

МИРНИЙ
АТОМ

РАДІАЦІЙНА
БЕЗПЕКА

БЕЗПЕКА
ПЕРЕВЕЗЕНЬ



Державна інспекція
ядерного регулювання України
State Nuclear Regulatory Inspectorate of Ukraine

ЯДЕРНА
БЕЗПЕКА

МИРНИЙ
АТОМ

РАДІАЦІЙНА
БЕЗПЕКА

БЕЗПЕКА
ПЕРЕВЕЗЕНЬ

ЯДЕРНА
БЕЗПЕКА

ФІЗИЧНИЙ
ЗАХИСТ

РАДІАЦІЙНА
БЕЗПЕКА

БЕЗПЕКА
ПЕРЕВЕЗЕНЬ

МИРНИЙ
АТОМ

ФІЗИЧНИЙ
ЗАХИСТ

REPORT

ON NUCLEAR AND RADIATION SAFETY IN UKRAINE FOR 2019

Kyiv – 2020



Dear Readers!

This Report has been developed by the State Nuclear Regulatory Inspectorate of Ukraine to inform about nuclear and radiation safety in our country in 2019.

The current system of state nuclear safety regulation in Ukraine is evolving in line with international safety standards, recommendations of international organizations and best practices of countries with developed nuclear programs.

The year of 2019 was marked by the most intensive discussions about the place and role of nuclear energy in ensuring nuclear safety of the state and social development.

A proper level of nuclear and radiation safety requires that the safety culture be understood and adhered to and that the government, state nuclear regulatory authority and nuclear entities acted in a coordinated manner.

The recovery of independence and the strengthening of SNRIU guarantee proper state oversight of compliance with requirements for nuclear and radiation safety on the territory of our country and a worthy contribution of Ukraine to the support of international safety regimes.

In 2019, events that significantly contributed to enhancement of nuclear and radiation safety took place, in particular:

- *construction of the New Safe Confinement over the Shelter was completed;*
- *an individual permit was issued for operation of civil structures of the New Safe Confinement enclosure;*
- *an individual permit was issued for the first delivery of nuclear fuel for the nuclear subcritical assembly “neutron source” to National Science Center “Kharkiv Institute of Physics and Technology”;*
- *decision was made to allow long-term operation of Khmelnytsky NPP Unit 1 and South-Ukraine NPP Unit 3 upon periodic safety review;*
- *two units (South-Ukraine NPP Unit 3 and Zaporizhzhya NPP Unit 5) whose cores had been loaded only with Westinghouse fuel were in operation;*
- *ChNPP decommissioning and transformation of the Shelter into an environmentally safe system continued;*
- *a series of measures on safety improvement of radioactive waste and spent nuclear fuel management facilities, uranium plants, and use and production of radiation sources were implemented.*

The Report sets forth in more detail the main events and safety improvement measures that took place in 2019.

Sincerely Yours

*Chairman of the State Nuclear
Regulatory Inspectorate of Ukraine*

Hryhorii Plachkov

TABLE OF CONTENTS

Introduction	2
Year 2019 in Detail	4
1. Safety of Nuclear Installations	6
1.1 Safety Improvement of Operating NPPs	
1.2 Implementation of the National Action Plan upon Stress Test Results	
1.3 NPP Long-Term Operation	
1.4 Safety Regulation of New Nuclear Installations	
1.5 Diversification of Fuel Suppliers for Ukrainian NPPs	
1.6 Commissioning of Radioactive Waste Treatment Plants at NPPs	
2. Emergency Preparedness and Response	17
3. Radioactive Waste Management	21
3.1 Management of Radioactive Waste in Exclusion Zone	
3.2 Management of Radioactive Waste on Ukrainian Territory	
3.3 Legacy Radioactive Waste	
3.4 Chornobyl NPP Decommissioning	
3.5 Radioactive Waste Management Facilities at Chornobyl NPP	
3.6 Shelter Transformation into Environmentally Safe System	
3.7 Concept of Exemption and Clearance from Regulatory Control	
4. Nuclear Security and Safeguards	37
4.1 Nuclear Weapon Nonproliferation Safeguards	
4.2 Measures to Improve Effectiveness of State Physical Protection System	
4.3 Training of Physical Protection Experts	
4.4 Project for Improving Security of Radiation Sources	
4.5 Detection of Radioactive Materials in Illicit Trafficking	
4.6 Safe Transport of Radioactive Materials	
5. Safe Use of Radiation Sources	44
5.1 Safety Regulation of Radiation Sources	
5.2 Improvement of Radiation Protection of the Public against Radon Exposure	
5.3 Safety of Uranium Mines	
6. Nuclear and Radiation Safety in Ukrainian Regions	50
7. International Activities	64
7.1 Cooperation with European Institutions	
7.2 Compliance with Obligations under International Conventions	
7.3 Participation in Programs and Projects of the International Atomic Energy Agency	
7.4 Bilateral Cooperation Programs	
8 List of Abbreviations	70

