production industry
- 76 related to non-uranium industry
- 16 related to nuclear testing
- 5 related to reactors
- 301 related to enterprises using sealed sources of different type.

This data was used in the "Conception of radioactive waste disposal in RK", but after the document completion the work to create and update the integrated RW cadastre in RK was not continued.

D.2.2. RW Management Facilities for Reactor Operational and Decommissioning Waste

At the territory of Republic of Kazakhstan there are 5 reactors, one BN-350 NPP in Aktau, three research reactors at territory of former Semipalatinsk Testing Site in Kurchatov and one research reactor near Almaty (Alatau settl.).

BN-350 NPP

BN-350 NPP in Aktau is now shut down and being decommissioned. There are the following facilities for RW management at the BN-350:

- Storage facility for low level and medium level solid radioactive waste (according to internal enterprise classification). SRW with dose rate from 0.1 to 30 mR/h (0,001-0.3 mSv/h) and from 30 to 1000 mR/h (0.3-10 mSv/h) and for high level waste with dose rate more than 1000 mR/h (10 mSv/h).
- Reactor equipment storage cooling facility, premise 510.
- BN-350 Hot Cell vault.
- Facility for liquid waste collection and storage.
- Sodium processing facility (SPF).

Table 2.1 presents the amount of accumulated radioactive wastes for 2017-2019.

Accumulation of RW at MAEC-Kazatomprom, 2017-2019

Waste type	Category	Amount by year		
		2017	2018	2019
SRW, ton	LLRW	2.00	0.54	0.95
	ILRW	0.00	0.00	0.00
	HLRW	0.00	0.00	0.025
LRW, m^3	ILRW	2.4	3.7	4.2

Note: LLRW – Low-active radioactive waste, ILRW – Intermediate Active Radioactive Waste, HRW – Highly Radioactive Waste.

Gaseous radioactive wastes are not accumulated at the enterprise.

WWR-K Reactor

Radioactive waste generation in the INP makes at the averages: liquid radioactive waste (LRW) from 6 to 24 m^3 per year, with activity up to 3GBq, low active and intermediate active solid radioactive waste (SRW) from 50 to 500 kg per year with the activity up to 14GBq.

Amount of accumulated liquid and solid radioactive wastes at the enterprise

Year	LRW, m^3	SRW, kg	
	Low-active radioactive waste	Low-active radioactive waste	Intermediate active radioactive waste
2017	-	-	75
2018	6,2	150	951.6
2019	-	601	150
2020	-	450	-

At the WWR-K reactor of the Institute of Nuclear Physics RK (RSE INP RK) there is a facility for simultaneous cementation of SRW and LRW.

Disposal facility is intended for disposal of low- and intermediate activity liquid waste. The design capacity of the DF makes 2375 m^3 and percentage of DF occupation for today makes 80% for low activity and 15-20% for intermediate activity waste. The design capacity in terms of activity makes 40000 Ci, and the actual activity makes 8500 Ci.

IGR, IVG.1M, and RA reactors

The average rate of radioactive waste formation at reactor complexes is as follows:

- Solidwaste-300 ... 400kg/year;
- Liquidwaste-2.0 ...3.0 m^3/year.

Radioactive wastes generated at IGR reactor are transported in the prescribed order to the long-term storage facility at "Baikal-1".

The amount of solid radioactive waste at KIR"Baikal-1" assigned to the enterprise's own accumulations, makes 184 716 kg with a total activity of 4929 GBq.

Total quantity of the wastes placed in "Baikal-1" long-term storage facility with the account of radioactive waste received by NNC RK externally (enterprises, organizations, orphan) is 2 820 194 kg with a total activity of 7658 GBq.

D.2.3. Facilities for Sealed Sources Management, Considered as RW

The main national facility for temporary storage of sealed sources is "Baikal-1" facility near Kurchatov. Besides, there are the storage facilities of IRS in the following organizations: MAEC-Kazatomprom Ltd (Aktau), Ulba Metalurgical Plant (Ust-Kamenogorsk), low level and intermediate waste storage in the RSE Institute of Nuclear Physics of RK (near Almaty) and Kazfosfat Ltd in Taraz; the former is going to be decommissioned and all the sources will be transported to "Baikal-1" site. All the listed facilities are licensed as RW long-term storage facilities. Annex D2.3 contains IRS quantity data in these facilities.

D.2.4. Facilities for Management of Waste from Uranium Mining and Production Industry

There are the following facilities to handle the waste of uranium mining and production industry in the Republic of Kazakhstan:

- Tail pit of Stepnogorsk ore&chemical enterprise is located in 25 km from Stepnogorsk town and 160 km from Astana city. Hydro-metallurgical plant of the enterprise processes not only uranium ore, but also concentrates of natural uranium for the enterprises of JSC "Kazatomprom". The enterprise discharge waters are withdrawn into the tail pit, which consists of three ponds with the surface area around 757 hectares (Pond #1 – 162 hectares, evaporation pond – 270 hectares and sludge lines – 22 hectares) and total fine dispersed sludge amount 49.1 million tons. Environmental management system guarantees the safety of the object provided the stable operation of the plant. As a result of upgrading the performance of the plant exceeded the rated capacity and is currently 4000 t of uranium oxide per year. Molybdenum ore processing concentrator is installed and put into operation on available capacity LLP "Stepnogorskore&chemical enterprise" (SOCE) in order to cover uranium tails by low-toxic solid waste of copper and molybdenum production. Currently the tail pits store 41979 cubic meters (49116 thousand tons) of low-level radioactive waste with total activity 7100 TBq.
- Liquid low-level waste are located in 5-evaporative ponds of mine Shantobe belonging to LLP "SMCC" at 450 km from Stepnogorsk town and 420 km apart from Astana city with total area of 6.5 hectares. Currently, the mine has181.4 thousand tons (178 thousand cubic meters) of liquid radioactive waste with a total activity of 1.752 GBq.
- Tail pit Kashkar-Ata of former Caspian mining&smelting enterprise near Aktau city. Kashkar-Ata contains 120000000 m^3 of radioactive waste. Since 2006 the tail pit is in rehabilitation process.

- Tail pits (ponds) of Ulba Metallurgical Plant (UMP). Storage of UMP radioactive waste is realized at the "Tailing Site" Storage (TSS). Liquid waste ponds are of open type and store the waste of discharges and sludge from all the production lines. As of the beginning of 2014 total amount of RW is 6411667.7 m^3 with total activity 194.33 GBq.
- Two near surface RW disposal facilities at production sections PV-1 and PV-2with 10000 m^3 and 16 m^3 designed capacity belonging Joint Enterprize Inkay Kazatomprom (RK) and Cameco Corporation (Canada), located in 10 km from Taykonyur settlement in Suzak area of South Kazakhstan oblast.
- Near surface RW disposal facility at Kanzhugan deposit, designed capacity 7200 m^3 belonging to TaukentOre&Chemical Enterprise in Suzak area of South Kazakhstan oblast.
- Near surface RW disposal facility with designed capacity 10000 m^3 belonging to "RU-6" Ltd, located in 90 km from Sheeli settlement of Kyzylorda oblast.
- Near surface RW disposal facility with designed capacity 80000 m^3 belonging to"Stepnoye Rudoupravlenie" Ltd, Kyzemshek settlement, Sozak area, South Kazakhstan oblast. It was commissioned in 2007.

D.2.5. Facilities for Miscellaneous RW Management

For RW of oil-extraction industry management:

- Facility for deactivation of pipes and metal equipment of oil fields in Mangistau oblast. Sites for cleaning and deactivation of pipes and equipment are constructed at the oil deposits Kalamkas and Zhetybay in Mangistau oblast. Storage facilities for radioactive waste are constructed and commissioned in Zhana-Ozen (100 000 tons) and Zhetybay (70 000 tons) deposits.

D.3. Facilities Being Decommissioned

Currently in the Republic of Kazakhstan there is only one decommissioning facility – fast breeder reactor of the BN-350 NPP, operated by MAEC-Kazatomprom and located near Aktau city.

It is necessary to note that a lot of radioactive waste will be produced during its dismantling. According to estimations, total amount of conditioned and packaged waste produced after the BN-350 decommissioning will be around 62300 m^3.

Additional information on the BN-350 decommissioning is shown in Appendix D3.

One of RK research reactors – RA reactor, located at Baikal-1 site near Kurchatov, is shut down, all fuel unloaded and transported to the Russian Federation, but formally reactor is in operation (extended shutdown mode).

SECTION E. LEGISLATIVE AND REGULATORY SYSTEM

E.1. Implementing Measures (Article 18)

Article 18. Implementing Measures

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The Convention is the basis for further improvement of the legislative documentation of the Republic of Kazakhstan, which regulates the safety issues of spent fuel and radioactive waste management in accordance with the obligations of the Republic of Kazakhstan resulting from the Joint Convention provisions.

The entering into force of the Law RK "On Ratification of the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management" (No. 246-IV, of February 3, 2010) means that the existing legislation of RK does substantially allow implementing the obligations of the Republic of Kazakhstan resulting from the Joint Convention provisions. Adoption of this law on ratification made the provisions of the Convention to be obligatory for all the executive authorities and the organizations involved in management of spent fuel and radioactive wastes.

The Republic of Kazakhstan is developing, and will seek to develop a national strategy for the safe management of spent nuclear fuel and radioactive waste.

E.2. Legislative and Regulatory System (Article 19)

Article 19. Legislative and Regulatory Framework

19-1 Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

19-2 This legislative and regulatory framework shall provide for:

i) the establishment of applicable national safety requirements and regulations for radiation safety;

ii) a system of licensing of spent fuel and radioactive waste management activities;

iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a license;

iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;

v) the enforcement of applicable regulations and of the terms of the licences;

vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

Functions specific to the nuclear regulator in terms of the Convention are currently assigned to the Ministry of Energy of the Republic of Kazakhstan (ME RK), which responsibilities in the field of atomic energy use were previously assigned to the Ministry of Industry and New Technologies of the Republic of Kazakhstan (MINT RK). Committee for Atomic and Energy Supervision and Control of ME RK (CAESC ME RK) (former Committee for Atomic Energy MINT RK), is the competent authority carrying out regulatory supervision and realization functions in the field of

atomic energy use within the competence of the ME RK. Department of Atomic Energy and Industry, as a part of Ministry of Energy structure, concurrently is responsible for promotion of nuclear energy.

Regulatory functions in the field of the atomic energy use in the Republic of Kazakhstan are also carried out by the Committee for Environmental Regulation and Control of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan (CERC MEGNR RK), which performs the functions of environmental protection, Committee of Quality Control and Safety of Goods and Services of the Ministry of Health of the Republic of Kazakhstan (CQCSGS MH RK) in the sphere of sanitary and epidemiological welfare of the population, the Ministry of Internal Affairs RK, carrying out permit functions and facilities security, the Committee for Industrial Development and Industrial Safety of the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan (CIDIS MIID RK), performs control and supervision in the field of industrial safety, and the Committee of Emergency Situations of the Ministry of Internal Affairs (CES MIA RK) performing the functions for liquidation of man-caused accidents.

The State regulation authorities are independent from each other, as well as from organizations whose activities are related to the use of atomic energy.

E.2.1. Legislative and Regulatory framework of safety assurance (Article 19-1)

The legal basis for regulating nuclear and radiation safety of personnel, population and environment while using the atomic energy in the Republic of Kazakhstan includes the Law RK "On Atomic Energy Use", the Law RK "On Radiation Safety of Population" and "Environmental Code of the Republic of Kazakhstan".

Regulation of safety of spent fuel and radioactive waste management is also realized in accordance with other delegated regulations of the Republic of Kazakhstan in the field of atomic energy use, the departmental technological regulations and safety instructions.

E.2.2. Constituent Parts of Legislative and Regulatory Framework (Article 19-2)

E.2.2.1 National Radiation Safety Requirements (Article 19-2(i))

Article 4 of the Law "On Atomic Energy Use" specifies that one of the main principles of the state policy in the field of the atomic energy use is the effective protection of people's life and health, their property, environmental protection, maintenance of nuclear, radiation safety and nuclear physical security, and nuclear weapons nonproliferation regime while using atomic energy.

The Law "On Radiation Safety of the Population" establishes the basic principles of ensuring radiation safety, requirements and regulating provisions for radiation safety.

Section 39 "Environmental Requirements for the Use of Radiation Materials, Atomic Energy and Ensuring Radiation Safety" of the Environmental Code of the Republic of Kazakhstan contains requirements for radiation safety from an environmental point of view.

The List of principal documents, that contain the requirements for radiation safety, is provided in Appendix E.

E.2.2.2. Licensing of the Spent Nuclear Fuel and Radioactive Waste Management Activities (Article 19.2(ii))

Article 9 of the Law RK "On Atomic Energy Use" establishes that the activities associated with the use of atomic energy shall be subject to compulsory licensing with a procedure established in

of the Law of the Republic of Kazakhstan “On Atomic Energy Use” and legislation of Republic of Kazakhstan in the field of permissions and notifications.

In accordance with the Law “On permissions and notifications”, the following activities or actions in the field of the atomic energy use are subject to licensing:

- work related to the life cycle stages of the objects using atomic energy;
- management of nuclear materials;
- management of radioactive substances, devices and installations containing radioactive substances;
- management of devices and installations generating ionizing radiation;
- management of radioactive wastes;
- transportation, including transit, of nuclear materials, radioactive substances, radioisotope sources of ionizing radiation, radioactive waste within the territory of the Republic of Kazakhstan.

E.2.2.3. Prohibition of spent nuclear fuel and radioactive waste management without license (Article 19-2(iii))

Activities related to the nuclear energy use are subject to mandatory licensing in accordance with the procedure established by the legislation of the Republic of Kazakhstan on permits and notifications.

Any activity related to the use of nuclear energy is carried out under the condition of ensuring the protection of public health and the environment, the protection of property of individuals and legal entities from the harmful effects of ionizing radiation. Nuclear and radiation safety is provided by the operating organization in accordance with established norms and rules.

Article 8 of the Law of the Republic of Kazakhstan "On Atomic Energy Use" establishes that individuals and legal entities that carry out activities in the field of the atomic energy use are required to have a license for the relevant type of activity in the sphere of the atomic energy use.

E.2.2.4. System of Institutional and Regulatory Control, Documentation and Reporting (Article 19-2(iv))

Nuclear and radiation safety is provided by the operating organization in accordance with the established rules and regulations.

Terms and conditions of the licenses issued by a state authority for safety regulation stipulate that the operating organization shall take appropriate measures in order for the control, inspection and testing of the equipment and systems important to safety to be carried out in accordance with the established procedures and schedules.

Regulatory control

CAESC ME RK controls the maintenance of a high level of nuclear and radiation safety at the controlled facilities. State control and supervision in the field of atomic energy use is carried out in the form of inspection and preventive control and supervision.

Inspection of the entities carrying out the activities with nuclear facilities and installations of categories I and II of potential radiation hazard (hereinafter referred to as the supervision subjects) is carried out by the competent authority on a periodic basis, but not more often than once a quarter, or may be unscheduled ones.

Periodic inspection is an inspection appointed by the competent authority in relation to the supervision subject in order to prevent and (or) eliminate an immediate threat to human life and health, the environment, the legitimate interests of individuals and legal entities, the state.

An unscheduled inspection is appointed by the competent authority due to specific facts and circumstances that served as the basis for the appointment of an inspection in relation to a specific supervision subject, in order to prevent and (or) eliminate an immediate threat to human life and health, the environment, the legitimate interests of individuals and legal entities, state.

Inspection of the entities carrying out activities with the facilities of III and IV categories of potential radiation hazard, with the exception of nuclear facilities, is carried out in accordance with the Entrepreneurial Code of the Republic of Kazakhstan.

Preventive control and supervision with visits to the entities carrying out activities with objects of I, II, III and IV categories of potential radiation hazard are carried out in accordance with the Entrepreneurial Code of the Republic of Kazakhstan.

Preventive control and supervision without visits to the entities carrying out activities with facilities of I, II, III and IV categories of potential radiation hazard are carried out in accordance with the Entrepreneurial Code of the Republic.

Based on the results of state control and supervision, depending on the established violations of the requirements of the legislation of the Republic of Kazakhstan in the field of atomic energy use, officials issue the following acts:

- Act on the Inspection Results is a document issued by an official exercising state control and supervision in the field of atomic energy use and based on the results of an audit of the entity for its compliance with the requirements of the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- an order to eliminate the violation of the requirements of the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- an order to suspend or prohibit certain types of activities;
- recommendation based on the results of preventive control and supervision without visiting the performer (target) of control and supervision.

Preventive control and supervision without visiting the subject (object) of control and supervision are of a preventive and routine nature.

Preventive control and supervision without visiting the subject (object) of control and supervision in the field of atomic energy use is carried out by analyzing:

- the information and reports submitted by individuals and legal entities in accordance with the requirements of the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- information received at the request of the competent authority on compliance with the legislation of the Republic of Kazakhstan in the field of atomic energy use within its competence – if there is information about legislation's violation;
- information received from third parties regarding compliance with the legislation of the Republic of Kazakhstan in the field of atomic energy use.
- If violations are revealed based on the results of preventive control and supervision without visiting the subject (object) of control and supervision in the actions (inaction) of the subject of control and supervision, the competent authority draws up and sends a recommendation no later than five working days from the date of detection of violations.

A recommendation sent in one of the following ways is considered delivered in the following cases:

- courier delivery – with a note of receipt;

- by mail – by sending a registered letter with notification;
- electronically – the competent authority sends a letter to the email address of the subject of control and supervision, which is specified in the documents previously submitted by the subject of control and supervision to the competent authority.

The deadline for the implementation of the recommendation to eliminate violations identified as a result of preventive control and supervision without visiting the subject (object) of control and supervision should be at least ten working days from the day following the day of its delivery.

The subject of control and supervision, in case of disagreement with the violations specified in the recommendation, has the right to send an objection to the competent authority that sent the recommendation within five working days from the day following the day of delivery of the recommendation.

Failure to comply with the recommendation on the elimination of violations identified as a result of preventive control and supervision without visiting the subject (object) of control and supervision in due time, entails the inclusion of the subject (object) of control and supervision in the six-month schedule of special procedure inspections.

The frequency of preventive control and supervisions without visiting the subject (object) of control and supervision is determined as necessary, but not more often than the frequency of providing the information.

Documentation and Reporting

The regulations and rules establish the requirements that the operating organization shall prepare and submit the periodic reports on the safety status of nuclear facilities and storage facilities to the state bodies for safety regulation and state public authorities.

The operating organization shall provide for filing of design documentation, executive documentation for construction, maintenance and repair of the safety systems (components) and the elements important for safety, as well as the materials of the investigations of operation violations throughout the lifetime of a nuclear facility and storage facility.

The operating organization shall ensure the transfer of information on violations at a nuclear facility and storage facility to the state body for safety regulation in accordance with the established requirements.

E.2.2.5. Measures Taken to Implement Existing Regulations and License Conditions (Article 19-2(v))

CAESC realizes the state control over compliance of a licensee with the license conditions in the field of nuclear and radiation safety and applies sanctions within its competence in case of licensee's failure to do so.

"Code on Administrative Offenses of the Republic of Kazakhstan" on June 5, 2017, stipulates for the imposition of administrative fines and withdrawal of the licenses for violation of the established rules and regulations for management of nuclear materials and radioactive substances.

E.2.2.6. Division of Responsibilities of the Bodies Involved at Different Stages of Spent Nuclear Fuel and Radioactive Waste Management (Article 19-2 (vi))

Functions specific to the nuclear regulator in terms of the Convention are currently assigned to the Ministry of Energy of the Republic of Kazakhstan (ME RK), which responsibilities in the field of atomic energy use were assigned to the Ministry of Industry and New Technologies of the Republic of Kazakhstan. Committee for Atomic and Energy Supervision and Control of Ministry of Energy

RK (CAESC ME RK) (former CAE MINT RK) is the agency carrying out control and realization functions in the field of atomic energy and electric energy use within the competence of the ME RK. Hereinafter referred to as the CAESC ME RK in the performance of its tasks within the competence of the ME RK is referred to as the "competent authority" in accordance with the legal definitions of the legislation of the Republic of Kazakhstan.

According to the Provisions on the CAESC ME RK the main tasks of the Committee under the authority of the Ministry are:

- implementation of the state policy in the field of electric energy and atomic energy use;
- realization of other tasks within the competence of the Committee.

In accordance with its tasks the CAESC ME RK, as prescribed by the legislation performs the following functions in the field of atomic energy use:

- provides for the implementation of state policy in the field of electric energy and atomic energy use;
- carries out the regulatory, realization and control-supervision functions and participates in the implementation of the strategic functions of the central executive body within its competence;
- approves legal acts on the matters within its competence and if it has direct competence for their approval in the ministries acts, with the exception of the normative legal acts concerning human and civil rights and freedoms;
- exercise control and supervision of the activities of individuals and legal entities within its competence;
- carries out control and supervisory functions over the activities of local executive bodies on the matters relating to the responsibilities of Committee;
- implement international cooperation within its competence;
- performs a permissive control;
- conducts inspections related to the execution of its responsibilities in the field of atomic energy;
- realizes state control in the field of atomic energy use;
- monitors compliance with the norms and rules of radiation safety and license conditions;
- carries out the state control in the field of radiation safety of the population;
- exercise control over the export, import, movement, transit and placement of nuclear materials and other ionizing radiation sources;
- exercise control over exports in the field of atomic energy use;
- performs state accounting and control of nuclear materials;
- performs state accounting and control of ionizing radiation sources;
- coordinates the issuance of a license from the authorized state body exercising state regulation in the field of export control for the export and import of nuclear and special non-nuclear materials, equipment, installations, technologies, ionizing radiation sources, equipment and related dual-use (purpose) goods and technologies, works, services related to their production;

- carries out licensing in the field of atomic energy use and permit control in accordance with the legislation of the Republic of Kazakhstan about the permissions and notifications;
- makes a decision on state registration or removal from state registration of nuclear materials, ionizing radiation sources;
- agree on calculation methods related to ensuring nuclear, radiation and nuclear physical safety and security presented by an expert organization;
- approves the designs of transport packaging sets, and also extends the validity of their certificates-permits, approved by the authorized bodies of other countries, on the territory of the Republic of Kazakhstan;
- organizes research on nuclear, radiation and nuclear physical safety and security, ensuring the nuclear non-proliferation regime and monitoring of nuclear tests;
- develops and approves methodological recommendations for individuals and legal entities carrying out activities in the field of atomic energy use, regarding methods and options of confirming the compliance of a facility involved in atomic energy use with the requirements of nuclear, radiation, nuclear physical safety and security established by the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- sets the values of the threshold activity for various radioisotopes;
- analyzes and verifies the information received on the presence, location and movement of ionizing radiation sources and enters it into the register of ionizing radiation sources;
- carries out certification of personnel employed at nuclear facilities;
- conducts accreditation of organizations carrying out expertise of nuclear, radiation and nuclear physical safety and security;
- maintains a register of accredited organizations carrying out expertise of nuclear, radiation and nuclear physical safety and security;
- develops, coordinates and approves, within its competence, normative technical acts of the Republic of Kazakhstan, instructions, guidelines in the field of electric power industry and the atomic energy use;
- within the competence, participates in the development, implementation of strategic and program documents, proposals for the Strategic and Operational Plans of the Ministry of Energy of the Republic of Kazakhstan;
- exercises other rights provided by the laws of the Republic of Kazakhstan, acts of the President of the Republic of Kazakhstan and the Government of the Republic of Kazakhstan.

CAESC ME RK realizes the state control of licensee's compliance with license conditions and in case of failure, it imposes sanctions within its competence.

"Code on Administrative Offences of the Republic of Kazakhstan" provides administrative fines imposition and license denial for violation of established rules and regulations while handling the nuclear materials and radioactive substances.

Ministry of Ecology, Geology and Natural Resources, which replaced Committee of Ecological Regulation and Control of Ministry of Energy Republic of Kazakhstan, provides for environmental protection functions, including the field of atomic energy use. Main goals of the Ministry:

- provides for the implementation of state policy within its competence;
- carries out the regulatory, realization and control-supervision functions and participates in the implementation of the strategic functions of the central executive body within its competence;

- approves legal acts on the matters within its competence and if it has direct competence for their approval in the ministries acts, with the exception of the normative legal acts concerning human and civil rights and freedoms;
- exercise control and supervision of the activities of individuals and legal entities within its competence;
- carries out control and supervisory functions over the activities of local executive bodies on the matters relating to the responsibilities of Ministry;
- implement international cooperation within its competence;
- performs licensing and permissive procedures within its competence;
- performs a permissive control;
- carries out state environmental examination within its competence, and coordinates the implementation of environmental impact assessment in the Republic of Kazakhstan and carries out its methodological guidance;
- maintain the State Register of natural resources users and sources of environmental pollution;
- provides access to environmental information within their competence in accordance with the legislation of the Republic of Kazakhstan;
- carries out state ecological control over the observance of environmental legislation of the Republic of Kazakhstan, environmental quality standards and environmental requirements, including:
    - compliance with the environmental legislation of the Republic of Kazakhstan;
    - mitigation of consequences of environmental pollution;
    - conservation and liquidation of subsoil use facilities;
    - disposal of harmful substances, radioactive waste and discharge of waste water into the subsoil;
    - compliance with the rules of use, storage, transportation, disposal, recycling or other treatment of radioactive and other environmentally hazardous substances in terms of environmental requirements for the prevention of environmental pollution;
    - compliance with environmental requirements for sanitary-protection areas of facilities with stationary sources of emissions, discharges of pollutants and storing the production and consumption wastes;
    - radiation situation on the territory of the Republic of Kazakhstan, the implementation of design solutions for the prevention of pollution of environment by radioactive substances;
    - compliance with the requirements on the mandatory state environmental review and the implementation of its conditions;
    - performs other functions in accordance with the laws of the Republic of Kazakhstan, Acts of the President and Government of Republic of Kazakhstan.

Committee of Quality Control and Safety of Goods and Services of the Ministry of Health of the Republic of Kazakhstan (functions of state authority in the sphere of sanitary and epidemiological

welfare of the population) replaced the Committee for Public Health Protection of the Ministry of Health of the Republic of Kazakhstan. It performs the following functions:

- issuance of the sanitary-epidemiological conclusions on the basis of test results, and other forms of control and sanitary-epidemiological examination, in accordance with the legislation of the Republic of Kazakhstan;
- inspections of vehicles within its competence on compliance with legal and regulatory documentation in the field of sanitary and epidemiological welfare of the population, which are used for the transportation of passengers, food products, food raw materials, technical and drinking water, radioactive, hazardous, chemical and toxic substances, conditions of carriage passengers and cargo;
- development of hygienic standards and sanitary regulations regulating the radiation safety of the population, the organization of sanitation and educational activities aimed at the protection of public health;
- implementation of the unified state accounting and control of individual and collective doses of the citizens of the Republic of Kazakhstan;
- implementation of state supervision and control within their competence on the territory of the State in accordance with the legislation of the Republic of Kazakhstan;
- approval of the import of X-ray equipment, devices and equipment using radioactive substances and isotopes;
- control within its competence in the form of inspections and other forms of control in accordance with the current legislation of the Republic of Kazakhstan;
- implementation of radiation monitoring in the field of sanitary and epidemiological welfare of the population on the territory of the Republic of Kazakhstan;
- the suspension of certain types of work, operation of existing, new or renovated facilities to eliminate violations of normative legal acts in the field of sanitary and epidemiological welfare of the population and hygienic standards in accordance with the legislation of the Republic of Kazakhstan on administrative violations;
- establishing and changing of the size of the sanitary protection zones.

Committee for Industrial Development and Industrial Safety of the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan performs control and supervision in the field of industrial safety and is responsible for compliance with the statements of the Law # 188-V “On Civil Protection” dated on April 11, 2014. In accordance with Article 70 of the Law the dangerous industrial objects are the facilities, which produce, use, process, generate, store, transport, or eliminate the radioactive and (or) ionizing radiation sources.

Industrial safety is ensured by:

- establishment and implementation of the requirements of industrial safety, which are mandatory with exceptions established by the legislation of Republic of Kazakhstan;
- approval to use technology, technical devices and materials at hazardous production facilities that comply with appropriate requirements of industrial safety;
- approval for use at the territory of Republic of Kazakhstan of dangerous technical devices, which meet the industrial safety requirements;
- declaration of industrial safety of hazardous production facilities;
- state supervision, as well as industrial control in the field of industrial safety;

- examination of industrial safety;
- certification of legal entities to have a right for performing the works in the field of industrial safety;
- monitoring of industrial safety;
- service of dangerous industrial facilities by professional emergency services and formations.

In the period until 1996, the procedure for issuing permits for the disposal of radioactive waste in the Republic of Kazakhstan was regulated by the rules in effect in the USSR. Beginning 1996, the distribution of responsibilities of state bodies for disposal of radioactive waste was determined by the Decree of the Government of the Republic of Kazakhstan "Regulations on the disposal of radioactive wastes in the Republic of Kazakhstan" of October 18, 1996, No. 1283, according to which permits for disposal were issued by the Ministry of Environmental Protection and Water resources in coordination with other authorized bodies.

In 2011, by Decree of the Government of the Republic of Kazakhstan dated April 2, 2011 No. 347 "On Approval of the Rules for the Disposal of Harmful Substances, Radioactive Wastes and Wastewater Discharges into the Subsoil", these powers were transferred to the authorized body for study and use of mineral resources (the Committee of Geology of the Ministry of Energy of the Republic of Kazakhstan). During the validity period of these Rules, only a few permits were issued and in 2012 they were no longer valid. In the period until 2016, the disposal of radioactive waste in the Republic of Kazakhstan was carried out within the framework of approved draft emission standards in coordination with local authorities and environmental departments of Ministry of Ecology and Water Resources.

At the moment, when handling radioactive waste, the Rules for the organization, collection and disposal of radioactive waste are in force, which were enacted by the Order of the Ministry of Energy of the Republic of Kazakhstan No. 39 of February 8, 2016.

E.2.3. Regulatory Body (Article 20)

Article 20. Regulatory Body

20-1 Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.

20-2 Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

CAESC ME RK is headed by the Chairman who is appointed and dismissed by the order of the first head of the Ministry of Energy RK.

The Chairman of the Committee directs and is personally responsible for the implementation of the tasks assigned to the Committee and for the performance of its functions; and within the limits of the authority presents the Committee in state bodies and other organizations.

Interaction of CAESC ME RK with other state executive bodies, as well as with the organizations responsible for the atomic energy use is conducted in accordance with applicable laws and other normative legal acts of the Republic of Kazakhstan.

The competent authority of the Republic of Kazakhstan in the field of atomic energy use is provided with human, financial and technical resources to allow performing its functions.

Section F. Other General Safety Provisions

F.1. Responsibility of the License Holder (Article 21)

Article 21. Responsibility of the License Holder

21-1 Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.

21-2 If there is no such license holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

In accordance with the Law of the Republic of Kazakhstan "On permits and notifications", the type of activity "Management of radioactive waste" includes the following subspecies:

- collection and sorting of radioactive waste;
- decontamination (elimination of radioactive contamination) of the premises, equipment and materials;
- processing of radioactive waste;
- storage and disposal of radioactive waste;
- radiation rehabilitation, reclamation of territories and facilities.

The qualification requirements for obtaining a license to carry out activities for radioactive waste management include the requirements for the applicant to have:

- specialized premises necessary for the performance of the claimed work on the basis of ownership or other legal grounds
- department (or responsible person) for radiation safety and person responsible for organizing collection, storage and delivery of radioactive waste
- industrial radiation monitoring of workplaces, contaminated equipment, products, materials, soil, waste
- the following documents approved by the applicant: instructions on radiation safety during the claimed work; instructions for personnel actions in emergency situations; an action plan to protect personnel and the public from a radiation accident and its consequences; radioactive waste register; technological regulations for the implementation of the claimed work, which determines the basic methods of work, the sequential order of operations, the limits and conditions of work, including methods and stages of collection, sorting, transfer to storage, processing, processing, storage, disposal of waste, decontamination of premises, equipment, materials
- systems for monitoring and recording radiation doses to the applicant's personnel
- measures to ensure the physical protection of radioactive waste
- qualified staff of technicians and workers with appropriate education, training and admitted to the implementation of the declared type/ subtype of activity
- storages for radioactive waste on the basis of ownership or other legal basis.

The Law of the Republic of Kazakhstan "On the Use of Atomic Energy" establishes that individuals and legal entities carrying out activities in the field of atomic energy use are obliged to:

- have a license for the relevant type of activity in the field of atomic energy use;
- ensure targeted use of nuclear facilities;
- ensure the compliance of the design and operational characteristics and parameters of the nuclear facility with the requirements of nuclear, radiation and nuclear physical

safety and security, export control and (or) the requirements of the nuclear non-proliferation regime;

- have an organizational structure and a system of internal documents ensuring the fulfillment of the requirements of nuclear, radiation and nuclear physical safety and established by the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- have an organizational structure and a system of internal documents ensuring the fulfillment of requirements for accounting for nuclear materials in accordance with the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- have an organizational structure and a system of internal documents that ensure the fulfillment of the requirements for accounting for ionizing radiation sources in accordance with the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- ensure accounting and control of nuclear materials and submit reports to the competent authority on their presence, movement and location;
- ensure accounting and control of ionizing radiation sources and submit reports to the competent authority on their presence, movement and location;
- inform the competent authority of any changes in systems, equipment, documentation of a nuclear facility related to ensuring nuclear, radiation or nuclear physical safety and security;
- inform the competent authority about accidents and incidents related to nuclear, radiation and nuclear physical safety and security;
- have the necessary organizational, financial, material and technical resources and have qualified personnel for the safe operation and maintenance of a nuclear facility throughout the entire life cycle;
- provide financial means to ensure the decommissioning of a nuclear installation, closure of the disposal site, post-utilization, disposal of radioactive waste, elimination of the consequences of radiation accidents, compensation for harm to life and health of people, property of individuals and legal entities, as well as the environment;
- comply with the requirements of nuclear, radiation and nuclear physical safety and security established by the legislation of the Republic of Kazakhstan in the field of atomic energy use;
- keep records and analysis of radiation doses to workers involved in nuclear and radiation hazardous activities in the field of atomic energy use, and ensure the implementation of their rights to compensation;
- carry out training, maintenance of qualifications and timely certification of personnel employed at nuclear facilities.

Individuals and legal entities operating nuclear facilities and (or) the owners of such facilities do not have the right to transfer nuclear facilities to other individuals and legal entities, if these persons do not have licenses for the relevant type of activity in the field of atomic energy use.

Upon termination of the activities, individuals and legal entities handling nuclear facilities are obliged to take the following measures for the safe termination of activities:

- transfer nuclear materials and (or) ionizing radiation sources to the individuals and legal entities handling nuclear facilities and having appropriate licenses to handle them;
- transfer radioactive waste and (or) spent radionuclide sources to storage or disposal facilities;
- transfer the spent nuclear fuel to storage or disposal facilities or to legal entities handling nuclear facilities that have appropriate licenses for handling nuclear materials;

- carry out work on the restoration of the environment, reclamation of the territory, decontamination of equipment and premises contaminated during the implementation of the terminated activity.