YEAR 2019 IN DETAIL

Date	Month/Event
	<i>January</i>
22	Individual permit for the operation of civil structures of Shelter New Safe Confinement enclosure was issued
29	Coordination meeting was conducted with representatives of the Norwegian Radiation and Nuclear Safety Authority (DSA) to discuss implementation of current bilateral cooperation projects
	<i>February</i>
05	Bilateral consultations were held to discuss the current state and prospects for cooperation between the SNRIU and Swedish Radiation Safety Authority (SSM)
13	A kick-off meeting was carried out within the cooperation project with the European Commission INSC U3.01/18 "Support of Ukrainian Regulatory Authority"
17-20	The information workshop was held for Hungarian experts on the state licensing practice and trial operation of Westinghouse fuel assemblies at Ukrainian NPP units
	<i>March</i>
14	The Memorandum of Meeting between the State Nuclear Regulatory Inspectorate of Ukraine and the United States Nuclear Regulatory Commission, which defines areas of bilateral cooperation for 2019-2020, was signed.
18-21	The IAEA expert mission visited Ukraine to update the Ukrainian Integrated Nuclear Security Support Plan (INSSP) for 2019-2021
	<i>April</i>
09-11	SNRIU Chairman participated in the spring plenary session of the Western European Nuclear Regulators Association (Budapest, Hungary)
12	Individual permit was issued for the first delivery of nuclear fuel for the neutron source to NSC KIPT
17-19	Participation in the X International Medical Forum was ensured
	<i>May</i>
14	The meeting was held with the management of the Society for Reactor Safety (GRS) to discuss the state and prospects of bilateral cooperation
17	The Project on the Creation of the Integrated Automated Radiation Monitoring System for the Environment at specialized plants of the Radon Association was approved
22	Participation in the annual meeting of the Ukraine-IAEA Safeguards Implementation Review Group (SIRG) was ensured
23	The IV Meeting of the Interdepartmental Expert Workgroup for Radiation Protection in Medicine was held
	<i>June</i>
04	The Executive Agreement on the Participation of Ukraine in the Radiation Protection Code Analysis and Maintenance Program (RAMP) was signed between the SNRIU and the United States Nuclear Regulatory Commission
04-06	The IAEA expert mission focusing on the approaches to performing independent neutronic calculations used within technical assessment of documents justifying the safety of mixed fuel cores was conducted
10-14	Participation in the Annual Regulators' Forum on Safe Management of Uranium Mining Waste and Residual Radioactive Materials with Natural Radionuclides was provided in Vienna (Austria)
17-20	SNRIU delegation participated in the 26 th Annual Meeting of the Forum of Nuclear Safety Authorities of the Countries Operating VVER Type Reactors (VVER Forum), which took place in Pravets (Bulgaria)
21	Safety Requirements for Nuclear Fuel Management were approved by SNRIU Order No. 269 dated 21 June 2019 (registered in the Ministry of Justice of Ukraine on 30 July 2019 under No. 833/33804)
	<i>July</i>
02	Public hearings were held in Netishyn to discuss potential long-term operation of Khmelnytsky NPP Unit 1
10	The New Safe Confinement was transferred from the Novarka Joint Venture to the State Specialized Enterprise Chornobyl NPP
	"Technical Solution on the Composition and Operation of the 30 th Fuel Loading of the Core at Zaporizhzhya NPP Unit 5. 05.OB.YM.TR.353-19" was approved. A second power unit appeared in Ukraine, the core of which is loaded only with Westinghouse fuel (the first one is South Ukraine NPP Unit 3)
18	The meeting of the SNRIU Board was held to consider the issue of the long-term operation of Khmelnytsky NPP Unit 1 upon the results of periodic safety review
24	Amendment No. 2 to the Agreement between the European Bank for Reconstruction and Development, the Cabinet of Ministers of Ukraine and the State Nuclear Regulatory Inspectorate of Ukraine of 8 July 2009 was approved by Ordinance of the Cabinet of Ministers of Ukraine No. 562

	August
15	The Eighth National Report on compliance of Ukraine with the obligations of the Convention on Nuclear Safety was submitted to the IAEA
21	Resolution of the Cabinet of Ministers of Ukraine No. 759 “On Amendments to the Procedure for Issuing Permit for the International Shipments of Radioactive Materials” was approved
	September
16	The working meeting between the SNRIU and the Swedish Radiation Safety Authority (SSM) was held to discuss the prospects of cooperation between Ukraine and Sweden in the sphere of nuclear and radiation safety
16-20	Ukrainian delegation participated in the 63 rd Session of the IAEA General Conference (Vienna, Austria)
18	The working meeting was held between the heads of the SNRIU and Hungarian Atomic Energy Agency to exchange experience in nuclear and radiation safety regulation
18	The Verkhovna Rada of Ukraine adopted the Law of Ukraine “On Amendments to Certain Laws of Ukraine on Nuclear Energy Use” No. 107-IX
23-27	SNRIU delegation participated in the meeting on technical cooperation with the USA on the implementation of small modular reactors
26-27	The VIII International Conference “Medical Physics: Current State, Issues and Development Areas. New Technologies”
30	Ukraine submitted the National Action Plan on Ageing Management to the European Nuclear Safety Regulators Group (ENSREG) with regard to the participation in the first topical review on “ageing management”
	October
22-24	SNRIU delegation participated in the Second Regional Conference “Radioactive Waste Management in GUAM Countries” (Tbilisi, Georgia)
24-25	Participation in the IV Forum of the Ukrainian Association of Medical Physicists
	November
20	ChNPP obtained the Certificate, which certifies the compliance of the completed NSC SP-1 with design documents and confirms its readiness for operation, issued by the State Architectural and Construction Inspectorate of Ukraine
25	SNRIU Order No. 508 dated 25 November 2019 approved amendments to the Nuclear and Radiation Safety Requirements for Instrumentation and Control Systems Important to Safety of Nuclear Power Plants (registered in the Ministry of Justice of Ukraine on 24 December 2019 under No. 1280/34251)
25-29	Participation in the International Coordination Meeting under IAEA Project “Control over Radiation Sources from Production to Disposal”
29	The Vth meeting of the Interdepartmental Group on Radiation Protection in Medicine was held
	December
5	SNRIU Order No. 526 dated 5 December 2019 approved the Forms of Documents Developed in Carrying Out State Oversight of Nuclear Energy Use” (registered in the Ministry of Justice of Ukraine on 21 December 2019 under No. 1268/34239)
17	Public hearings were held to discuss potential long-term operation of South-Ukraine NPP Unit 3 (in Yuzhnoukrainsk)
23	SNRIU Board meeting was held to consider the issue on long-term operation of South-Ukraine NPP Unit 3 upon results of periodic safety review
28	SNRIU approved the decision on transfer of Westinghouse nuclear fuel in commercial operation at South-Ukraine NPP Unit 3
November-December	The SNRIU with the support of the IAEA carried out internship for representatives of regulatory authorities of the Kyrgyz Republic and groups of experts from the Republic of Belarus