F.2. Human and Financial Resources (Article 22)

Article 22. Human and Financial Resources

Each Contracting Party shall take the appropriate steps to ensure that:

i) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

To ensure nuclear, radiation and nuclear physical safety and security, emergency preparedness and response to nuclear and (or) radiation accidents, the personnel employed at nuclear facilities must have appropriate qualifications.

The personnel employed at nuclear facilities must comply with the qualification requirements approved by the competent authority.

Individuals and legal entities carrying out activities in the field of atomic energy use are prohibited from admitting to work at nuclear facilities of workers who do not meet the qualification requirements and (or) have medical contraindications to the declared type of work.

In order to maintain the proper professional level and meet the need to improve the knowledge and skills of personnel employed at nuclear facilities, individuals and legal entities involved in atomic energy use provide advanced training of personnel in the manner determined by the competent authority.

Personnel employed at nuclear facilities undergo certification to determine whether the level of their qualifications and professional training correspond to their positions.

Personnel certification is carried out in order to test knowledge of the norms and requirements of nuclear, radiation, nuclear physical safety and security, as well as to determine the ability to make decisions in the performance of work duties.

The competent authority carries out certification:

- specialists, whose job responsibilities include direct management of the facility, ensuring nuclear, radiation, nuclear physical safety and security in the course of activities in the field of atomic energy use;
- personnel of a nuclear facility, whose duties include accounting and control of nuclear materials, ionizing radiation sources, radioactive waste, ensuring the physical protection of the nuclear facility and nuclear materials;
- personnel of the radiation, electro physical facility, whose duties include monitoring of radiation safety, accounting and control of ionizing radiation sources.

Other personnel are certified by individuals and legal entities operating in the field of atomic energy use.

Individuals and legal entities involved in atomic energy use are prohibited from admitting to work at nuclear facilities an employee who has received an opinion from the attestation commission on inaptitude of his/her qualifications and professional training to the position held.

The Law of the Republic of Kazakhstan "On the Use of Atomic Energy" establishes that individuals and legal entities operating nuclear facilities and (or) the owners of such facilities must have the necessary organizational, financial, material and technical resources and have qualified personnel for safe operation and maintenance of a nuclear facility throughout the entire life cycle.

They are also required to provide financial means to ensure the decommissioning of a nuclear installation, the closure of a disposal facility, post-utilization, disposal of radioactive waste, elimination of the consequences of radiation accidents, compensation for harm to life and health of people, property of individuals and legal entities, as well as the environment.

The harm caused to individuals and legal entities because of improper handling of nuclear facilities is subject to compensation in accordance with the legislation of the Republic of Kazakhstan.

Individuals and legal entities guilty of improper handling of nuclear facilities are obliged, in the manner prescribed by the legislation of the Republic of Kazakhstan, to compensate for the damage caused to land, water, flora and fauna, including the costs of land reclamation and restoration of soil fertility.

The operating organization is obliged to have financial support within the limits of civil liability established by the Law of the Republic of Kazakhstan "On the Use of Atomic Energy". Financial support of civil liability in the event of compensation for the caused nuclear damage consists of insurance of civil liability of the operator for the caused nuclear damage or other support provided for by the legislation of the Republic of Kazakhstan.

F.3. Quality Assurance (Article 23)

Article 23. Quality Assurance

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

When managing spent nuclear fuel and radioactive waste, as one of the directions of activities in the sphere of atomic energy use, the operating organizations and those that perform the activities and provide the services must assure their quality at all stages of development, operation and decommissioning of the facility through proper implementation of the quality assurance programs.

In accordance with the requirements of the Technical Regulations "Nuclear and Radiation Safety", at all stages of the life cycle of nuclear facility, quality management activities and a safety culture aimed at ensuring the implementation of basic safety principles and criteria should be planned, systematically implemented, analyzed and evaluated.

Quality management activities should ensure the performance of works and the provision of services in an established manner, and their results meet the requirements presented to them at all stages of the life cycle of nuclear facility, including placement, design, construction, commissioning, operation and decommissioning, and the design and the manufacture of systems (elements) and equipment important for safety when handling nuclear materials, radioactive materials and radioactive waste. As a result of this activity, errors in the performance of work and the provision of services should be identified and corrected, and measures taken to eliminate the repetition of errors in the future.

F.4. Operational Radiation Protection (Article 24)

Article 24. Operational Radiation Protection

24-1 Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and

iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

24-2 Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

24-3 Uncontrolled and Unplanned Releases

Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

The Law of the Republic of Kazakhstan “On Radiation Safety” No. 219-I dated 23.04.1998 identifies the following responsibilities of the operating organization:

- operating organization conducts production control over the quality of radiation protection.
- order of execution of production control in the field of radiation safety for each organization is determined taking into account characteristics and conditions of its work, coordinated with the authorized state body in the sphere of sanitary and epidemiological welfare of the population and approved by the authorized state body in the field of use of nuclear energy.
- officials of operating organizations, implementing production control of radiation protection has the right to apply sanctions provided by laws of Republic of Kazakhstan in case of violations of radiation safety requirements, rules, regulations and hygienic standards, radiation safety rules, building codes, occupational safety regulations, administrative, instructional, teaching and other documents in the sphere of radiation safety in corresponding organization.

The Law of the Republic of Kazakhstan "On Radiation Safety" identifies requirements for assessment of radiation safety:

1. Radiation safety assessment is carried out by competent authority in the field of population sanitary and epidemiological welfare, competent authority in the field of environmental protection and the competent authority in the field of nuclear energy use
2. Organizations engaged into activities with the use of ionizing radiation sources, shall:

- implement a systematic production control of the radiation situation in the workplace, in the premises, in the territories of organizations in controlled areas, as well as emissions and discharges of radioactive substances;
- conduct regular monitoring and recording of individual radiation doses of staff and on regular basis to inform staff about the ionizing radiation dose rates at their working places and about the individual radiation doses;
- organize a preliminary (when applying for a job) and periodic medical examinations of personnel;

Technical regulation "Nuclear and radiation safety" determines requirements for radiation monitoring in design work. The project should provide radiation monitoring in premises of NI, on the site of their placement, in the sanitary protection zone, and surveillance zone.

Technical Regulation "Nuclear and Radiation Safety" obliges operating organization to control the volume, methods, means of radiation monitoring of dose levels, and changes of radiation situation, and to provide early detection and prediction of changes of radiation situation for all modes of nuclear installation operation, including accidents.

F.5. Emergency Preparedness (Article 25)

Article 25. Emergency Preparedness

25-1 Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

25-2 Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

Issues of protection of the personnel and population in case of accidents at facilities managing spent nuclear fuel and radioactive waste are subject to laws and other regulatory documents of RK. These documents have been developed considering international experience and take account of IAEA safety guides recommendations.

In accordance with the Law of RK "On Civil Defense", with the purpose to ensure preparedness for activities on localization and elimination of accidents and their consequences, the organizations having hazardous industrial facilities (organizations carrying out management of SNF and RW) shall be obliged to:

- plan and implement activities on localization and elimination of accidents and their consequences at hazardous industrial facilities;
- involve militarized emergency rescue services and units in scheduled maintenance for prevention of accidents at hazardous industrial facilities and their consequences;
- have reserves of material and financial resources for localization and elimination of accident and incident consequences;
- train employees for methods of protection and actions in case of accident, incident at hazardous industrial facilities;
- create systems of observing, warning, communication and support of actions in case of accident, incident at hazardous industrial facilities and ensure their sustained functioning.

F.6. Decommissioning (Article 26)

Article 26. Decommissioning

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

i) qualified staff and adequate financial resources are available;

ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

iii) the provisions of Article 25 with respect to emergency preparedness are applied; and

iv) records of information important to decommissioning are kept.

In accordance with the Ecology Code of RK:

- Decommissioning procedure of the nuclear installation or facility designed for radioactive waste management and closure of radioactive waste storage facility shall be envisaged by the design in accordance with the norms, regulations and standards in the field of use of atomic energy. The owner of nuclear installation or facility designed for radioactive waste management shall carry out financing of expenditures.
- Decision on prescheduled decommissioning of the nuclear installation or facility designed for radioactive waste management and on closure of radioactive waste storage facility shall be approved by the Government of the Republic of Kazakhstan and brought to the notice of the operating organization or specialized enterprise not later than two years prior to commencement of the indicated activities.

In accordance with the Technical Regulations "Nuclear and Radiation Safety", the Nuclear Radiation Electro physical Installation (NREI) decommissioning shall be carried out on the basis of the NREI administration decision agreed with the competent authority and in accordance with the Final Plan of the NREI decommissioning.

It is required during planning of the NREI decommissioning to establish stages of work performance in such a way in order to ensure functioning of observing, registration and protection systems from external exposure, systems and elements important for safety until the moment while radioactive materials are at the NREI.

During preservation of the NREI it is required to envisage ensuring of resistibility of protective and other structures, systems and elements important for safety, their long-term strength and capability to keep resistibility for external exposure of maximum possible level, as well as possibility to control these characteristics.

The following are applied as safety targets during the NREI safety analysis (according to the type) at the designing stage and in the process of operation (including decommissioning):

- assessed value of likelihood of heavy damage or core melting in case of accident shall not exceed the value of 10^{-5} events per reactor per year; generation of secondary critical masses in case of destruction and (or) core melting shall be excluded by technical means;
- assessed value of likelihood of maximum accidental release of radioactive materials shall not exceed the value of 10^{-7} events per installation per year for the NREI of category I (first) of the radiation hazard with the purpose to exclude necessity of evacuation of the population outside of the area for planned protective measures;
- envisaged activities on accident management and mitigation of consequences of beyond design basis accidents shall reduce the likelihood of radioactivity accidental release, for which it is required to take countermeasures outside of the NREI site, at least in 10 times;

- during storage, transportation, reprocessing of nuclear materials the value of effective neutron multiplication factor (K_{eff}) shall not exceed the value of 0.95 under normal operation and 0.98 under any violation of normal operation as for any piece of certain equipment containing nuclear materials and for any neutron-isolated system as a whole;
- the limit of individual life radiation risk of technogenic exposure to the personnel and population under normal operation of the NREI within a year shall not exceed the values of 1×10^{-3} and 5×10^{-5} correspondingly.

Section G. Safety of Spent Fuel Management

G.1. General safety requirements (Article 4)

Article 4. General Safety Requirements

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

In so doing, each Contracting Party shall take the appropriate steps to:

i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

iii) take into account interdependencies among the different steps in spent fuel management;

iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

v) take into account the biological, chemical and other hazards that may be associated with spent fuel management;

vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

vii) aim to avoid imposing undue burdens on future generations.

Regulatory framework of the Republic of Kazakhstan provides necessary measures to ensure that at all stages of spent fuel management there is adequate protection of personnel, population and environment from radiation exposure associated with this management.

G.1.1. Criticality and removal of residual heat (Article 4 (i))

Rules and regulations for the safe use of nuclear energy provides a comprehensive package of measures to ensure nuclear safety in the handling of spent fuel and removal of residual heat generated during spent fuel management, including the steps of: at near-reactor storage, transportation, storage long-term storage outside the reactor site.

In accordance with existing legal and regulatory framework, the value of effective neutron multiplication factor (K_{eff}) for storage, transportation, processing of nuclear materials, as for any individual unit of equipment, which contains nuclear material, and for any neutron-isolated system in general, should not exceed the value of 0.95 under normal operating conditions and 0.98 for any violations of normal operation.

Prevention of self-sustaining chain reaction (SSCR) in non-reactor installations is ensured through the implementation of one or a combination of several of the following ways:

- Restrictions of geometric shape and size of equipment;
- Restrictions on the mass of nuclear fissile materials, their isotopic composition and concentration;
- Limit the mass fraction of the neutron moderator in nuclear fissile materials;

- Restrictions on the use of reflectors of neutrons and placement of equipment;
- The use of homo-and heterogeneous neutron poisons.

Technical Regulations "Nuclear and Radiation Safety" provides that:

- Ability to achieve criticality in the storage of nuclear and radioactive materials, fresh and spent fuel at their placement and movement should be excluded physically by providing the relevant characteristics of storage;
- Design of storage of spent fuel and radioactive waste should provide heat removal systems and corresponding chemical composition of the heat removal media to prevent interaction, in which radioactive materials could enter the premises of the installation or the environment.

G.1.2. Minimization of radioactive waste generation (Article 4 (ii))

A general approach to spent fuel and radioactive waste management includes efforts to reduce the amount of generated waste by all available means and methods. A great attention is paid to this at all the stages of nuclear fuel cycle, from the time of the initial design till a full decommissioning completion and site closure.

Minimization of radioactive waste generation and its reliable isolation from population and the biosphere for the duration of waste's potential hazards is one of the basic safety measures at all stages of spent fuel management.

In accordance with Technical Regulations "Nuclear and Radiation Safety", when choosing a process technology one should prefer continuous processes and safe handling of radioactive materials, as well as minimal, practically achievable: number of technological operations, emissions and discharges, formation of explosive and flammable concentrations of substances, quantities of generated radioactive waste.

G.1.3. Interdependencies among the different steps in spent fuel management (Article 4 (iii))

At the present the storage of the spent fuel is realized in two options:

- The spent fuel of BN-350 reactor is stored in double-purpose steel concrete containers on the specially designed site for a long-term storage, on the earth surface.
- The spent fuel of the research reactors are on the supervised storage in special near-reactor depositories.

The system existing in RK that regulates design, construction, operation, maintenance and repair, inspection and testing of the facilities for spent fuel management, as well as accounting and review of irregularities in their work, ensures the continuity of safety of spent fuel management at all stages, taking into account the interdependence of these stages. Regulatory bodies are responsible for safety implementation of these activities at all stages of the life cycle of nuclear installations.

G.1.4. Protection of individuals, society and the environment (Article 4 (iv))

In accordance with regulations of RK, the operating organization applies for a license for the construction and operation of a nuclear a with a detailed safety analysis case.

The analysis case contains a detailed description of the location and characteristics of the unit, working conditions, assessment of radioactive emissions, projected radiological impact on the population and the environment, models used for impact assessments.

Regulatory body shall consider submitted safety analysis case and make a decision whether a license could be granted.

During operation of a nuclear installation involved in spent nuclear fuel management, an operating organization carries out its own monitoring to control that discharges and emissions of radioactive substances into the environment and the content of radionuclides in the environment are within established limits. Local or central authorities also carry out independent monitoring program.

In accordance with Technical Regulations on nuclear and radiation safety, the design of nuclear installation must be provided with technical means and organizational measures to protect personnel from radiation exposure, including:

- Automation and mechanization of technological processes, during which an irradiation impact is possible;
- Remote location of the working places and equipment from the locations where chain reaction is not excluded;
- Use of protective screens;
- Use of radiation monitoring means after an accident;
- Organization of emergency points for staff collection and management of measures to eliminate the consequences of an accident.

The design must provide for smooth evacuation of the staff in the event of a nuclear or radiological accident.

Design of nuclear installation must include necessary means for exclusion of individual human error or weaken their effects.

Design must envisage systems for control of radioactive and toxic substances in indoor air of the nuclear installation.

The design shall be provided with a set of technical means and organizational measures to limit the intake of radionuclides into the premises, prevention of pollution of air and work areas surfaces, skin and clothing of personnel and the environment during normal operation of nuclear installation, design-basis accidents, and elimination of consequences of these accidents.

The design shall provide a complex of sanitary facilities, including a wardrobe of personal clothing, men's and women's sanitary inspection rooms and radiation monitoring devices, sanitary locks, special laundry.

G.1.5. Taking into Account Biological, Chemical and other Hazards that May be Associated with Spent fuel Management (Article 4 (v))

While designing, constructing and operating the facilities and devices used in spent fuel management all the exposure factors are taken into account, and risk assessment of this impact is performed.

Risk analysis is carried out for both normal operation and for emergency situations. A positive conclusion on the review and evaluation of the final SAR is a prerequisite for issuing a license for nuclear facility operation.

Design of the systems important for safety of nuclear facility and storage facilities shall include consideration of mechanical, thermal, chemical and other effects that arise during design basis accidents.

G.1.6. Analysis of Actions that Impose Predictable Impacts on Future Generations (Article 4 (vi))

The principle of protection of future generations is realized through the implementation of the requirements for the analysis of projected levels of radiation effects on future generations due to spent fuel management, which should not exceed the permissible levels of exposure of the population established by the existing regulations (Appendix E).

G.1.7. Minimization of Burdens on Future Generations (Article 4 (vii))

Minimization of burdens on future generations due to need to ensure the safe management of spent fuel, is defined by the requirements of regulatory documents (Appendix E).

G.2. Existing facilities (Article 5)

Article 5. Existing Facilities

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

G2.1. BN-350 RP

BN-350 RP is currently being decommissioned. All fuel is unloaded from the reactor, packed in sealed canisters with an inert atmosphere inside, loaded into metal-concrete casks and transported to long-term storage site

G2.2. Research reactors

All research reactors are designed, constructed and operated in full compliance with existing regulations.

WWR-K reactor

Reactor was commissioned in 1967, worked at the thermal power of 10 MW up to 1988 without deviating from the normal modes.

Since 1988 to 1998 works were carried out to increase safety in conditions of high seismicity (calculations and justification, strengthening of structures, duplication of systems responsible for safety, development of new documents). By changing the configuration of the core thermal power has been reduced to 6 MW, without loss of neutron flux.

Since December 2008 to May 2009, part of the spent nuclear fuel from the WWR-K research reactor of the Institute of Nuclear Physics was removed from the territory of the Republic of Kazakhstan for reprocessing in Russia. By now, all spent fuel has been removed for reprocessing. The received radioactive waste from reprocessing of SNF will be returned to the Republic of Kazakhstan in 20 years. Instead of sent spent fuel, new nuclear fuel was supplied to Kazakhstan in the form of fuel assemblies.

Since 2016, fuel assemblies of WWR-KN have been used as fuel for WWR-K RR. The fuel composition is uranium dioxide dispersed in an aluminum matrix (UO2-Al). Fuel enrichment with

uranium-235 makes 19.7%, and uranium density makes 2.8 g/cm^3. The maximum permissible burnup is 60% for uranium-235.

Two types of WWR-KN fuel assemblies are used in the WWR-K RR core – the eight-tube (type 1 fuel assemblies) and five-tube (type 2 fuel assemblies).

IGR reactor

Discharge of fuel from the reactor was not performed since 1968. Experimental devices with fuel tested in the reactor IGR were placed in storage facility of nuclear materials for 3 to 5 months ageing followed by transportation to the radiation-protective chamber (hot cell) of the "Baikal-1" RRC for the post-irradiation studies. After investigation the fuel is placed for long-term storage. The IGR fuel discharged in 1968 is stored in a separate IGR RRC vault storage. The safety of the IGR reactor is at a high level. No special safety measures are planned at this time.

IVG.1M reactor

Water-cooled reactor IVG.1M was created as a result of modernization of high temperature gas cooled reactor IVG.1, commissioned in 1975, and was originally designed for testing of fuel elements and fuel assemblies for NRE. During this upgrade gas-cooled reactor core was replaced by a water-cooled one. Fuel of IVG.1 reactor was delivered to Russia in the course of its modernization for IVG.1M reactor.

There are three fuel assemblies with spent fuel placed long-term storage at the IVG.1M reactor, which are stored in a specially equipped storage facility with biological shielding and transfer mechanisms.

RA reactor

The RA research reactor was commissioned in 1987. Until 1997 various studies were carried out at the reactor in substantiation of nuclear power safety, including the study of the effect of radiation on biological objects, and other work. In 1998, in accordance with intergovernmental agreements, the fuel from the reactor was unloaded and taken to Russian Federation.

G2.3. Long-term storage site for spent fuel BN-350 RP

Long-term cask storage of BN-350 spent nuclear fuel is carried out at the Spent Nuclear Fuel Cask Storage Facility (SNFCSF) of "Baikal-1" RRC. Transportation of spent fuel and its placement at SNFCSF site for long-term storage was completed in November 2010.

The storage area is a concrete pad on which the casks are placed in an upright position in four rows. To perform the transfer operations the storage is equipped with 150 ton gantry crane. The effective area of the crane provide the performing of all lifting operations required for receiving, unloading of casks, and hoisting works performed during operation of the storage.

In total there are 60 casks of dual-use (transport and long-term storage).Casks are sealed and are under IAEA guarantee, and control. The site spent fuel storage system is equipped with physical protection.

CAESC ME RK approved storage of the reactor BN-350 spent fuel in dry metal-concrete casks for which a detailed analysis of safety was performed and confirmed the high level of safety in various emergency situations and natural disasters such as floods, earthquakes, hurricanes, extreme external temperatures, and so on. Efficiency of the passive cooling system for spent fuel was

confirmed. With the lapse of time, the temperature of the fuel in casks is gradually reduced, which increases the level of safety at long-term storage.

In accordance with the regulations and safety requirements when dealing with spent fuel management focus in terms of safety is paid to the criticality and removal of residual heat. Operating experience shows that the spent fuel management at reactors in the RK, is safe and effective.

G.3. Siting of proposed facilities (Article 6)

Article 6. Siting of Proposed Facilities

6-1 Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;

(iii) to make information on the safety of such a facility available to members of the public;

(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

6-2 In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

Siting of facilities for spent fuel management is licensed and regulated by the regulatory framework of the RK (E.2.2).

Since the facilities of spent fuel management are among the sources of increased danger and their activities constitute a threat to health of the population and the environment, the Kazakh legal and regulatory practice establishes requirements regarding the placement of these objects.

TR "NRS" establishes that at all stages of the life cycle, the safety of a NREI must be ensured through the consistent implementation of a system of organizational and technical measures, which include, first of all, the choice of a site suitable for placing the NREI

When assessing the suitability of the site for the placement of NRFI, the following aspects should be considered:

- influence on the NRFI of natural phenomena, processes and external man-made events occurring in the area of the site;
- characteristics of the location area and environment that may affect the transport and accumulation of radioactive products;
- medical and demographic indicators and characteristics of the location area, important for ensuring measures to protect the population.

In assessing the suitability of the site, taking into account the relevant requirements, the possibility of storing nuclear and radioactive materials should be shown; storage of spent nuclear fuel; storage and (or) disposal of radioactive waste..

The site is considered suitable for the placement of NRFI if it is possible to ensure the safe operation of the NRFI taking into account all the identified hazard factors, as well as ensuring the safety of the population and protecting the environment from radiation effects.

Characteristics of the site should be monitored throughout the life cycle of NREI. The decision on siting is made taking into account:

- the need for it to solve the economic problems of the Republic of Kazakhstan and its regions;
- availability of necessary conditions to accommodate these facilities, corresponding to the rules and regulations in the field of nuclear energy;
- absence of safety threats for nuclear installation, radiation source or storage facility from nearly located civil works;
- possible social and economic consequences of nuclear facilities placing for industrial, agricultural, social, and cultural and community development in the region.

Documents on environmental impact assessment, including radiation impact, as part of project documents, must undergo a state environmental review, taking into account public opinion. Before submission for expertise, public hearings are held in the region of the proposed location of the new installation.

When selecting sites for new facilities for spent fuel management Kazakhstan will proceed from the provisions of paragraph 2 of Article 6 of the Convention.

G.4. Design and construction of facilities (Article 7)

Article 7. Design and Construction of Facilities

(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

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

Design and construction of facilities for spent fuel management is licensed and regulated by the Kazakhstan's legal and regulatory framework (E.2.2).

Facilities of spent fuel management, according to safety requirements, shall be designed and constructed so that its radiation effects on personnel, population and the environment during normal operation, violations of normal operation, including design basis accidents do not result in exceeding the prescribed limits doses to workers and population, standards of emissions and discharges of radioactive substances, the content of radioactive substances in the environment.

Requirements of the rules and regulations establish that the organizational and technical measures in the design and construction of spent fuel management should be carried out in view of its upcoming decommissioning (closure).

Technical and organizational solutions adopted to ensure the safety of facilities for spent fuel management must be tested prior experience or testing, research and experience in operating prototypes. Such approach should be applied for installations designing, development and

manufacture of equipment, construction, reconstruction and modernization of its systems (components)

If additional factors are identified at any stage of the construction of facilities that lead to a decrease in the safety level of these facilities, a deterioration of the environment or entailing other adverse consequences, the construction is terminated or suspended, while proposals for revising the decision on construction may be made by state authorities, authorities of local government and public organizations (associations).

G.5. Assessment of safety of facilities (Article 8)

Article 8. Assessment of Safety of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

In order to receive a license for the construction or operation of a spent fuel management facility, the operating organization shall develop and submit to the regulatory body a preliminary safety analysis report (SAR), which should contain a system of technical and organizational measures to ensure the safety of the spent fuel management facility. The SAR should contain the results of the safety analysis of the spent fuel management facility, including the list of initiating events for design basis accidents and the list of beyond design basis accidents, the results of deterministic and probabilistic safety analyzes of the spent fuel management facility.

TR "Nuclear and Radiation Safety" states that:

- At the stage before the start of construction, the operating organization submits to the competent authority a preliminary SAR of NREI. The official permission of the competent authority to start construction is a positive conclusion based on the results of consideration and assessment of the preliminary SAR.
- At the stage after completion of construction, the operating organization submits to the competent authority the final SAR, taking into account all the changes made to the design during the construction and commissioning of the NREI. A positive conclusion based on the results of consideration and assessment of the final SAR is a prerequisite for issuing a license to carry out activities for the operation of NREI.
- The composition and content of the SAR is established by the competent authority with regard to the type of NREI.

In accordance with article 47 of the Environmental Code of the Republic of Kazakhstan, the state environmental examination is mandatory for feasibility studies (calculations) and projects for placement, construction, reconstruction, development, technical re-equipment, re-profiling, liquidation of enterprises, facilities and complexes, buildings and structures containing environmental impact assessment.

Article 37 of the Environmental Code establishes that the environmental impact assessment is carried out sequentially, taking into account the stages of urban planning and construction,

provided for by the legislation of the Republic of Kazakhstan. Environmental impact assessment includes the following stages:

Stage 1. Preliminary environmental impact assessment.

Stage 2. Impact assessment carried out for the purpose of a complete and comprehensive analysis of the possible effects of the project implementation or further implementation of economic and other activities, justification of alternative options and development of a plan (program) for environmental protection management.

Stage 3. The section "Environmental Protection" in the working design, which contains solutions to prevent adverse impacts on the environment.

G.6. Operation of facilities (Article 9)

Article 9. Operation of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the license to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

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

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

(v) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body;

(vi) programmes to collect and analyze relevant operating experience are established and that the results are acted upon, where appropriate;

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

All organizations operating spent fuel management facilities are licensed to operate. The issuance of operating licenses is carried out by CAESK only after receiving a positive conclusion of the safety examination expertise, completion of the program for commissioning the facility and conducting inspections to verify the state of safe operation and the readiness of the operating organization for safe operation of the facility. Inspections in the process of considering materials for issuing of licenses are carried out in order to:

- assessments of safety issues directly at the facility;
- on-site verification of the information provided;
- assessment of the capabilities and availability of conditions for the operating organization to conduct the declared activity.

In accordance with the requirements of the Law "On the Use of Atomic Energy", the operating organization constantly monitors safe operation of nuclear facility at all stages of its life cycle.

The control and inspection system carried out by the operating organization is aimed at early detection and prevention of deficiencies in the operation of the facility and their timely elimination. Periodically, in accordance with the requirements of regulatory documents, the performance of safety systems and other facility systems important to safety is checked.

The operating organization carries out comprehensive and thematic inspections of the safe operation of the facility, submits weekly messages and reports on operational safety to the regulatory body.

The operating organization also provides constant control and inspection of the condition of the equipment by carrying out a technical examination of the equipment. After reaching the end of design service life of the facility, the operating organization shall confirm the existence of a residual service life of the installation.

The operating organization ensures that decommissioning plans are developed taking into account the upgrades carried out and the consequences of incidents that have occurred.

Technical Regulations "Nuclear and Radiation Safety" establish that:

- Documented information on monitoring the limits and conditions of safe operation should be stored at the NREI for two years or two campaigns between refueling of the reactor core. Prior to the destruction of records, these results should be included in periodic reports issued by the administration of the nuclear power plant and sent to the competent authority.
- Collection, processing, analysis, storage of information on equipment failures and erroneous actions of personnel during operation should be provided at NREI.
- The administration of NREI, in the manner established by the competent authority, investigates, maintains records and informs the competent authority about all cases of violations of design limits and conditions of safe operation of NREI.
- Emergency situations and accidents that occurred at the NREI should be investigated by the commissions in the manner prescribed by the competent authority.
- Decommissioning of NREI is carried out on the basis of the decision of NREI Administration agreed with the competent authority and in accordance with the final plan of NREI decommissioning.

G.7. Disposal of spent fuel (Article 10)

Article 10. Disposal of Spent Fuel

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

Disposal of spent fuel is currently not provided for in the Republic of Kazakhstan.

Section H. Safety of Radioactive Waste Management (Articles 11-17)

Article 11. General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

(ii) ensure that the generation of radioactive waste is kept to the minimum practicable;

(iii) take into account interdependencies among the different steps in radioactive waste management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

Article 12. Existing Facilities and Past Practices

Each Contracting Party shall in due course take the appropriate steps to review:

(i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

Article 13. Siting of Proposed Facilities

13-1 Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

(iii) to make information on the safety of such a facility available to members of the public;

(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

13-2 In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11

Article 14. Design and Construction of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;

(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

Article 15. Assessment of Safety of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

Article 16. Operation of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the license to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal

facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(v) procedures for characterization and segregation of radioactive waste are applied;

(vi) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body;

(vii) programmes to collect and analyze relevant operating experience are established and that the results are acted upon, where appropriate;

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

Article 17. Institutional Measures after Closure

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

RW management are planned and implemented in accordance with the following the internationally agreed principles:

- Protection of human health. The work on RW management works should be carried out in such a way as to ensure an acceptable (established by law) level of human health protection.
- Environmental protection. The work on RW management should be carried out in such a way as to ensure an acceptable (established by law) level of environmental protection.
- Protection beyond national borders. The work on RW management should be carried out in such a way as to take into account possible consequences for human health and the environment beyond national borders.
- Protection of future generations. The work on RW management should be carried out in such a way that the predictable consequences for the health of future generations do not exceed the corresponding levels of consequences that are currently applicable.
- Burden on future generations. The work on RW management should be carried out in such a way as not to impose an undue burden on future generations.
- Control over the generation of radioactive waste. The amount of radioactive waste generated during the performance of work on RW management shall be kept at the minimum practically achievable level.

- Interdependence of radioactive waste generation and management. Optimization of one stage of the predisposal management of radioactive waste should not impose significant restrictions on subsequent stages or exclude other viable options in advance..
- Safety of facilities. The safety of all facilities involved in the process of RW management shall be ensured throughout their entire service life.

The fundamental documents aimed at protecting the health and life of people, protecting the environment, as well as establishing the legal responsibility of individuals and legal entities carrying out activities for the management of radioactive waste are as follows:

- Law "On the Use of Atomic Energy";
- Law "On radiation safety of the population";
- Environmental Code of the Republic of Kazakhstan;
- "Code of Public Health and Health Care System";
- Law "On Civil Protection";
- Law "On Permits and Notifications".

Safety requirements for collection, processing, storage of solid and liquid radioactive waste at nuclear installations, facilities for radioactive waste management, in storage facilities for nuclear materials and radioactive substances, radioactive waste storage facilities, are established by rules and regulations in the field of atomic energy which are set out in the sanitary rules "The sanitary and epidemiological requirements for radiation safety," regulation and manuals of internal enterprises developed on the basis of design documentation, technological regulations and operating instructions. According to these documents, technical means and organizational measures to ensure radiation safety for the collection, processing and storage of radioactive waste should be determined on the basis of the maximum activity of radioactive waste and to limit radiation exposure to personnel, population and environment to the levels established hygienic standards GN-2015, rules and regulations in the field of nuclear energy and other regulatory documents.

Installation design should provide technical and organizational means and measures to ensure that levels of radiation dose to personnel and the population, discharges and environmental pollution by radioactive substances do not exceed the limits and standards, established by the applicable rules, regulations and technical documents. This requirement must be met both in the normal course of the process, and for all possible violations of the normal course of the process.

The design of radioactive waste management facilities should provide for the means for safe collection, processing and storage of radioactive waste. All the designed radiation-hazardous facilities should be approved by relevant ministries and agencies, including independent environmental, health, and technical expertise, public hearings, according to the Law "On the Use of Atomic Energy" and Ecology Code. The design should also take into account the requirements of the Technical Regulations "Nuclear and Radiation Safety», "Nuclear and radiation safety of nuclear power plants» and "Nuclear and Radiation safety of research reactors». Projects of facilities for RW management should contain, in addition to architectural and construction, space-planning and structural solutions, the following sections:

- Basic safety requirements;
- Requirements and conditions for the development of environmental measures and activities;
- Requirements for occupational safety and health;
- Engineering civil defense means. Measures for the prevention of emergency situations;

- The plan of measures to protect workers and the public from radiation accidents and their consequences;
- Evacuation plan for personnel radiation accident;
- Declaration of industrial safety of the facility;
- Plan for facility decommissioning.

Section I. Transboundary movement (Article 27)

Article 27. Transboundary Movement

27-1 Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

In so doing:

(i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

(ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

(iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

(iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

(v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

27-2 A Contracting Party shall not license the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

27-3 Nothing in this Convention prejudices or affects:

(i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

(ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

(iii) the right of a Contracting Party to export its spent fuel for reprocessing;

(iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

In accordance with Article 17 of the Law of RK “On the Use of Atomic Energy”:

- Transportation of nuclear materials and sources of ionizing radiation shall be carried out in accordance with the Legislation of the Republic of Kazakhstan and the International Agreements ratified by the Republic of Kazakhstan.

The rules for the transportation of nuclear materials and sources of ionizing radiation provide for the rights, obligations and responsibilities of the consignor, carrier and consignee, security measures, physical protection, a system of coordinated measures to prevent transport accidents and accidents, requirements for packaging, labeling and vehicles, and measures on localization and liquidation of consequences of possible accidents.

The Ecology Code has the following provisions in the clause 270 concerning transboundary movement of nuclear materials and sources of ionizing radiation:

- It is prohibited to import into the Republic of Kazakhstan for storage or disposal of radioactive waste from other states, with the exception of the Republic of Kazakhstan's own radioactive waste exported for processing to other states. Disposal (placement) of radioactive waste and materials on the surface of the earth and in the depths without taking measures to prevent the ingress of radioactive substances into the environment is also prohibited.
- The import into the Republic of Kazakhstan of radioactive materials, semi-finished products, raw materials, components containing radioactive substances above the level of exemption established by the radiation safety standards is carried out in accordance with the legislation of the Republic of Kazakhstan in the field of export control and is subject to state accounting of nuclear materials and sources of ionizing radiation in accordance with the legislation of the Republic of Kazakhstan in the field of atomic energy use.