Державна інспекція ядерного регулювання України

State Nuclear Regulatory Inspectorate of Ukraine

ЯДЕРНА
БЕЗПЕКА

МИРНИЙ
АТОМ

РАДІАЦІЙНА
БЕЗПЕКА

БЕЗПЕКА
ПЕРЕВЕЗЕНЬ

1. SAFETY OF NUCLEAR INSTALLATIONS

Fifteen power units are operated in Ukraine: thirteen VVER-1000 and two VVER-440 units. Ukraine ranks the tenth in the world according to the number of power units and seventh the world according to the established capacity of 13,835 MW.

The only operator of all operating nuclear power plants in Ukraine is the State Enterprise “National Nuclear Energy Generating Company Energoatom” (hereinafter called Energoatom).

According to requirements of the Law of Ukraine “On Nuclear Energy Use and Radiation Safety” and the Convention on Nuclear Safety, the operating organization shall ensure stable and safe NPP operation. Measures are systematically taken to improve safety of operating nuclear power plants (NPPs) in accordance with the requirements of the national regulations, rules and standards on nuclear and radiation safety, recommendations of the International Atomic Energy Agency (IAEA) and taking into account great operating experience and international practice.

SNRIU activities on safety regulation of nuclear installations in 2019 were aimed at nuclear and radiation safety at all life cycle stages of nuclear installations, protection of personnel, the public and the environment. The primary focus was safety improvement of Ukrainian operating NPPs.

1.1 Safety Improvement of Operating NPPs

Safety level is improved by implementing measures under the Comprehensive (Integrated) Safety Improvement Program (C(I)SIP) at nuclear power plants, which was approved by Resolution of the Cabinet of Ministers of Ukraine No. 1270 dated 07 December 2011. The period of C(I)SIP validity: 2012 – 2023.

In 2019, the SNRIU provided the control over implementing C(I)SIP measures through:

- considering and approving the annual schedules of comprehensive measures under C(I)SIP and establishing their deadlines;
- considering quarterly reports on measures under C(I)SIP and control of compliance with their deadlines;
- control over the scope of planned measures under C(I)SIP before scheduled outage of Ukrainian NPPs;

- control of measures planned under C(I)SIP during kickoff meetings before commissioning of Ukrainian NPPs after scheduled outage with core refueling;
- control of current scope and quality of C(I)SIP measures during inspections by SNRIU inspectors.

The SNRIU agreed reports on 92 implemented measures under C(I)SIP regulatory support. In total, as of 31 December 2019, the SNRIU agreed 929 reports on implementing C(I)SIP measures of 1295 planned, it means 71.74%.

The following was issued for Energoatom in 2019:

- 15 individual written permits for unit startup after scheduled outage with core refueling;
- 2 licenses for the right to perform activities during nuclear facility operation life cycle at Khmelnytsky NPP Unit 1, South-Ukraine NPP Unit 3 during their long-term operation and 3 amendments to the operator's licenses;
- 23 licenses for the right to continue activities by officials of the operating organization responsible for administrative functions related to nuclear and radiation safety;
- 162 licenses for the right of direct management of reactor facility.

1.2 Implementation of the National Action Plan upon Stress Test Results

In June 2011, Ukraine joined the European initiative on NPP stress tests in the member countries of the European Union and in the neighboring countries (Declaration of stress tests). Stress tests for Ukrainian NPPs were carried out in accordance with the methodology approved by the European Commission and ENSREG for stress tests at European NPPs.

The National Action Plans (NAPs) include safety improvement measures that were identified upon stress test results and schedules for their implementation at nuclear power plants.

In 2019, the activities in this area were focused on measures for the power units whose long-term operation was ensured (Zaporizhzhya NPP Unit 5, South-Ukraine NPP Unit 3 and Khmelnytsky NPP Unit 1).

At Ukrainian NPPs, measures were taken to develop documents and perform qualification of power unit components, provide power supply and cooling of the spent fuel pool under NPP long-term total blackout, provide power supply of steam generators under NPP long-term total blackout, provide operability of group A service water system loads in case of dewatering of spray ponds, instrumentation during and after accidents, post-accident monitoring of systems important to safety, emergency power supply under NPP long-term total blackout, prevent early bypassing of the containment resulting from the entry of core melt from the reactor cavity beyond the containment, develop and implement measures for reducing hydrogen concentration in the containment for beyond design basis accidents.