When transboundary moving radioactive materials the user of nature shall be obliged to assume the measures to ensure movement in compliance with the standards of international law. In doing this:

- the user of natural resources shall be obliged to assume measures to ensure movement by permission and preliminary notification, as well as with the consent of the state of destination;
- the transboundary movement through transit states shall be carried out subject to fulfillment of those international liabilities, which correspond to the specific used types of transport;
- shipment of spent nuclear fuel or radioactive waste is prohibited to the destination point to the south of 60 degrees of southern latitude.

Section J. Disused sealed sources (Article 28)

Article 28. Disused Sealed Sources

28-1 Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

28-2 A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

In accordance with the current legislation of the Republic of Kazakhstan, sealed IRS withdrawn from circulation, if the designated service life has expired or they are recognized as defective, are classified as radioactive waste.

All IRS of this type are placed for long-term storage in one of the IRS storage facilities at territory of the Republic of Kazakhstan. A list of such repositories is given in Appendix D2.3.

There is a licensed laboratory in the Republic of Kazakhstan that conducts a metrological study of the residual resource of sources for metrological purposes with the right to extend their service life.

Currently, the Republic of Kazakhstan does not produce ionizing radiation sources intended for export.

Section K. Planned Activity on Safety Enhancement

Simultaneously with the ongoing work on disposal of radioactive waste, the generation of new waste continues, and a far from complete the scope of work has been completed on remediation of previously contaminated lands. The formation and accumulation of low-level radioactive waste occurs at non-ferrous metallurgy, oil industry, and health care organizations.

The storage facilities in which long-term storage of radioactive waste is carried out were designed and built according to the norms and rules of the former USSR, therefore, it is required to assess the safety of their condition and revise the issues related to their closure after filling. However, there are no relevant regulatory legal acts and methodological guidelines, as well as regulatory legal acts determining the procedure for transferring radioactive waste from long-term storage facilities to disposal facilities. The current documents on land remediation concern only enterprises of the extractive industry and cannot be fully used for areas contaminated with products of nuclear explosions.

As part of improvement of national legislation, the updating of the regulatory documents is planned in the field of radiation safety and radioactive waste management.

Current activity on updating legislation is reflected in the Preface to this National Report.

Section L. Appendices

Appendix D.1. List of installations on spent fuel management

D1.1. Nuclear power reactor BN-350

The BN-350 reactor facility is an experimental-industrial one. The BN-350 is a loop type facility. Heat removal scheme has three circuits. In the first and second coolant is sodium, the third circuit is water-steam. The designed thermal power of the reactor was 1000 MW, equivalent to 350 MW of electrical power. Reactor facility never reached the nominal design parameters during operation period. Maximal thermal power reached was of 750 MW. The reactor was in operation from 1972 till 1999.

Technical characteristics

Thermal power, MW	1000
Fuel	UO_2
Loading of ^{235}U, kg	Fuel is unloaded
Enrichment on ^{235}U, %	17, 21, 26

All fuel assemblies (FA) of the BN-350 reactor can be divided into the following main types: standard (assembly of the core and the lateral breeding blanket), control and safety system assemblies, and experimental fuel assemblies.

The design of standard fuel assemblies of the core and blanket assemblies changed during the operation of the reactor with the accumulation of operating experience and materials science research, leading to the development of new designs and materials. During operation, fuel assemblies of the core of three types and fuel assemblies of the blanket of two types were loaded into the reactor. Experimental fuel assemblies were also used in the reactor to test new structural materials for the canister and fuel element cladding, as well as for testing other types of fuel.

From the point of view of spent fuel management, the BN-350 reactor plant has all the systems and related equipment that a conventional nuclear power plant has. After being unloaded from the reactor, the spent fuel was stored under water in spent fuel pools and then sent to Russia for reprocessing. After the collapse of the USSR, the transportation of spent fuel ceased, and the remaining fuel continued to be stored in the spent fuel pools. Then, with financial and technical support from the United States, the spent fuel was packaged in sealed stainless steel canisters. After that, all the fuel was reloaded into specially made dual-use (packaging and long-term storage) metal-concrete containers and transported by rail to territory of the former Semipalatinsk test site, where it is currently in long-term storage. Service life of containers is 50 years.

Currently there is no spent fuel at the BN-350 RP.

D1.2. WWR-K reactor

The research WWR-K reactor is a pool type pressurized water reactor of a heterogeneous type with a thermal spectrum of neutrons, a design capacity of 10 MW and uranium-235 enrichment of 36%. WWR-K was continuously operated without failures until 1988.

From 1988 to 1998, the work was carried out on improvement of safety in conditions of high seismicity (calculations and justifications, reinforcement of structures, duplication of systems responsible for safety, development of new documentation). By changing the configuration of the core, the thermal power was reduced to 6 MW without loss of neutron fluxes.

From 1998 to 2015, work was carried out on the conversion of the reactor (the transition from highly enriched fuel with 36% uranium-235 enrichment to low-enriched fuel with 19.7% uranium-235 enrichment) and modernization of the reactor safety systems. Since September 2016, regular operation of the reactor on low-enriched nuclear fuel has been resumed.

The reactor is equipped with hydraulic-mail, pneumatic mail, universal loop installation, the installation of a neutron radiography, facility for analysis of uranium-containing samples by delayed neutron, in-reactor plants for testing of construction materials on the long-term strength and creep, a chain of hot cells for work with high-level irradiated materials.

On the basis of the reactor, in addition to fundamental nuclear physics and materials research and in-reactor tests, work is being carried out on the production of medical radioisotopes and gamma sources, neutron doping of silicon, and neutron activation analysis.

From December 2008 till May 2009 a spent nuclear fuel of the research reactor WWR-K was delivered from the RK to Russian Federation for processing. There were exported of 278 fuel assemblies of WWR-C type, which contain a total mass of all isotopes of uranium after irradiation - 73.795 kg. The radioactive waste resulting from reprocessing of spent nuclear fuel will be returned to the RK in 20 years. Instead of sent uranium a new nuclear fuel was delivered to the RK in fuel assemblies. Experimental fuel assemblies have successfully been tested in WWR-K reactor.

Since 2016, WWR-KN fuel assemblies have been used as fuel at the WWR-K RR. The fuel composition is uranium dioxide dispersed in an aluminum matrix (UO2-Al). Fuel enrichment with uranium-235 makes 19.7%, uranium density: 2.8 g/cm^3. The maximum permissible uranium-235burnup is 60%.

Two types of WWR-KN fuel assemblies are used in the WWR-K RR core: eight-tube (type 1 fuel assembly) and five-tube (type 2 fuel assembly).

From 05/18/2016 to 05/15/2020, during 774 effective days of reactor operation, 38 LEU spent fuel assemblies were produced, thus the rate of spent fuel production of the WWR-KN type averages 9-10 fuel assemblies per year

The amount of accumulated spent fuel (number of assemblies, total activity)

Year	Number of SFAs	Total activity 2, ТБк
2017	1	4182
2018	25	72094
2019	5	14406
As of 14.05.2020	7	19050
Total	38	109732

The spent nuclear fuel (SNF) storage system of the WWR-K research reactor (WWR-K RR) is intended for temporary storage in water of spent fuel assemblies (SFAs) of the WWR-K RR removed from the core. The storage system consists of two storage facilities: wet storage and storage tank. Both storage facilities are located in the central hall of the reactor.

During the first four years after removal from the core, spent fuel assemblies are stored in a wet storage facility, followed by transferring to a storage tank. The minimum total storage time for spent fuel assemblies is determined by the need to reduce the residual energy release to a value

[2] Activity at the moment of unloading from the reactor core

that allows safe transportation from the reactor site to reprocessing facility in a special container of the reprocessing facility.

The wet storage is located next to the reactor, under the floor of the reactor hall (at the level of -4.0 ÷ 0.0), in the monolithic lower part of the building, which is not destroyed when exposed to an earthquake up to the maximum design earthquake (MCE) inclusive.

The wet storage is made in the form of a SAV aluminum alloy tank, which is inserted into a second tank made of stainless steel. Tank capacity is 10 m^3. An inclined pipe from the reactor was brought into the wet storage, through which the spent fuel assemblies are lowered into a receiver, installed at the bottom of the tank, lined with rubber. The tank is equipped with an overflow pipe with a hydraulic valve, a drain pipe and a pipe for the level gauge. There are openings in the upper part of the tank for ventilation of the storage. From above, the storage is closed with a cast-iron protection of three plates. The storage facility is replenished with demineralized water from the make-up tanks. On top of the storage there is a cast-iron protection with holes through which the spent fuel assemblies are moved by rods or container ass.12. The thickness of the cast iron protection is 0.5 m.

The storage facility contains cassettes for installation of spent fuel assemblies, which can be placed in two tiers. The cassette consists of two grids spaced apart from each other. The distances between the spent fuel assemblies in the cassettes are set in such a way as to exclude the possibility of a self-sustaining chain reaction (SCR), which is confirmed by the corresponding neutron-physical calculation. The water layer above the spent fuel assemblies in the first tier is 3.05 m, and above the second tier is 2.6 m.

The cassette of the upper tier is removable; it fits into the storage when the cells of the lower tier are full. In the lower tier cassette, the spent fuel assemblies are installed in channels with an inner diameter of 80 mm and a height of 900 mm. In the cassette of the upper tier, which consists of two blocks, spent fuel assemblies are inserted with shanks into glasses with an inner diameter of 50 mm. To provide access to the SFA of the lower tier, the glasses are removable. The number of cells in the lower tier cassette is 107, in the upper tier cassette blocks – 48. The grid pitch of the upper and lower tiers is 120×110 mm.

For water purification, the storage is connected to an independent filtering system located in room 015 of the reactor building.

The water temperature in the storage is monitored by a continuously indicating device-ratio meter, located on the control panel in the reactor control room and a resistance thermometer, which is installed directly in the storage, together with the sensor. To eliminate the measurement error caused by a change in the resistance of the connecting wires when the ambient temperature changes, the resistance thermometer is connected to the ratio meter in a three-wire circuit.

The check of the parameters of the water-chemical regime of the storage, such as pH, electrical conductivity, salt content, is carried out by the sampling method. Water parameters meet the requirements of OST-95.10134-91. Due to the residual heat release in the spent fuel assemblies, the water temperature in the storage usually remains at the level of ~ 50° C. If this level is exceeded, water is supplied to the storage from feed tanks 1-4, where the water temperature is much lower (20° C in winter and not higher than 27°C in summer), excess water flows through the overflow pipe to the drainage system.

The working value of the water level in the storage facility is 370 cm, the maximum allowable value is 350 cm. Two warning signals from the storage facility are displayed on the reactor control panel: "Decrease in water level in the wet storage to 350 cm", "Temperature rise in the wet storage".

All equipment included in the storage system is manufactured, completed and assembled in accordance with the design documentation. Upon completion of the equipment installation,

commissioning works were carried out. The quality of manufacturing, debugging and functioning of the system is confirmed by certificates, acts and passports. The normal functioning of the system during operation is ensured by periodic monitoring of its condition, including:

- periodic inspections, revisions, repairs and tests of units and mechanisms of equipment in accordance with the schedule of preventive maintenance;
- technical examination of reloading equipment.

Operation of the wet storage is carried out in accordance with the instruction "Transportation and storage of fresh and spent fuel and experimental assemblies at the WWR-K reactor" ISM-I-03-15.01-66-01-2019 dated February 27, 2019, and the working instructions for the return of irradiated fuel from the wet storage to the reactor core ISM-RI-03-15.01-002-2018 2209 dated October 16, 2018.

Spent fuel is also stored in a storage tank, which is mounted in settling chamber No. 2. The storage tank is hermetically lined with sheet stainless steel, length 2.7 m, width 2 m, height 3.5 m, volume 17.8 m3. There is an overflow at a height of 3.3 m. The tank is filled with demineralized water from the header of make-up tanks 1 ÷ 4 through one of the plugs using a flexible hose. For periodic water purification, the tank is connected by a pipeline with a diameter of 40 mm to the filtering unit No. 2. The spent fuel storage tank contains one- and two-tier cassettes. The biological protection of the tank is provided by two cast iron plates and two rotating cast iron covers, the axes of which are offset by 293 mm. The small cover has a hole for loading, unloading fuel assemblies, installing a periscope. The storage tank can accommodate up to 213 fuel assemblies (94 + 95 + 24) on the lower tier, 189 (94 + 95) on the upper tier, up to 402 in total.

The storage facility is equipped with a physical protection system and is under the safeguards and control of the IAEA. An IAEA inspection for accounting and control of spent fuel is carried out once a quarter.

The safety of the WWR-K reactor is at a high level. No special safety measures increase are currently planned.

All the spent fuel from the WWR-K reactor was sent for reprocessing to the Russian Federation. The spent fuel management at the RR currently consists of its unloading from the reactor, transportation to a nearby storage facility, and long-term controlled storage.

D1.3. IGR reactor

The IGR reactor, commissioned in 1961, is still a unique source of neutron and gamma radiation, characterized by high dynamics of power variation.

A pulsed graphite reactor is used for experimental studies of non-stationary physical processes in its core, arising from the introduction of high reactivity, and for conducting experiments to justify the safety of nuclear power.

Technical characteristics of IGR reactor

Thermal power, MW	10 GW - unregulated impulse 1 GW - regulated mode
Fuel	Graphite impregnated with uranyl nitrate
Loading ^{235}U, kg	9.056
Enrichment ^{235}U,%	90

The IGR research reactor is a pulsed thermal neutron reactor with a homogeneous uranium-graphite core of heat capacity type. The high heat capacity of graphite made it possible to dispense with the system of forced removal of heat released during the operation of the reactor in the core.

The absence of a traditional coolant circuit significantly reduces the risk of a radiation accident at the reactor.

The nuclear safety of the IGR reactor is due to a significant negative reactivity coefficient, which ensures guaranteed damping of the power pulse initiated by the injection of positive reactivity by removing the control rods.

The rate of generation of spent fuel at the KIR IGR is determined by the amount of fuel in the experimental devices tested (irradiated) in the reactor IGR. Since 1968 there was no discharge of spent fuel from the reactor.

Tested in the IGR reactor experimental devices with fuel are placed in storage for nuclear materials in room 0101 of building 1 for a cooling period of 3...5 months and then transported to the hot cell at "Baikal-1" RRC for post-irradiation examinations. After investigation the fuel is placed for long-term storage. The amount of accumulated spent fuel in 20 experimental devices of the IGR reactor is – 94.8 kg of uranium. The total activity as of May 1, 2020, is – 7450 GBq.

There are two storages for nuclear materials to store spent fuel at KIR IGR: storage in room 0101 in building 1 for experimental devices and the storage in room 25 in building 20, which has elements of the first graphite reactor core of IGR. Storage is equipped with a system of physical protection and safeguards, and are under IAEA supervision.

The possibility of upgrading of the core to use low-enriched uranium is being investigated.

D1.4. IVG.1M reactor

Water-cooled IVG.1M research reactor is an upgrade of gas cooled IVG.1 reactor, which was used to test fuel assemblies (FAs) and active zones of high-temperature gas-cooled reactors, including reactors, nuclear rocket engines (NRE), and fission-type propulsion facilities (FTPF). Fuel of IVG.1 reactor was transported to Russia in the course of its modernization into IVG.1M.

IVG.1M reactor allows to carry out investigations to ensure the following objectives:

- testing various types of fuel assemblies in operating modes;
- in-pile tests of structural materials for nuclear and thermonuclear technology;
- investigation of possible emergency situations to ensure the safety of nuclear power and development of measures to prevent them.

Technical characteristics of the IVG.1M reactor

Thermal power, MW	72 MW
Fuel	Uranium-zirconium alloy
Loading of ^{235}U, kg	4.6 kg
^{235}U Enrichment, %	90

During the operation of the IVG.1M reactor (1990 - 2020), three HEU fuel assemblies were unloaded from the reactor core: one in 2004 and two in 2017. In the period from 2017 to 2019. two LEU fuel assemblies were loaded, tested and unloaded. In 2019, two HEU fuel assemblies unloaded in 2017 were returned to the IVG.1M reactor

The IVG.1M reactor storage facility contains three fuel assemblies for the IVG.1M reactor for long-term storage. The amount of accumulated spent fuel in the assemblies is 530 grams of uranium. The value of the total activity as of 05/01/2020 is 1380 GBq.

Assemblies are stored in a container in a specially equipped storage facility in room 140 of building 101, which has biological shielding and reloading mechanisms. The storage facility is equipped with a physical protection system and is under the safeguards and control of the IAEA.

The possibility of upgrading of the core to use low-enriched uranium is being investigated.

D1.5. RA reactor

RA research reactor was based on the design of bench prototype nuclear rocket engine, and was commissioned in 1987. Prior to 1997 the various studies to substantiate the safety of nuclear power engineering were carried out on the reactor, studying the effect of radiation on biological objects and other works. In 1998, in accordance with intergovernmental agreements, the fuel from the reactor was unloaded and transported to Russia.

All reactor systems are in operable condition. The resumption of operation of the reactor is possible subject to the manufacture of fuel assemblies for completing the core. The RA reactor is considered operational within the IAEA classification

Technical characteristics of the RA reactor

Thermal power, MW	Depends on fuel
Fuel	Fuel is discharged and transported
Loading of ^{235}U, kg	No fuel since 1998
Enrichment with ^{235}U, %	-

D1.6. Site for a long term storage of the BN-350 reactor spent fuel

Long-term container storage of spent fuel of the BN-350 reactor is carried out at "Baikal-1" RRC site. The transportation of spent fuel and its installation at SNF container long term storage facility (SNFCLTSF) site was completed in November 2010. The SNFCLTSF site includes two zones:

- storage area - an open-type platform with a size of 62.6×21 m, which allows storage and maintenance of 60 containers with BN-350 spent nuclear fuel;
- transshipment area, an area with a size of 28×21 m, designed for unloading containers from railway cars to road trailers, loading empty overpack containers from road trailer onto a railway car.

The storage area is a concrete pad on which the casks are placed in an upright position in four rows. To perform the transfer operations the storage is equipped with a gantry crane of 150 tons. Ways to move a crane are located on the outer sides of the site. The effective area of the crane allows to perform all lifting operations required for receiving, unloading of casks, and hoisting works performed during the operation of the storage.

In total, there are 60 dual-use containers (transportation and long-term storage). The containers are sealed and are under the safeguards and control of the IAEA. The spent fuel storage area is equipped with a physical protection system.

Appendix D.2. RW inventory in RK

D2.1. Radioactive waste from nuclear power

There are five reactors at territory of Kazakhstan - one power reactor in Aktau, owned by MAEC-Kazatomprom, and four research reactors, of which three belonging to the NNC RK are at the Semipalatinsk test site and one belonging to the RSE "INP" in Alatau village, near Almaty.

Waste of BN-350 RP, SRW

Collection of SRW at BN-350 RP is carried out in containers in accordance with the contamination group. SRW, in accordance with the internal document TI-02-02-12, "Instructions for the management of radioactive waste of the BN-350 RPA". SRW are subdivided into:

High activity:

- more than 800 particles/(cm^2min) in β-activity;
- more than 200 particles/(cm^2min) in α-activity;
- dose rate of γ-radiation at a distance of 1 m more than 1 μSv/s

Low activity:

- all levels lower than those indicated for high activity solid waste.

As non-radioactive waste *is considered the waste whose contamination levels are less than:*

:

- 50 β-particles/(cm^2 min);
- 5 α-particles/(cm^2 min)

and concentration of α- and β-products is less than:

- $7{,}4\times10^3$ Bq/kg (2×10^{-7}Ci/kg) for ***α;***
- $7{,}4\times10^4$ Bq/kg (2×10^{-6}Ci/kg) for ***β***,

and the dose rate of γ-radiation is less than 0.003 mrem/h (0.03 μSv/h) at a distance of 10 cm

Low-activity SRW is collected in special containers, as well as in bags (polyethylene or paper). After filling the bags and containers are loaded on a special transport and are transported to SRWSF to the ground trench structure 156. High activity SRW are collected in protective bottom discharge containers. After filling, containers are transported to SRWSF by special transport and unloaded into the structure 158.

Storage facilities for solid radioactive waste are designed to store incoming SRW generated during operation and at the initial stage of decommissioning of the BN-350 RP. SRWSF is located at the industrial site of MAEC-Kazatomprom LLP and covers an area of 6.3 ha (268×235 m). The following RW storage facilities are located at territory of SRWSF:

Structure 156/$_{1\text{-}2}$

Structure 156/$_{1\text{-}2}$ (storage facility for low-activity and intermediate-activity SRW) is the groungd storage facility, made in the form of two trenches. Currently, both trenches of structure 156 / 1-2 are filled, backfilled and concreted

Structure 158 - storage facility for high-activity solid radioactive waste

Structure 158 reinforced concrete storage, consisting of a bunker with twelve loading hatches and an exhaust ventilation building.

Structure 159, storage facility for large-size SRW.

Structure consists of two trenches for storing of large-sized SRW (SFA cans made of carbon steel, MAVRs (small-size in-reactor absorber) No. 1-3). Currently, the trenches are backfilled and concreted.

Arched hangar No. 1

The arched hangar is installed on the concreted site of structure 159.

Arched hangar No. 2

Is intended for storage of NZK-150-1.5P (non-returnable protective container). The hangar is not currently in use.

Reinforced concrete protective non-returnable containers of the NZK-150-1.5P type

– for storage of low-activity and intermediate-activity SRW, located next to the arched hangar No. 1, in the amount of 77 pcs. with a total weight of 77.4 tons. 100% filled.

Enclosure for RITEG storage

The enclosures are located on the concreted site of building 156 and are intended for storing elements of RITEG radioisotope sources.

Waste of BN-350 RP, LRW

In accordance with the requirements of SP AS-88/93, acting at the BN-350 RP as a regulatory document for the collection and handling of liquid radioactive waste, LRW is divided into three categories according to the level of activity:

- Low activity $< 3.7 \times 10^5$ Bq/l;
- Intermediate activity from $3.7 \times 10^5 \div 3.7 \times 10^{10}$ Bq/l;
- High activity $> 3.7 \times 10^{10}$ Bq/l.

LRW follows to 3 receiving 250 m^3 tanks each of special water treatment (building 150A) by gravity through the C-1 special sewage system with an activity of up to $3{,}7 \times 10^7$Bq/l(10^{-3}Ci/l) and through the C-3 special sewage system through pressure pipelines from prefabricated pools (tanks) of buildings 130, 150, 150A. 157. Water from the sanitary checkpoints and the special laundry room enters the control tanks of the special water treatment facility (SWT) and, after control measurements of activity, is discharged into the industrial sewerage system, if the permissible levels of activity are not exceeded, or for treatment as liquid radioactive waste. Water purification is carried out by distillation on evaporators.

After treatment, distilled water is pumped to distilled water tank, where the purification efficiency is monitored, and if purification is satisfactory distilled water is supplied to storage tank or if not then is supplied for repeated purification. Distilled water produced by additional purification using

ion-exchange method is used for needs of special laundry and for washing purposes. Vat residue is pumped to LRWSF (building 157).

At present, the enterprise is working on the commissioning of a reserve storage facility for LRW with a total volume of 1000 m^3.

The rate of generation of radioactive waste at the enterprise.

The table shows the amount of generated radioactive waste (RW) for 2017-2019.

Kind of waste	**Category**	**Quantity per year**		
		2017	**2018**	**2019**
SRW, tons	LAW	2,00	0,54	0,95
	IAW	0,00	0,00	0,00
	HAW	0,00	0,00	0,025
LRW, m^3	IAW	2,4	3,7	4,2

Note: The enterprise does not accumulate gaseous radioactive waste.

Summary data on RW of MAEC-Kazatomprom LLP as of March 31, 2020

Kind of waste	**Category**	**Quantity**
Solid RW, t	LLRW	6438,8
	ILRW	642,3
	HLRW	169,7
Liquid RW, m^3	ILRW	2670,7

Estimated volumes of radioactive waste that will be generated during decommissioning of the BN-350 RP.

In accordance with the design materials, in the process of bringing the BN-350 reactor plant into a state of long-term safe storage (the first stage of decommissioning), the following amounts of RW are generated:

- Liquid RW ~1000 m^3;
- Low and intermediate Solid RW ~690 t (987 m^3);
- Low-activity soil and concrete chips ~2200 m^3.

WWR-K Research reactor

The rate of generation of radioactive waste at the enterprise

The rate of radioactive waste generation in INP is on the average: low-activity liquid radioactive waste (LLRW) from 6 to 24 m^3 per year with activity up to 3GBq, solid low-activity and intermedium activity radioactive waste (SRW) from 50 to 500 kg per year with activity up to 14GBq.

The amount of accumulated liquid and solid radioactive waste at the enterprise, their activity, what class they belong to (low-, intermediate-, high-activity radioactive waste).

Year	Liquid RW, m^3	Solid RW	
	Low activity waste	Low activity waste, (kg)	Intermediate activity waste ()
2016	-	-	480
2017	-	-	75
2018	6,2	150	951.6
2019	-	601	150
2020	-	450	-

The INP radioactive waste disposal facility (RWDF) was designed and built in 1965 according to the project of the Moscow Design Institute GPTI. RWDF is located in the southeastern part of the INP industrial zone and covers the area of 2.4 hectares at a distance of 15 km from Almaty city and is part of the INP industrial zone. Before the start of RWDF construction, geological exploration work was carried out at the design stage in order to determine the structure of geological rocks and aquifers in this area. The industrial zone of the INP is surrounded by a sanitary protection zone, the boundaries of which are determined by the project carried out by Promstroyproekt JSC in Almaty in 1994 and approved in accordance with the established procedure by the Chief State Doctor of the Republican Health Service. According to the specified sanitary protection zone project, the boundaries of the zone extend: in the northern direction - at a distance of 1000 m from the reactor, in the eastern and southern directions - at a distance of 500-650 m from the reactor, in the western direction - along the border of the industrial zone of the INP

RWDF is designed for disposal of low and intermediate level, solid and liquid waste. The design capacity of RWDF in terms of capacity is 2375 m^3, the actual filling at the moment is about 80% for low-activity, 15-20% for intermediate activity. The design capacity of the RWDF by activity is 40,000 curies, the actual filling is ~ 8500 curies. According to the design documentation for RWDF, the method of joint disposal of solid and liquid low-level waste in concrete storage facilities with a capacity of 125 m^3 (total of 16 compartments) is used for RW disposal. Solid low-activity waste is placed in a storage facility, where then liquid low-level waste is fed, mixed with cement in a ratio of 1:1.5, resulting in the formation of a solid monolith, which provides an eternal and sanitary disposal of radioactive waste. After the compartments are filled with radioactive waste, the containers are filled with cement slurry to the level of the storage surface, reinforced concrete slabs are placed on top, then hot bitumen smearing and asphalting are performed. The RWDF has a map showing the location of the disposal tanks. The necks of the tanks for intermediate level radioactive waste are closed with cast iron covers and sealed.

For pressing and forming briquettes from solid low-level waste (personal protective equipment, rags, waste from "hot" chambers, etc.), the size of 730x500x700 mm, a hydraulic packaging press (HPP) is installed.

The territory of the RWDF is surrounded with a concrete fence. There are signs of radiation hazard on the gates, and the gates are locked. RW is delivered to the RWDF on a specially equipped vehicle. The accounting of radioactive waste is kept in the register of radioactive waste, the log is laced and numbered. By order of the General Director of the INP, a person responsible for the reception of radioactive waste for disposal was appointed, and those responsible for the collection, storage and delivery of radioactive waste for disposal were also appointed.

The RWDF has a "Sanitary and Epidemiological Conclusion for the Right to Work with Ionizing Radiation Sources" issued by the Department of the Committee for State Sanitary and Epidemiological Surveillance in Almaty, Ministry of Health of the Republic of Kazakhstan. In

2012, the disposal of radioactive waste was carried out in accordance with the "Permit No. 11 for the disposal of hazardous substances, radioactive waste and discharge of wastewater into the subsoil" issued by the Committee for Geology and Subsoil Use of the Ministry of Industry and New Technologies of the Republic of Kazakhstan. The acceptance for disposal of radioactive waste from third-party organizations was carried out under separate Temporary permits issued by the territorial bodies of environmental protection, and in accordance with the "Procedure for accepting of radioactive waste for disposal from third-party organizations" approved by the administration of the Institute.

IGR research reactor

SRW of the IGR research reactor is transported for storage to the storage facility for radioactive waste and radiation sources at the "Baikal-1" RRC.

LRW from the maintenance of the IGR reactor follows into a collecting tank. Spectrometric analysis of industrial wastewater activity in collecting tank is conducted and if the intervention level is exceeded by 10 times, the wastewater is pumped into the transport tank and delivered to the building No. 140 by a special vehicle.

"Baikal-1" RRC, research reactors IVG.1M and RA

SRW management

The IAE currently has two main storage facilities for radioactive waste and radiation sources, the main data of which are given in the table. These storage facilities are used to store their own radioactive waste "Baikal-1" RRC and IGR RRC. In addition, the storage facilities are used to receive RW from other enterprises and organizations, as well as ownerless (orphan) ones.

Name of facility	Area, m^2	Construction volume, m^3	Maximum design activity
Storage facility, structure 313	1440	11360	$7,5\times10^{15}$Bq
Storage facility, structure 357	516	2714	$1,5\times10^{16}$Bq

Structure 357 is designed for long-term storage of solid radioactive waste and spent sources of ionizing radiation. Building 357 is a separate, buried, earth-bounded, monolithic, reinforced concrete building. The structure consists of separate cells with loading hatches for loading radioactive waste. Hatches are closed with concrete blocks in metal casings.

Structure 313 is intended for long-term storage of solid radioactive waste and sources of ionizing radiation with an expired service life, supplied for long-term storage from enterprises of the Republic of Kazakhstan. The structure consists of separate cells with loading hatches for loading radioactive waste. Hatches are closed with concrete blocks in metal casings.

The amount of solid radioactive waste at the KIR "Baikal-1", attributed to the company's own accumulations, is 184,716 kg with a total activity of 4,929 GBq.

The total amount of radioactive waste placed for long-term storage at the "Baikal-1" RRC, taking into account the radioactive waste supplied to the RSE NNC RK from outside (enterprises, organizations, ownerless), is 2,820,194 kg with a total activity of 7,658 GBq.

LRW management

Sources of liquid radioactive waste can be leaks of water used as a coolant, any solutions after processing radioactive materials, decontamination of equipment and premises, discharges of active drains, as well as wastewater from a sanitary inspection room and other sanitary-technical devices, if the content of radioactive substances in them exceeds the levels of intervention, regulated by the legislation of the Republic of Kazakhstan.

Household and special sewerage systems are provided for wastewater disposal. The first system is designed to remove wastewater that does not have radioactive contamination.

The special sewage system is designed to remove wastewater containing radioactive substances and has no connections with the domestic sewage system.

Structure140 is intended for accommodation of liquid low-level radioactive waste and their concentration by evaporation. There is a screen in the structure 140 made of hydro-resistant 0.5 m thick clay, which excludes the penetration of special drains into the ground and groundwater.

Due to the natural evaporation of water in the structure 140, the soaked layer is dried, with the deposition of radionuclides in it in a bound form.

D2.2. IRS in RK

CAESC ME RK created and maintains the Register of radionuclide sources on the basis of processing of reports of organizations, data on export-import operations, as well as the results of the inventory of radiation sources.

Using the information from licensed organizations, which they submit in their annual reports CAESC RK verifies its database on the used radiation sources

CAESC RK maintains a database on radionuclide sources that have served their service life and are placed for long-term storage in specialized storage facilities. There are 5 storage facilities for long-term storage of sources of ionizing radiation (IRS) in the Republic of Kazakhstan:

1. The IRS storage facility located at "Baikal-1" RRC site near Kurchatov city, in the branch of the IAE RSE NNC RK (IAE NNC RK).
2. IRS storage facility located in Ala-Tau settlement near Almaty of the Institute of Nuclear Physics (RSE INP).
3. IRS storage facilities located in several buildings and premises of BN-350 RP, MAEC-Kazatomprom (NAC-Kazatomprom).
4. IRS storage facility belonging to Ulba Metallurgical Plant (UMP), (NAK-Kazatomprom).
5. Storage facility of “Kazphosphate” LLP, located in Taraz city. Currently, the issue of moving a part of the sources to other storages at territory of the Republic of Kazakhstan is being considered.

D2.3. Radioactive waste management at uranium mining and uranium processing enterprises

Joint Stock Company "Ulba Metallurgical Plant" (JSC "UMP")

Dynamics of waste generation at UMP JSC is shown in the table:

The rate of generation of radioactive waste at the enterprise

Waste designation	2017	2018	2019

LRW, (m^3)	108535,9	106132,2	120480,3
SRW, (t)	73,4	84,4	131,9

The amount of accumulated liquid and solid radioactive waste at the enterprise, their activity, class

Waste designation	Accumulation as of 01.01.2020	total activity, GBq
LRW*, (m^3)	8010691	541,8
Including the low active, (m^3)	8010691	541,8
SRW**, (t)	3870,4	2046,7
Including the low active, (t)	853,8	189,4
Including the intermediate active, (t)	3016,6	1857,3

Note:

* LRW are located in map No. 1, map No. 2, map No. 3, map No. 1-3 (section 1), structure 498B;

** SRW is placed in structure No. 710, structure No. 498A, structure No. 734.

Waste of JSC UMP is placed at the "Tailing Site" storage facility (TSSF). Production waste, which is currently stored at this site, includes radioactive, toxic wastes of hazard class 3 – 4 and non-toxic ones; the physical conditions – solid and liquid wastes.

Receivers of liquid waste at TSSF are of open type, made in the form of ponds (maps) and accumulate, with partial evaporation, effluents and sludge from all production zones. Since, when placing LW in ponds, the effluents of all production zones were mixed, the clarified part and sediments of all ponds can be considered radiation-contaminated. Waste receivers at the site were constructed and filled with the development of production and depending on the volume of waste generation. Disposal of LRW generated as a result of production activities of UMP JSC is carried out in special facilities of the TSSF section. These include:

1. Pond accumulator (map) No. 2 - storage facility of pouring type. Maximum filling volume 2,447,000 m^3. The dimensions along the axes of the dams are 620 × 405 m. The maximum filling level (absolute mark) is 358.75 m. The anti- seepage screen is made along the bottom and slopes of the map from bentonite clays and polyethylene film stabilized with soot, 0.4 mm thick. Map No. 2 is used for placement of liquid radioactive waste in the form of solutions of uranium, tantalum production and service center, transported through pipelines.

2. Pond-evaporator (map) No 3 - storage facility of pouring type with dimensions along the dam axes 917×387 m. Capacity 4475 thousand m^3. The absolute elevation of the dams is 345.05 m. The maximum filling level is 343.03 m. The anti-seepage screen is made of a 1 mm thick "SOLMAX" geomembrane. The bottom and slope, including the berm, are covered with two layers of film above the berm in one layer. A protective layer of loam with a layer thickness of 0.5 m and a boulder-gravel-sand mixture with a layer thickness of 0.35 m is made along the film.

Map No. 3 is filled with clarified drains from Map No. 2 by means of siphons, as well as polluted groundwater from vertical drainage wells. Control and measuring equipment of map No. 3 consists of surface and depth marks and piezometers in the amount of 13 pieces, located in the dam body, to record the total settlement of the foundation and the dam body, to monitor the position of the depression curve in the dam body.