1.3 NPP Long-Term Operation

Khmelnitsky NPP Unit 1

The design lifetime of KhNPP-1 expired on 13 December 2018.

The activities under the “Program of KhNPP Unit 1 Preparation for Long-Term Operation.1.NR.7947.PM-17” agreed with the SNRIU were completed in full.

SNRIU Board Order No. 5 approved the following decision on 18 July 2019:

- approval of the conclusions from the state review on nuclear and radiation safety of the periodic safety review report for KhNPP Unit 1;
- consideration of justification for safe operation of KhNPP Unit 1 at power levels specified in the design;
- determination of the date for the next periodic safety review for KhNPP Unit 1: 13 December 2028.

South-Ukraine NPP Unit 3

The design life of South-Ukraine NPP Unit 3 expires on 10 February 2020.

The activities under the “Program of SUNPP Unit 3 Preparation for Long-Term Operation. PM.3.3812.0240” agreed with the SNRIU were completed in full.

SNRIU Board Order No. 16 approved the following decision on 23 December 2019:

- approval of the conclusions of the state review of nuclear and radiation safety of the periodic safety review report for SUNPP Unit 3;
- consideration of justification for safe operation of SUNPP at power levels specified in the design;
- determination of the date for the next periodic safety review for SUNPP Unit 3: 10 February 2030.

Zaporizhzhya NPP Unit 5

The design life of Zaporizhzhya NPP Unit 5 will expire on 27 May 2020.

Long-term operation activities are performed in compliance with the “Program for ZNPP Unit 5 Preparation for Long-Term Operation. 05.MR.00.PM.23-17/N”.

Safety review of Rivne NPP Units 1, 2 and Zaporizhzhya NPP Unit 6

Pursuant to the requirements of Article 33 of the Law of Ukraine “On Nuclear Energy Use and Radiation Safety”, “General Safety Provisions for Nuclear Power Plants and Requirements for Safety Assessment of Nuclear Power Plants”, Energoatom performs periodic safety review of NPP units and draws up its results in the form of periodic safety review reports.

Rivne NPP Unit 1

In 2019, all 14 safety factors and section “Comprehensive Safety Analysis” of the periodic safety review report for Rivne NPP Unit 1 were considered, of which as of the end of 2019:

- deliverables on 7 safety factors and section “Comprehensive Safety Analysis” undergo the state review of nuclear and radiation safety;

- deliverables on 4 safety factors underwent the state review of nuclear and radiation safety, consideration of the comments by the operating organization is underway;
- deliverables with assessment results of 3 safety factors underwent the state review of nuclear and radiation safety and were improved by the operating organization according to its comments.

The deadline for completion of the periodic safety review of Rivne NPP Unit 1 is 1 December 2020.

Rivne NPP Unit 2

In 2019, 11 of 14 safety factors of the periodic safety review report for Rivne NPP Unit 2 submitted to the SNRIU were considered. As of the end of 2019:

- deliverables on 4 safety factors and section “Comprehensive Safety Analysis” undergo the state review of nuclear and radiation safety;
- deliverables on 4 safety factors underwent the state review of nuclear and radiation safety, consideration of its comments by the operating organization is underway;
- deliverables with assessment results of 3 safety factors underwent the state review of nuclear and radiation safety and were improved by the operating organization according to its comments.

The deadline for submission of the full set of the periodic safety review report of Rivne NPP Unit 2 to the SNRIU is 14 June 2020. The deadline for completion of the full set of documents of the periodic safety review report by the SNRIU is 14 June 2021.

Zaporizhzhya NPP Unit 6

In 2019, the SNRIU started the state review of nuclear and radiation safety of deliverables with assessment results of seven of fourteen safety factors of the Periodic Safety Review Report for Zaporizhzhya NPP Unit 6 submitted to the SNRIU.

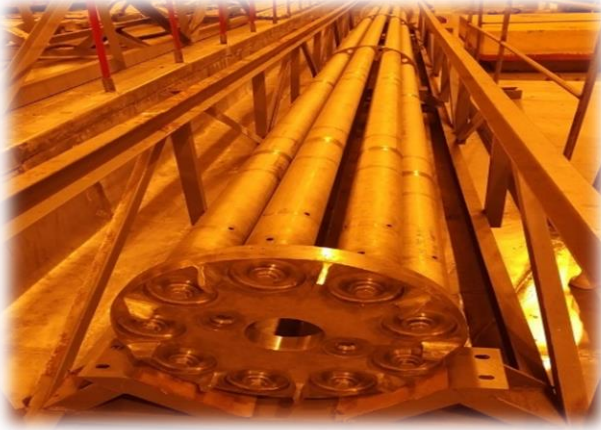
The deadline for submission of the full set of the Periodic Safety Review Report for Zaporizhzhya NPP Unit 6 is 28 December 2020. The deadline for completion of the periodic safety review for Zaporizhzhya NPP Unit 6 is 28 December 2021.