3. Pond-evaporator (map) No 1 - storage facility of pouring type. It was put into operation in 1982, the reconstruction of the anti- seepage screen was made in 2010-2011. Maximum filling volume 945268 m^3. Dimensions along the dam axes 562.5 × 255. The maximum filling level (absolute mark) is 349.0 m. A polymer geomembrane based on high density polyethylene (HDPE), resistant to the influence of liquid industrial wastes of UMP JSC, was used for making of anti-filtration impervious screen. The evaporation pond is filled with clarified waste streams from the map No. 2 by means of siphons for subsequent evaporation.

4. Pond-evaporator (map) No 1-3 (section No.1 for liquid waste) of pouring type. It was put into operation in 1970, the reconstruction of the anti-seepage screen was made in 2012-2013. Maximum filling volume 722550 m3. The dimensions along the axes of the dams are 390 x 350 m. The maximum filling level (absolute mark) is 348.5 m. A polymer geomembrane based on high density polyethylene (HDPE), resistant to the influence of liquid industrial waste of UMP JSC, is used for the device of the impervious screen. The evaporation pond is filled with clarified waste streams from the map No. 2 by means of siphons for subsequent evaporation.

Solid radioactive waste generated at UMP JSC, depending on its type, is disposed of at the TSSF in special structures of various design. All solid waste is weighed before disposal. The disposal of SRW, formed as a result of the production activities of UMP JSC, is carried out in special facilities of the TSSF. These include:

Structure 734. – a repository for the placement of solid radioactive low-activity and intermediate-activity waste, is an underground storage facility with a total capacity of about 4690 m^3. The burial ground is made of reinforced concrete and consists of separate compartments with a capacity of about 200 m^3 each. The size of the compartment is 5250x4900x8000 mm. Each compartment has a loading hatch with a concrete cover. The cover hangs over the hatch from all sides, excluding the ingress of precipitation inside the repository. The base and walls of the burial ground are reinforced concrete, wall thickness 300 mm. At the base under the bottom of the burial ground, a gravel-sand drainage layer 0.3 m thick was laid on compacted loam

For every four compartments, one pipe with a diameter of 100 mm was installed with perforation in the drainage layer to control the lack of groundwater under the structure.

To exclude the ingress of groundwater into the compartments, the walls of the burial ground are covered with hot bitumen on the outside with a primer. The drainage of surface storm water and melt water is provided by an upland ditch with unloading of surface water into the general surface water collection system into the regulator pond No. 2.

Disposal facility for placement of spent sources of ionizing radiation represents a steel capsule in the form of a cylinder with a diameter of 450 mm and a height of 1500 mm, made of grade X18H9T stainless steel. The capsule is placed at a depth of 6020 mm in a concrete niche with external waterproofing. To load sources of ionizing radiation (IRS), there is an S-shaped pipe with a diameter of 100 mm. At the top of the pipe there is a funnel with a lockable lid.

Structures 498B and 498A – underground reservoirs made of monolithic reinforced concrete with a diameter of 24.8 m, a height of 4.2 m, with a capacity of 2000 m^3 each. The bottoms and walls are lined with a sheet of 4 mm thick grade St 3 steel, protected with epoxy paint.

Waterproofing of walls and ceilings is done with hot bitumen and clay. Under the bottom of the tanks, a drainage device is made with an outlet to the inspection well.

NAC Kazatomprom enterprises

The rate of generation of radioactive waste at the enterprise

Name of enterprise	The amount of waste generated, tons		
	2017	2018	2019
JSC JV"Akbastau"	22,6	20,36	36,54
“Kyzylkum” LLP	69,48	101,45	139,42
"RU-6" LLP	723,457	732,441	470,126
"Karatau" LLP	225,1	244,63	102,7
"Baiken-U" LLP	48,781	76,623	143,136
JSC JV “ZARECHNOE”	156,884	148,608	233,466
“Kazatomprom-SaUran” LLP			
branch “Stepnoye-RU”	110,2	59,38	831,71
branch “Taukent”	80,1	96,36	184,17

The amount of accumulated liquid and solid radioactive waste at enterprises, their activity, class

	Temporary storage site for low activity radioactive waste, tons	LLRWDF (since the beginning of operation), tons	Class of RW
JSC JV"Akbastau"	9,5	–	Low-activity
“Kyzylkum” LLP	203,5	–	Low-activity
"RU-6" LLP	0	2757,99	Low-activity
"Karatau" LLP	0	–	Low-activity
"Baiken-U" LLP»	3,174	–	Low-activity
JSC JV “ZARECHNOE”	83,466	–	Low-activity
“Kazatomprom-SaUran” LLP			
branch “Stepnoye-RU”	0	72377,00	Low-activity
branch “Taukent”	0	7180,03	Low-activity

Radioactive waste management at enterprises

Waste management at all mining enterprises of “NAC Kazatomprom” JSC (subsidiaries and dependent companies) is carried out under the current state licenses.

Liquid radioactive waste generated in the process of washing overalls, decontamination of PPE and equipment is discharged into the sump of return solutions. Thus, liquid radioactive waste is not generated at subsidiaries.

Temporary storage of solid low-activity radioactive waste (SLLRW) at subsidiaries and affiliates, is carried out in a specially designated area - the site for temporary storage of SLLRW. Temporary storage of SLLRW is carried out in special containers and does not exceed one month. Equipment, structural parts, waste parts of submersible electric pumps and other items made of stainless steel that cannot be completely decontaminated are collected in a separate TUK. Destroyed sorbent, filter cloth, silt, sands precipitated from technological solutions, sediments obtained at various stages of processing, salts formed as a result of clogging on equipment, worn-out overalls, footwear and PPE decontamination of which is impractical, breakage of laboratory glassware is collected in collection containers TUK. Sands, soil contaminated with radionuclides are poured into bags or directly into TUKs, which are delivered directly to the technological blocks, on which SLLRW was formed. Cuts of polyethylene pipes, unrepairable shut-off valves contaminated with radionuclides are stored in the TUK. SLLRW is not processed before being transferred for disposal. Large fragments of HDPE pipes are divided into segments that allow them to be placed in a TUK container.

RW management activities are carried out in accordance with the regulatory legal acts of the Republic of Kazakhstan, as well as the internal standards of NAC Kazatomprom JSC and SDCs.

SDCs of NAC Kazatomprom JSC on a contractual basis send their SLLRW to the disposal sites of the following organizations - RU-6 LLP, Stepnoye-RU branch and Taukent branch of Kazatomprom-SaUran LLP.

LLP "Joint Venture" South Mining and Chemical Company"

The main activity of the company is the extraction of natural uranium by the in situ leaching method. Production method: sorption extraction of sulphate complexes of uranyl ion from productive solutions, production of a chemical concentrate of natural uranium in the form of nitrous oxide, temporary storage, shipment by special vehicles of "TTK" LLP and shipment of chemical concentrate of natural uranium (CCNU) through auto-transshipment base to railway cars. The finished product is packed into transport containers TUK-44/8.

1. Low-activity wastes at the enterprise are: used PPE, sediment of suspended solids in the form of sand and sludge from sand ponds, broken resins in the process of sorption, soil contaminated with spills of technological solutions, waste equipment.

The average monthly generation of solid low-activity radioactive production waste during 2019 amounted to ≈12,166 tons. The bulk of the formation of low-activity radioactive waste falls on the spring-autumn period.

2. In 2019, 146.0 tons of solid radioactive waste were generated. The generated radioactive waste is classified as low-activity radioactive waste. The generated low-activity radioactive waste in 2019 was taken out for disposal in the surface repository of Kazatomprom-Sauran LLP in the amount of 146.0 tons (under the contract). To date, 5.2 tons have been accumulated at the site of temporary storage of low-activity radioactive waste of JV “YUGHK”LLP.

3. The order appointed persons responsible for the organization of collection, accounting, storage and delivery for disposal, who keep records in the appropriate log. The system of low-activity RW management includes: primary collection at the place of their formation in bags, sorting, packing into collection containers (TUK-118), temporary storage at the low-activity RW site and removal for disposal in accordance with the agreement to the disposal facility. The temporary storage area

is a fenced area with a concreted surface, equipped with a tray and a sump for collecting waste water. The site is equipped with a radiation hazard sign, an inscription on the person in charge, an inscription on restricting access of unauthorized persons "Entry to the site is prohibited for unauthorized persons".

4. There is no inherited waste from previous activities on the territory of JV “YUGHK” LLP.

An agreement for the disposal of low-activity RW is signed with “Kazatomprom-Sauran” LLP every year. The disposal of generated low-activity RW for disposal in the near-surface disposal facility of “Kazatomprom-Sauran LLP” is carried out as it accumulates. In this connection, the mine has no plans for long-term radioactive waste management.

5. There are no abandoned mines of the uranium mining industry on the territory of the mine.

"Stepnogorsk Mining and Chemical Complex" LLP

The rate of generation of radioactive waste at the enterprise in 2019.

Types of radioactive waste	Actually for 2019	Environmental permit limits for 2019
Solid radioactive alpha and beta active sludge, in tons/year	5204	6678
Solid radioactively contaminated waste, tons/year	398,58	4689,285

The amount of accumulated solid, low-activity RW at the enterprise

The total mass of accumulated waste from the start of operation as of April 30, 2020. - 52 866 574.17 tons, their activity - 6.9 E+15 Bq.

Radioactive waste management at the enterprise

GMZ tailing site storage facility (TSSF)

TSSF of hydrometallurgical plant is a part of the tailings facility and includes a complex of facilities required for waste storage.

TSSF has been in operation since 1968.

- map No. 1 - 162 ha;

- map No.2 - 270 ha;

- evaporative - 300 ha;

- intermediate pumping station and slurry pipelines - 22 ha.

Map No. 1, size 900x1800m (162 ha). Was in operation from 1968 to 1976. It is undergoing remediation by method of hydraulic flooding with non-radioactive waste from hydrometallurgical production.

Map No. 2, size 1500x1800m (270 ha). It has been in operation since 1982. Evaporation card size 1500x2000m (300 ha). It was in operation from 1976 to 1990. Used to reduce the volume of unbalanced water during operation. After the completion of the remediation of the map No. 1, it is

planned to carry out the remediation of the evaporation map by the method of hydraulic flooding with non-radioactive waste from hydrometallurgical production.

Plans for long-term management of radioactive waste at the enterprise

In 2014, a project was developed for the remediation of map No. 1 by the method of hydro-injection with non-radioactive waste from the enrichment of copper-molybdenum and flotation production.

The main directions of reconstruction of the tailing facilities of the GMZ SGHK LLP, considered in this project, areas follows:

- remediation of map No. 1, which consists in building up the enclosing dams up to elevation. 296.00 m and installation of a distribution slurry line with slurry outlets on the crests of dams for storing tailings from processing copper-molybdenum and gold-bearing ores;
- construction of a pumping station for circulating water supply on map No. 1;
- remediation of the anti-radiation shield with non-radioactive waste from the enrichment of hydrometallurgical production;
- erection of an anti-erosion screen with soil from a dump of overburden.

The first stage envisages the construction of structures that will provide an overflow of an anti-radiation shield from non-radioactive waste from hydrometallurgical production. At the time of preparation and execution of construction works of the 1st stage of remediation of map No. 1, the discharge of pulp obtained from the tailings of processing of copper-molybdenum non-radioactive ores is provided for in map No. 2.

The second stage provides for the actual washing of the anti-radiation shield 3.0 m thick from the tailings (waste) of the processing of non-radioactive ores.

At the third stage, it is planned to install an anti-erosion coating over the washed anti-radiation shield with soil from a dump of overburden. The thickness of the anti-erosion layer is taken as 0.5 m.

Thus, the depleted non-radioactive pulp is planned to be dumped on the map No. 1 of the GMZ TSSF to cover the uranium waste with non-radioactive waste from the flotation production. Temporarily, until the completion of construction and installation work, placement of wastes of enrichment of copper-molybdenum, gold-bearing and sulphide ores is provided on map No. 2, and as remediation material is provided on map No. 1. The proposed method of erecting an anti-radiation shield on the spent maps of the GMZ tailing dump will significantly improve the environmental situation in the region, ensuring compliance with the radiation safety standards of the Republic of Kazakhstan.

The implementation of this project allows solving of several strategic tasks at once:

- remove the risk of radioactive contamination of the environment by covering the dusty beaches of the uranium tailing dump with non-radioactive tails;
- eliminate the need to attract budget funds for the remediation of the tailing dump in Stepnogorsk.
- eliminate the need to build a new TSSF (another source of environmental pollution), which will require the allotment of new land in the amount of at least 200 hectares. At the same time, lands will be withdrawn from circulation, a negative impact will be exerted on the soil and vegetation cover, the animal world.
- Rehabilitation of abandoned mines of the uranium mining industry takes no place. The Shantobe mine is under conservation and partial remediation.

D2.4. Radioactive waste of the non-uranium industry

A number of deposit occurrences of complex ores, rare-earth metals and phosphorites in Kazakhstan contain uranium mineralization, which is extracted together with the main ore during ore production. Part of radioactive mineralization goes to damps and tailings; part stays in the main product (especially in phosphate fertilizers). As a result of aero-gamma-spectrometry there were registered radioactive waste of metallurgical, chemical and metal mining enterprises within the limits of established sanitaгy-protective zones in Semey, Taraz, Shymkent and Akmola region..

Top oxidized parts of coal beds at some coal deposits are accompanied with uranium mineralization as well. This coal is not realized as a fuel and subject to stockpiling as RW.

The storage sites for bulk radioactive waste in non-uranium mining and processing plants, have generally not been designed so far. Currently, coal mining projects with oxidized parts provide for the storage and subsequent disposal of radioactive waste.

Contaminated (mainly Ra-226 and Th-232) soils, oil-slimes, equipment, pipes were revealed when surveying oil-gas fields. It relates to long-term exposure of oil water enriched with natural radionuclide. Overwhelming part of the waste (98%) is generated at oil fields. Currently, RW of this group is gaining more and more importance due to intensive development of Mangyshlak-Caspian oil fields and mass inclusion into development of small deposits of brown coals characterized by increased content of natural radionuclide. 57 from 76 registered storing places relate to contaminated equipment and soils at oil-gas fields.

The strata water of oil fields contains the maximum number of radionuclide in comparison with all known strata water, except water of uranium deposits. For example, permissible content of radium was determined the hundreds of times and thorium in 20-30 times exceeding as a result of sample analysis from the wells of Uzen, Zhetybai fields. There were revealed 1.3 mln.m^3 of radioactive waste and 650 ha of contaminated territory with surface radiation over 1mcSv/h only as a result of conducted surveys on the territory of Mangistau and Atyrau regions.

The plans for the development of new fields provide for measures to ensure radiation safety, but the normalization of the situation at old and already used facilities is proceeding slowly. To date, at the Kalamkas and Zhetybai oil fields in the Mangistau region, sections have been created for the decontamination of equipment and pipes. At the Zhetybai and Zhana-Ozen oil fields, radioactive waste storage facilities were commissioned for 100 thousand tons (Zhana-Ozen) and 70 thousand tons (Zhetybai).

According to some estimations, the volume of radioactive waste of non-uranium industry is 2.3mln tons with the activity of 4921 GBq.

D2.5. Territories contaminated with radionuclides as a result of nuclear tests

Nuclear explosions on the territory of the Republic of Kazakhstan were during the period from 1949 to 1989, on Semipalatinsk test-site, Azgyr and Lira test-sites. Since 1965 to 1987 on the territory of the Republic of Kazakhstan there were 39 underground nuclear explosions for national economy needs, 17 of them with explosion yield of 584 TNT equivalent on the territory of the Azgyr test-site, where in salt domes there were created 9 cavities with initial volume around 1,2 mln. m^3, at this in the generated cavities there were deposited radionuclide with total activity of $0{,}7\times10^{16}$ Bq. Two cavities were used for disposal of radioactive soil and contaminated metal construction and mechanism units. Totally, in the Azgyr underground cavities there are disposed solid RW with volume of 200 m^3 and activity of 18.5 GBq. Daylight surfaces of all the sites were subject to decontamination and remediation in 1989-1994 by VNIIEF.

The Semipalatinsk test site (SIP) covers an area of 18,500 km2. 456 explosions were tested at territory of the Semipalatinsk test site. Of these, 86 are air, 30 are ground and 340 are underground.

Among all the ground-based nuclear tests carried out at the Semipalatinsk test site, some tests can be distinguished, which, in general, determined the scale of radioactive contamination of the environment in the test site and adjacent regions. These are ground nuclear tests conducted on the site “Opytnoe pole” on 29.08.49 (yield ~ 22 kt), 24.09.51 (yield ~ 38 kt), 12.08.53 (yield ~ 400 kt), 24.08.56 (yield ~ 26,5 kt), 07.08.62 (yield ~ 9,9 kt), and underground tests with soil burst conducted on the test-site “Balapan” (15.01.65) and “Sary-Uzen” (14.10.65). The radioactive tracks, as a rule, were generated on the territory of the test-site after other ground explosions characterized by low and, basically, ultra-low yield.

Until now, radioactive fallout traces from ground tests carried out on 24.09.51 and 12.08.53 and underground tests carried out on 15.01.65 and 14.10.65 are well detected on the ground by radiometric methods, and laboratory analyzes of selected samples of natural environments confirm the presence of technogenic radionuclides ^{137}Cs, ^{90}Sr and ^{239,240}Pu in quantities of hundreds and thousands of Bq/kg.

Thus, radioactive fallout after ground nuclear tests formed radionuclide contamination of the area in the form of extended traces and separate spots, both on the territory of the test site territory and outside its limits.