Operation of wet spent nuclear fuel storage facility at Chornobyl NPP (ISF-1)

During 2019, the SNRIU reviewed and conducted state reviews of nuclear and radiation safety, upon the results of which relevant conclusions were submitted on the following ChNPP technical documents:

- Program of Activities on Temporary Disconnection of 1VTs Special Exhaust Ventilation System in ISF-1” 100PR-TsOOIaT;
- Conceptual Solution of ISF-1 Modification “Major Maintenance of 6 kV Cable Lines for Power Supply of 237T, 238T Transformers of the ChNPP ISF-1 External Power Supply System”, No. 02 of 19 March 2019;
- Working Project “Major Maintenance of 6 kV Cable Lines for Power Supply of 237T, 238T Transformers of the ChNPP ISF-1 External Power Supply System”;
- Technical Solution for Installation Activities of the Modification Facility “Major Maintenance of 6 kV Cable Lines for Power Supply of 237T, 238T Transformers of the ChNPP ISF-1 External Power Supply System”, No. 23-ETs-2019 of 11 October 2019;

- Technical Solution for Putting 6 kV Cable Lines for 237T of the Modification Facility into Commercial Operation “Major Maintenance of 6 kV Cable Lines for Power Supply of 237T, 238T Transformers of the ChNPP ISF-1 External Power Supply System” of 24 December 2019.



Operation of dry spent nuclear fuel storage facility at Zaporizhzhya NPP (DSFSF)

As of 31 December 2019, 155 ventilated concrete containers are located at DSFSF.

During 2019, the SNRIU considered and agreed two technical solutions “On the Composition of Loading Large-Capacity Sealed Baskets with Spent Nuclear Fuel”.

1.4 Safety Regulation of New Nuclear Installations



Construction of Khmelnytsky NPP Units 3 and 4

No documents on the construction of Khmelnytsky NPP Units 3 and 4 were submitted to the SNRIU in 2019.

Construction of nuclear fuel fabrication plant

In 2019, SNRIU Chairman Hryhorii Plachkov and SSTC NRS Director Ihor Shevchenko participated (as observers) in the meetings of the working group on the

establishment of enterprises for own nuclear fuel fabrication formed by the Ministry of Energy and Coal Industry of Ukraine in 2018.

At the meetings of the working group, the first priority steps were discussed regarding the arrangement of nuclear fuel fabrication for VVER-1000 using the Westinghouse technology, as well as draft task to develop the Feasibility Study for the Construction of a Nuclear Fuel Fabrication Plant developed by the Nuclear Fuel State Concern.

In addition, the Decree of the President of Ukraine No. 104/2019 of 4 April 2019 approved measures to support the development of nuclear energy and improve safety in nuclear energy use. At the same time, the information on implementing the measures provided by the above Decree on the immediate establishment of own nuclear fuel fabrication for national NPPs were not submitted to the SNRIU.

Neutron Source

Construction of the nuclear subcritical facility “Neutron Source Based on a Subcritical Assembly Driven by a Linear Electron Accelerator” (Neutron Source)

The nuclear installation is constructed on the territory of the National Science Center “Kharkiv Institute of Physics and Technology” (NSC KIPT) in accordance with the conditions of license EO No. 001018 for the right to construct and commission the neutron source issued by the SNRIU to the operating organization on 10 October 2013.

Safety regulation of neutron source construction and commissioning of the neutron source is implemented by monitoring of construction and assembling activities, as well as state review of nuclear and radiation safety and approval of technical conditions and technical specifications for equipment important to safety, as well as operational documents of the neutron source.

In compliance with the conditions of license EO 001018, the operating organization should obtain three individual licenses for the following:

- transport of nuclear fuel for the neutron source to NSC KIPT industrial site for the first time;
- initial startup of the neutron source;
- trial and commercial operation of the neutron source.

On 12 April 2019, the SNRIU issued an individual permit No. EO 001018/1/15 to NSC KIPT for the first transport of nuclear fuel for the neutron source.

In addition, during the year, two applications for obtaining an individual permit for neutron source initial startup were returned to NSC KIPT due to NSC KIPT inability to perform the declared activity.

Construction of the centralized spent fuel storage facility (CSFSF)

The activities under the project for CSFSF completion in 2019 were performed in compliance with the conditions of license EO No. 001060 for the construction and commissioning of the spent fuel storage facility (CSFSF) issued by the SNRIU on 29 June 2017.

Safety regulation of construction and commissioning of this storage facility is carried out by the SNRIU through state review of nuclear and radiation safety and approval of technical specifications and design documents for systems and equipment important to CSFSF

safety, as well as projects of NPP unit modification within their preparation for spent nuclear fuel unloading by equipment developed using Holtec International technology.

During 2019, Energoatom continued developing and approving of the sets of technical specifications and design documents for systems and equipment important to safety in accordance with the established procedure.

As of 31 December 2019, the SNRIU performed the following according to the CSFSF licensing plan:

1. Sixteen technical specifications for equipment important to safety of 16 technical specifications developed according to the design were preliminary agreed.

2. Fourteen testing programs for equipment important to safety of sixteen testing programs developed according to the design were agreed.

3. Ten technical specifications for equipment important to safety of sixteen technical specifications developed according to the design were finally approved.

4. Conclusions of the state review of nuclear and radiation safety of modification projects were approved for: Rivne NPP Units 1, 2, 3, 4 and Khmelnytsky NPP Units 1, 2.

5. Manufacturing, testing (with the participation of a regulatory authority representative) and supply of the main equipment important to safety are underway, in particular:

- multi-purpose canister (MPC) MPC-31: three units of three envisaged by the design were supplied to the client (Energoatom);
- multi-purpose canister MPC-85: one MPC-85 envisaged by the project was supplied to the client;
- transport overpack HI-STAR: one cask of five envisaged by the design was supplied to the client, one more is under preparation for factory acceptance tests;
- storage cask HI-STORM: four HI-STORM casks envisaged by the design of CSFSF startup package were manufactured and passed factory acceptance tests: three for VVER-1000 spent fuel and one for VVER-440 spent fuel.

6. The manufactured units were tested according to the established procedure and the following auxiliary equipment of systems important to safety was supplied to the client:

docking device;
MPC internal cover lifting device;
lifting device for MPC with spent fuel;
bracket for MPC lifting device;
HI-STAR lifting beam;
HI-TRAC lifting beams;
additional radiation protection screen for HI-TRAC.

Construction of dry spent fuel storage facility at Chornobyl NPP (ISF-2)

The activities on construction completion and commissioning of ISF-2 are conducted in compliance with the conditions of license EO No. 001002 for the right for the construction and commissioning of nuclear installation (spent fuel storage facility (ISF-2)) issued by the SNRIU on 20 February 2013

Safety regulation of construction and commissioning of this facility is implemented by the SNRIU through the following:

- state review and agreement of technical specifications for systems and equipment important to safety;
- state review and agreement of testing programs for systems and equipment important to safety;
- direct involvement of SNRIU representatives in testing of systems and equipment important to safety;
- state review and agreement of ISF-2 operational and technical documents (technical specifications, operating manuals, etc.).



In 2019, the SNRIU performed the following according to ISF-2 licensing plan:

1. Preliminary agreement of:

- 7 technical specifications for systems important to safety of seven technical specifications developed according to the design;
 - 41 technical specifications for equipment important to safety of 41 technical specifications developed according to the design, as well as one technical specification for equipment with not defined impact of safety (table for damaged nuclear fuel management).
2. 33 testing programs of equipment important to safety of 33 planned programs (factory acceptance tests are not envisaged for eight equipment units, individual acceptance tests were performed at ISF-2 site instead of them).
3. SNRIU representatives participated in 33 factory acceptance tests of equipment important to safety of 33 proposed ones.

The following technical specifications and programs were agreed:

4. 25 technical specifications for equipment important to safety of 41 technical specifications developed according to the design (four of which were approved in 2019).
5. 12 programs for comprehensive testing of systems important to safety and process systems of twelve ones envisaged in the design.
6. Two ChNPP procedures (of four procedures required for ISF-2 commissioning stage).

Resolution of the Cabinet of Ministers of Ukraine No. 562-r dated 24 July 2019 extended the Agreement with the European Bank for Reconstruction and Development.

In addition, in the 4th quarter of 2019, the SNRIU started the state review of preliminary safety analysis report for ISF-2, which was revised and improved upon results of completed construction and installation of systems and components.

1.5 Diversification of Fuel Suppliers for Ukrainian NPPs

The implementation of Westinghouse fuel (or in other words qualification) is performed to avoid dependence on a monopoly supplier.

Safety regulation of Westinghouse fuel implementation is carried out through state NRS review and approval of the operating organization's documents on safety justification of such fuel use and modification of other related systems important to safety.

During 2019, the SNRIU considered the documents of the operating organization on safety justification in using Westinghouse fuel and modification of other related systems related to safety.

In addition, the participation of SNRIU representatives in the activities of the operational headquarters on the implementation of Westinghouse modernized nuclear fuel was ensured.

On 10 July 2019, the SNRIU approved the “Technical Solution on the Composition and Operation of the 30th Fuel Loading of the Core at Zaporizhzhya NPP Unit 5.

05.OB.YM.TR.353-19”. According to the Technical Solution, a second power unit appeared in Ukraine, the core of which is loaded only with Westinghouse fuel (the first one is South-Ukraine NPP Unit 3).



As of 31 December 2019, Westinghouse nuclear fuel is operated at South-Ukraine Units 2, 3 and Zaporizhzhya NPP Units 1, 3, 4, 5.

1.6 Commissioning of Radioactive Waste Treatment Plants at NPPs

During 2019, the SNRIU provided review of nuclear and radiation safety of safety justification documents of industrial radioactive waste treatment plants at Zaporizhzhya NPP and Rivne NPP, oversight of compliance with the radiation safety requirements during commissioning of these plants.



In particular, in November 2019, the SNRIU approved the safety analysis report and technical solution to put the radioactive waste treatment plant at Zaporizhzhya NPP into commercial operation.

A new infrastructure facility (radioactive waste treatment plant) included into the process system was commissioned at Rivne NPP according to SNRIU individual permit OD 000313/30/15 dated 01 June 2018

and Quality Assurance Program for Radioactive Waste Treatment Plant Commissioning.

On 27 December 2019, Rivne NPP completed procedures for commissioning of the radioactive waste treatment plant.

In order to develop technical specifications for NPP radioactive waste packages for final disposal in accordance with safety requirements and best international practice, in 2019, the SNRIU first approved “Radionuclide Vector for Characterization of Salt-Bitumen Compound at RNPP” developed by Energoatom.

Within INSC Project U4/01/14A “Determination of Waste Forms Ensuring Safe Processing, Storage and Disposal of Radioactive Waste Stored at Ukrainian Nuclear Power Plants”, Energoatom submitted the “Sampling Methodology and Instrument Selection Methodology” to the SNRIU for consideration and approval regarding “problematic” waste accumulated and generated at Ukrainian NPPs such as: fusion cake, dry salt, ion-exchange resins, dehydrated ion-exchange resins.