The exposure dose rate in air on the site "Experimental field" due to the presence of gamma-emitting radionuclides Cs-137, Eu-152, Co-60, is very high and in extreme points reaches 80-100 mSv/h or more (natural background 0 10-0,25 mSv/h) and on the site Balapan - up to 10.5 mSv/h. In areas of above-ground nuclear explosions the plutonium isotope concentrations reach 28000 Bq/kg, in the areas of excavation explosions –up to 3222000 Bq/kg; there is excessive concentration in communities outside of the Test site. In 1953-57, on STS there were implemented programs on testing of the radiological warfare agents (RWA). RWA tests were conducted on the sites "4" and "4a" located to the north and to the west from “Opytnoe pole”. RWA spreading was carried out by blasting of individual shells, bombing of areas by mortar shells, release of bombs by bombers or dispersion of RWA by aircraft. The basic contaminant is radionuclide ^{90}Sr, at the same time there are present other radionuclide (^{137}Cs, ^{241}Am,^{60}Co, Pu and Eu isotopes). The specific activity of radionuclide ^{90}Sr reaches 5x10^{8}Bq/kg in soil covering on separate areas. The areas of contamination vary from hundreds up to hundred thousand square meters and the extent of some of them reaches several kilometers. The radionuclide content in soil-vegetable covering can be classified as RW.

During the period from 1995 to 2000, work was carried out on elimination of infrastructure for conducting nuclear tests. The facilities intended for underground testing, 181 tunnels of the Degelen mountain massif and 13 unused wells at the Balapan site were brought to a state that did not allow their use for testing nuclear weapons (closing of tunnel portals, liquidation of wells).

Less known are the tests carried out for peaceful purpose in other places in Kazakhstan. These are the objects "Lira" (6 explosions), "Sai-Utes" (3 explosions), as well as explosions within the framework of the programs "Meridian" (3 explosions), "Region" (2 explosions), “Batolit” (1 explosion) for the study of the geological structure of the earth's crust.

At the Lira test site, at a depth of 700-900 m, 6 cavities with a volume of about 50 thousand m^3 were created, designed to store gas condensate from the Karachaganak field.

According to survey data for 2006, the total amount of radioactive waste from nuclear tests is 237,200 thousand tons with an activity of 570 million GBq. Including high-activity 0.5 thousand tons with activity 70 million GBq, intermediate-activity 6,500 thousand tons with activity 488 million GBq, low-activity 230,700 thousand tons with activity 11.1 million GBq.

Appendix D3. Nuclear facilities under decommissioning

Currently, the only reactor that is under decommissioning on the territory of the RK is a fast-breeder BN-350 NPP in Aktau. On April 22, 1999, the Kazakhstan Government adopted Resolution № 456 on BN-350 decommissioning. This Resolution determined the concept of the reactor facility decommissioning. This concept provides the decommissioning in three main stages:

Stage 1. Bringing the BN-350 reactor plant into a state of long-term safe storage.

Stage completion criteria are:

- the fuel is unloaded from the RF and placed for a long-term storage;
- liquid metal coolant is removed from the RF, processed, radioactive processing products are placed for a long-term storage;
- RW are processed and placed for a long-term storage;
- RF, buffer area and control area radiation monitoring is provided;
- The composition of remaining under operation, dismantled and mothballed equipment is determined, and the required work is performed.

Stage 2. Long-term safe storage.

Stage completion criteria are:

- the 50-year long storage period term is being completed;
- the decision to commence work on final dismantling is made.

Stage 3. Partial or complete dismantling of equipment, buildings and structures, and disposal of. Criteria for completion of the third main stage:

- partial or complete dismantling of equipment, buildings and structures is performed;
- complete decontamination and rehabilitation of the territory is performed;
- RW are placed for a long-term storage or disposed of.

As of August 2020, in cooperation with organizations of the Russian Federation, a feasibility study for the decommissioning project of the BN-350 RP has been developed and is undergoing approval, which, after approval, will serve as the basis for allocating funding, developing individual projects for construction phases and their implementation.

Current status of decommissioning activities

Nuclear fuel management: all spent nuclear fuel of the BN-350 RP was packed in protective sealed containers and sent to "BAIKAL-1" RRC SNFLTSF site of the RSE IAE National Nuclear Center of the Republic of Kazakhstan for safe long-term storage.

Liquid metal coolant handling:

- Sodium of the primary circuit was purified from cesium isotopes to an acceptable level of specific activity, drained into storage tanks and transferred to a solid state. Radioactive cesium accumulating traps are brought into a safe state.
- A sodium processing facility (SPF) primary sodium processing into liquid sodium hydroxide with a concentration of 50% was created and commissioned in December 2016.
- In accordance with the project, the SPF was updated to obtain the final product of processing in the form of solid 70% alkali.

- The design of the facility for processing of sodium hydroxide produced at the SPF into geocement stone (FP GCS) is outdated, because within three years was not implemented. Correction and re-approval of the FP GCS project is required. Funds were not allocated for the adjustment and re-approval of the FP GCS project.
- Work was performed to remove sodium residues from the reactor tank, equipment and pipelines of the primary and secondary loops by hydro carbonization method.

***Liquid radioactive waste (LRW) management*:**

- The design of the complex for the processing of liquid radioactive waste (CP LRW) is outdated, because within three years was not implemented due to lack of funding. The project needs updating.

Solid radioactive waste management:

- The design of the complex for the processing of solid low and intermediate-activity waste was not completed (no state expert examination was carried out) and, accordingly, was not approved.
  To complete the project, its actualization and, possibly, correction with the use of modern technologies is required.
- The High Activity Waste (HAW) Management Project was developed in 2010. Approval and state examination of the project was suspended due to lack of funding. An update of design estimates is required.

Bringing buildings and structures into a safe state for long-term storage (fifth stage of construction):

The project of the fifth stage of construction was developed, but did not pass the State Expertise and, accordingly, was not approved. There is no funding to complete the project. In the period from 2005 to 2008, part of the work was carried out based on the results of a comprehensive engineering and radiation survey of building constructions of buildings and structures.

Works carried out in MAEC-Kazatomprom LLP at BN-350 RP on local projects:

In 2017, work was completed on the placement of radioactive non-nuclear materials and sources with the expired lifetime loaded in protective packages at the site of Interim Storage Facility of SNF BN-350 (SNFISF).

Work is underway to complete the development of a feasibility study (FS) for the decommissioning of the BN-350 reactor.

Development work is underway to remove radionuclides from LRW using Corebrick technology.

Partial dismantling of BN-350 RP equipment was carried out, preparatory work is underway to dismantle tube bundles of intermediate heat exchangers of the primary circuit.

Appendix E. Information on regulatory legal acts in the field of atomic energy use

1. Constitution of the Republic of Kazakhstan (adopted at the republican referendum on August 30, 1995) (with amendments and additions as of 02.02.2011)
2. Law of Republic of Kazakhstan dated on February 3, 2010, No. 243-IV "On Ratification of the Convention on Early Notification of a Nuclear Accident"
3. Law of Republic of Kazakhstan dated on February 3, 2010, No. 244-IV "On Ratification of Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency"
4. Law of Republic of Kazakhstan dated on December 22, 2004, No. 17 "On Accession of the Republic of Kazakhstan to the Convention on the Physical Protection of Nuclear Material", Law of Republic of Kazakhstan dated on March 19, 2011, No. 416-IV "On Ratification of the Amendments to the Convention on the Physical Protection of Nuclear Material"
5. Law of Republic of Kazakhstan dated on October 21, 2000, No. 86-II "On Accession of the Republic of Kazakhstan to the Convention on Environmental Impact Assessment in a Transboundary Context"
6. Law of Republic of Kazakhstan on February 3, 2010 No. 245-IV "On Ratification of the Convention on Nuclear Safety"
7. Law of Republic of Kazakhstan on February 10, 2011 No. 405-IV "On Ratification of the Vienna Convention on Civil Liability for Nuclear Damage of 1997 (Consolidated text of the Vienna Convention on Civil Liability for Nuclear Damage of May 21, 1963, as amended by the Protocol of September 12, 1997)"
8. Law of Republic of Kazakhstan on February 3, 2010 No. 246-IV "On Ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste"
9. Law of the Republic of Kazakhstan on October 23, 2000 No. 92-II"On Ratification of the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in issues related to the Environment"
10. Draft Law on the Ratification of the Agreement on the Cooperation of the CIS Member States on Preparedness in the Event of a Nuclear Accident or a Radiation Emergency and Mutual Assistance in Elimination of Their Consequences

Main Codes of the Republic of Kazakhstan

11. Code of the Republic of Kazakhstan dated October 29, 2015 No. 375-V LRK Entrepreneurial Code of the Republic of Kazakhstan
12. Code of the Republic of Kazakhstan dated on July 9, 2003, No. 481 "Water Code of the Republic of Kazakhstan"
13. Code of the Republic of Kazakhstan dated June 20, 2003 No. 442 "Land Code of the Republic of Kazakhstan"

14. Code of the Republic of Kazakhstan dated on December 10, 2008, No. 99-IV “About Taxes and Other Obligatory Payments to Budget (Tax Code)”
15. Code Of the Republic of Kazakhstan dated on January 9, 2007, No. 212 “Environmental Code of the Republic of Kazakhstan”
16. Code of the Republic of Kazakhstan dated July 7, 2020 No. 360-VI "On people's health and the health care system"
17. Code Of the Republic of Kazakhstan “on July 5, 2014 No. 235-V “On Administrative Offenses”
18. Code of the Republic of Kazakhstan dated December 27, 2017 No. 125-VI ZRK "On Subsoil and Subsoil Use”

Main Laws of the Republic of Kazakhstan

19. Law of the Republic of Kazakhstan dated November 9, 2004 No. 603 "On technical regulation"
20. Law of Republic of Kazakhstan dated on May 16, 2014 No. 202-V “On Permissions and Notifications”
21. Law of Republic of Kazakhstan dated on October 19, 2000 No. 85 “On Security Activities”
22. Law of Republic of Kazakhstan dated on April 11, 2014 No. 188-V “On Civil Protection”
23. Law of Republic of Kazakhstan dated on January 12, 2016 No. 442-V “On Atomic Energy Use”
24. Law of Republic of Kazakhstan dated on April 23, 1998 No. 219 “On Radiation Safety of Population»
25. Law of Republic of Kazakhstan dated on July 13, 1999 No. 416 “On Counteracting Terrorism”
26. Law of Republic of Kazakhstan dated on July 21, 2007 “On Export Control”

Principal Decrees of the Government of Republic of Kazakhstan

27. Decree of the Government of Republic of Kazakhstan on August 13, 1996, No. 1002 “On Additional Measures to Ensure the Activities of the National Nuclear Center of Kazakhstan, as well as Nuclear Radiation Safety at Its Sites”
28. Decree of the Government of the Republic of Kazakhstan dated April 23, 2015 No. 274 "On the determination of a licensor in the field of atomic energy use"
29. Decree of the Government of the Republic of Kazakhstan dated February 24, 1998 No. 130 "On some issues of regulation of the export of uranium products"
30. Decree of the Government of the Republic of Kazakhstan dated June 29, 2011 No. 728 "On approval of the" Program for the development of the nuclear industry in the Republic of Kazakhstan for 2011-2014 with the prospect of development until 2020"

31. Decree of the Government of the Republic of Kazakhstan dated August 28, 2013 No. 876 "On approval of the list of objects of the Republic of Kazakhstan vulnerable to terrorist attacks"

Orders of ministries and agencies

32. Order of Minister of Environment Protection of Republic of Kazakhstan dated on May 21 2012 № 164-ө “On Approval of Form of Report on Dangerous Wastes and Instruction on Filling the” Registered in Ministry of Justice of Republic of Kazakhstan on June 25, 2012 № 7746
33. Order of acting Minister of Investment and Development of Republic of Kazakhstan dated on December 26, 2014 № 297 “On approval of Rules for Ensuring Industrial Safety while Geological Exploration, Mining and Processing of Uranium”. Registered in Ministry of Justice of Republic of Kazakhstan on February5, 2015 № 10187
34. Order of acting Minister of Investment and Development of Republic of Kazakhstan dated on December 26, 2014 № 301 « On approval of Rules for Ensuring Industrial Safety while Handling Ionizing Radiation Sources”. Registered in Ministry of Justice of Republic of Kazakhstan on February 11, 2015 № 10225
35. Order of the Minister of Energy of the Republic of Kazakhstan dated February 8, 2016 No. 39 "On approval of the Rules for the organization of collection, storage and disposal of radioactive waste and spent nuclear fuel." Registered in Ministry of Justice of the Republic of Kazakhstan on March 28, 2016 No. 13537
36. Order of the Minister of Energy of the Republic of Kazakhstan dated January 20, 2016 No. 12. "On approval of the Rules for certification of personnel employed at nuclear facilities." Registered in Ministry of Justice of the Republic of Kazakhstan on March 15, 2016 No. 13468
37. Order of the Minister of Transport and Communications of the Republic of Kazakhstan dated February 18, 2011 No. 79. “On approval of the List of dangerous goods intended for transportation by civil aircraft”. Registered in Ministry of Justice of the Republic of Kazakhstan dated March 14, 2011 No. 6805
38. Order of the Minister of Energy of the Republic of Kazakhstan dated January 21, 2015 No. 26. “On approval of the List of pollutants and types of waste for which emission standards are established”. Registered in Ministry of Justice of the Republic of Kazakhstan on February 20, 2015 No. 10302
39. Order of the Minister of Energy of the Republic of Kazakhstan dated February 9, 2016 No. 44. “On Approval of the Rules for State Accounting for Nuclear Materials”. Registered in Ministry of Justice of the Republic of Kazakhstan on March 15, 2016 No. 13470
40. Order of the Minister of Energy of the Republic of Kazakhstan dated November 13, 2014 No. 123. "On approval of the Rules for maintaining the state cadaster of disposal of hazardous substances, radioactive waste and wastewater discharge into the subsoil." Registered in the Ministry of Justice of the Republic of Kazakhstan on December 24, 2014 No. 9996

41. Order of the Minister of Energy of the Republic of Kazakhstan dated February 20, 2017 No. 58 “On approval of Technical Regulation“ Nuclear and radiation safety ”. Registered in the Ministry of Justice of the Republic of Kazakhstan on April 11, 2017 No. 15005

42. No. 59 “On Approval of Technical Regulations “Nuclear and Radiation Safety of Research Nuclear Facilities”. Registered in Ministry of Justice of Republic of Kazakhstan on April 11, 2017 № 15006.

43. Order of the Minister of Energy of the Republic of Kazakhstan dated February 20, 2017 No. 60 “On approval of technical regulations“ Nuclear and radiation safety of nuclear power plants ”. Registered in Ministry of Justice of the Republic of Kazakhstan on April 11, 2017 No. 15007

44. Order of the Minister of National Economy of the Republic of Kazakhstan dated February 27, 2015 No. 155. "On approval of hygienic standards" Sanitary and epidemiological requirements for ensuring radiation safety "". Registered in Ministry of Justice of the Republic of Kazakhstan on April 10, 2015 No. 10671

45. Order of the Minister of Health of the Republic of Kazakhstan dated June 26, 2019 No. ҚР DSM-97. "On the approval of the Sanitary Rules" Sanitary and Epidemiological Requirements for Ensuring Radiation Safety. "Registered in Ministry of Justice of the Republic of Kazakhstan on June 27, 2019 No. 18920

46. Order of the Minister for Investments and Development of the Republic of Kazakhstan dated April 30, 2015 No. 548. "On approval of the Rules for the transport of dangerous goods." Registered in Ministry of Justice of the Republic of Kazakhstan on August 11, 2015 No. 11857

47. Order of the Acting Minister of National Economy of the Republic of Kazakhstan dated March 27, 2015 No. 259 "On approval of the Rules for monitoring and accounting for individual radiation doses received by citizens when working with sources of ionizing radiation, conducting medical X-ray and radiological procedures, as well as those caused by a man made radiation background" Registered in Ministry of Justice of the Republic of Kazakhstan on May 5, 2015 No. 10943.

Rules and requirements

48. Fire safety standards. Design of nuclear power plants, VSN-01-87.

49. SP-AS-88/93 (5.01.021-99) "Sanitary rules for the design and operation of nuclear power plants".

50. Safety requirements for collection, processing and storage of radioactive waste "TBSPH-2003.

51. RD-06-03-22-04 Requirements for procedure of accounting of sources of ionizing radiation for licensees of the Committee on Atomic Energy.

52. RD-09-02-01-99 Requirements for programs to ensure the quality of radiation safety of activities related to the use of atomic energy ".

53. RD-05-02-29-05 Requirements for the composition and content of documents to justify the operation of a dry storage facility for spent fuel.

54. RD-08-02-28-04 Safety requirements for the processing of radioactive sodium (TBPRN-2004).

Methodical instructions

55. Guidelines for informing, investigating and recording violations when working with radioactive substances and radioactive waste (approved by order of the Chairman of the Atomic Energy Committee of the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan dated November 5, 2008 No. 88-pr)

56. Guidelines for informing, investigating and recording violations in the operation of research nuclear installations (approved by order of the Chairman of the Atomic Energy Committee of the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan dated November 5, 2008 No. 88-pr)

57. Guidelines for informing, investigating and recording violations in the operation of nuclear fuel cycle facilities (approved by order of the Chairman of the Atomic Energy Committee of the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan dated November 5, 2008 No. 88-pr)

58. RD-RU-007-08 "Safety Guidelines for Near-Surface Disposal of Radioactive Waste

59. RD-TS-006-08 "Typical content of the report on the safety analysis of the spent fuel storage facility"