For this “problematic” radioactive waste, except ChNPP radioactive waste, processing technologies have not been defined today and there are no clear conclusions on the possibility or impossibility of its disposal in near-surface facilities.

Therefore, the operating organization of nuclear facilities, which are not the largest radioactive waste generator, started practical activities to select processing technologies for the most problematic radioactive waste streams and justification of possible ways for their disposal (after processing).



Державна інспекція ядерного регулювання України State Nuclear Regulatory Inspectorate of Ukraine

ЯДЕРНА
БЕЗПЕКА

МИРНИЙ
АТОМ

РАДІАЦІЙНА
БЕЗПЕКА

БЕЗПЕКА
ПЕРЕВЕЗЕНЬ

2. EMERGENCY PREPAREDNESS AND RESPONSE

Ensuring and maintaining the proper level of emergency preparedness and response in the event of nuclear and radiation incidents are among the fundamental principles for the safe use of nuclear energy.

In accordance with Resolution of the Cabinet of Ministers of Ukraine No. 450 dated 6 June 2018, the SNRIU was established as the central executive body that forms a functional nuclear and radiation safety subsystem under the Unified State Civil Defense System.

The improvement of own emergency preparedness system and strengthening of the capability to response, oversight of the status of emergency preparedness of nuclear entities by approving the emergency plans, revision of the safety analysis reports, inspections and testing, observations and regulatory assessments of different training level of licensees was provided during 2019.

At the same time, a draft Order “On the Approval of the Provision on the Functional Nuclear and Radiation Safety Subsystem of the Unified State Civil Defense System” was developed that is currently subjected to approval by other central executive bodies. The development of a draft new National Plan for Responding to Nuclear and Radiation Accidents with the support of the Norwegian Radiation and Nuclear Safety Authority (DSA) was completed in 2019; its professional discussion started, in particular as part of the participation of SNRIU representatives in the training sessions for management of the territorial bodies and emergency and rescue teams of the State Emergency Service of Ukraine (SESU) related to emergency response at nuclear power plants that took place on 9-11 December in the city of Varash in Rivne region at Rivne NPP.

The SNRIU provided a review and developed draft regulatory decisions on the emergency plans of the Vektor site, the Emergency Plan of the NSC-the Shelter, the Plan of emergency measures during the implementation of activities at Tsybuleve facility, etc.

Pursuant to the Convention on Immediate Notification of a Nuclear Accident, Convention on Assistance in the Case of a Nuclear Accident or Radiation Situation in accordance with para. 2 of Resolution of the Cabinet of Ministers of Ukraine No. 1570 of 02 October 2003 “On Assigning the Competent National Authorities for the Implementation of International Conventions in the Use of Nuclear Energy” (as amended by Resolution of the Cabinet of Ministers of Ukraine No. 336 of 13 August 2014) and the relevant intergovernmental bilateral agreements with other countries, the following was provided:

- 1) round-the-clock duty and interfacing in accordance with the regulations for the interaction of dispatchers of the monitoring group of nuclear installations (MGNI) (operational duty person of the Emergency and Information Center (EIC)) and SNRIU;
- 2) development of informational reports on the status of the nuclear power plant units, notification on the operational events at Ukrainian NPPs, their posting on SNRIU website, and sending monthly statistical reports to the Cabinet of Ministers of Ukraine;
- 3) analysis of notifications of incidents that occurred in other countries under INES-NEWS Nuclear Events Web-based System and the Unified System for Information Exchange in Incidents and Emergencies (USIE);
- 4) exchange of information with the IAEA and the competent authorities of other countries under emergency exercises and training;
- 5) testing of communication with the competent authorities and/or communication points with Austria, Belarus, Bulgaria, Latvia, Germany, Norway, Poland, Romania, Slovakia, Turkey, Hungary, Finland and Sweden for the implementation of intergovernmental agreements with other countries on immediate notification of nuclear accidents, information exchange and cooperation in the field of nuclear safety and radiation protection;
- 6) participation of Ukraine in three international IAEA exercises ConvEx-2a (12 June 2019), ConvEx-2b (26-28 March 2019) and ConvEx-2d (23-24 October 2019) with the activation of the SNRIU EIC ad interaction with the SESU;
- 7) participation of SNRIU personnel in three emergency international exercises without activating the EIC under ConvEx-1a (19 January 2019), ConvEx-1c (29 May 2019) and ConvEx-1b (15 July 2019) as regards testing constant availability of the national contact points and the ability of the national competent authorities to respond immediately to notifications and verifying access rights to the USIE web portal;
- 8) participation of SNRIU representatives in staff training and special tactical exercises at ZNPP, SU NPP and KhNPP with the logistic support of the Defense Threat Reduction Agency (DTRA) at the US Department of Defense.

Exercises under the international training provided a unique opportunity in real time to check:

the ability of the automated monitoring systems of radiation situation at NPP, Chornobyl exclusion zone, Ukrainian Hydrometeorological Center to pass to emergency mode to track changes in radiation characteristics in the air over the country in the event of a threat of transboundary transfer;

the effectiveness of notification and information exchange procedures at the intergovernmental, state and international levels;

procedures for immediate processing of incoming information on event progression and its application for the assessment, prediction and development of agreed proposals for decision-making on response and protection;

verification of atmospheric transfer models that were developed by Real Time Online Decision Support system RODOS in the SNRIU EIC, Ukrainian Hydrometeorological Center and at Rivne NPP, as well as by the Norwegian Regulatory Body using ARGOS code.

In cooperation with the Energoatom, the development and publication of modules from Ukraine was provided in the IAEA Emergency Preparedness and Response Information Management System (EPRIMS).

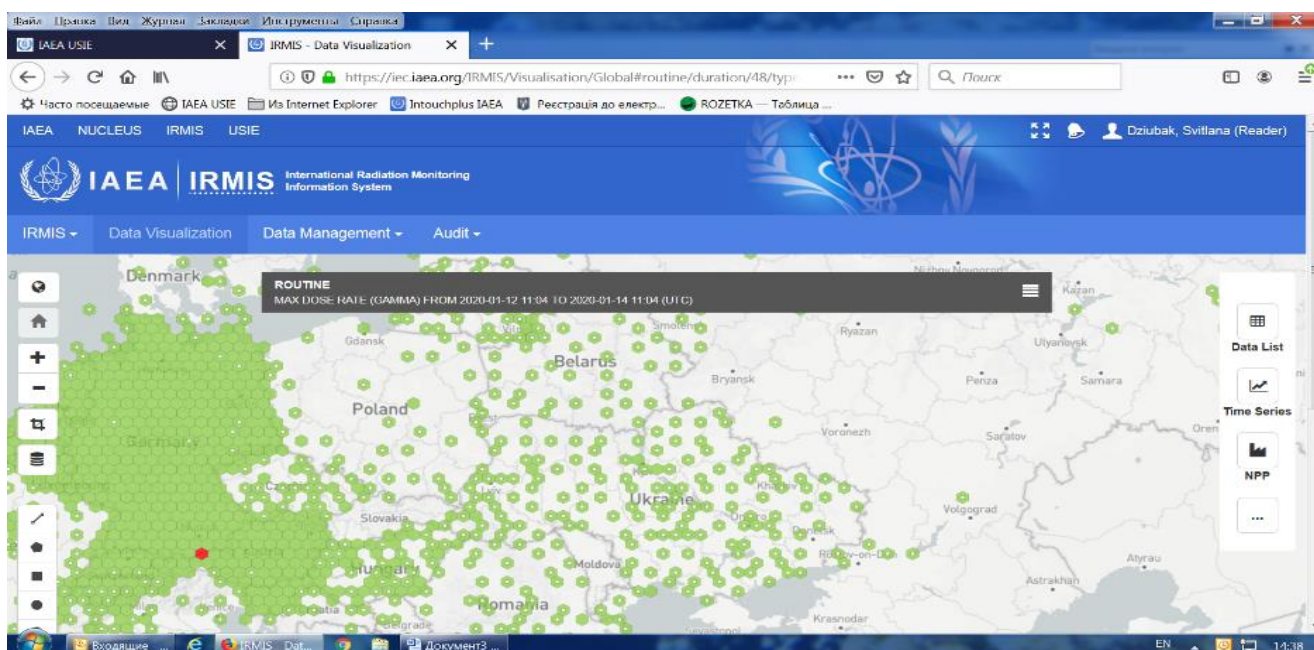
EPRIMS is designed to respond to nuclear and radiological emergencies at the international, national, regional and local levels and allows minimizing requests for information exchange between responders, as well as a more detailed prediction and assessment of the situation.

The measurement data of gamma-radiation equivalent dose rate received from NPP ASKRO posts and from the network of radiometric observation stations of the hydrometeorological service are transferred to IRMIS system through the Ukrainian Hydrometeorological Center in a test mode since November 2019.

Such data are daily loaded to IRMIS system and highlighted on the website of the IAEA Incident and Emergency Centre since December 2019. Access to IAEA EIC webpage is provided for accredited specialists.

Interagency cooperation with the Ukrainian Hydrometeorological Center at the SESU, Energoatom and SAUEZM provides the exchange of radiological data of Ukraine with the EU countries on the EURDEP platform. Information is available at <https://remon.jrc.ec.europa.eu/About/Rad-Data-Exchange>

The International Radiation Monitoring Information System (IRMIS) was developed by the IAEA to support the implementation of the Convention on Early Notification of a Nuclear Accident as a mechanism for the global exchange of large scope of radiation monitoring data. IRMIS helps the competent authorities, international organizations and the IAEA EIC to exchange information during a nuclear or radiological emergency and analyze radiation monitoring data to assess hazards, determine protective actions, inform the public and support transparency of data processing.



The membership of Ukraine in the European information space for the exchange of radiological data.

In 2019, the EIC personnel provided response to real events that did not directly affect the safety of nuclear installations and activities in the field of nuclear energy use, but they caused an increased attention of the mass media and public concern, and required appropriate information support, in particular, for immediate assessment and notification of the Cabinet of Ministers of Ukraine on the risk of radiation consequences of fire in the natural ecosystems of the exclusion zone.

An explosion accompanied by human losses and a short-term increase in radiation background in the nearby settlements recorded by the automated radiation monitoring systems occurred in the Russian Federation at a military test site located on the coast of the Dvina Gulf of the White Sea (Nenoksa) on 8 August 2019.

The SNRIU in cooperation with the Ukrainian Hydrometeorological Center at the SESU, Energoatom radiation safety services, SAUEZM Ecocentre and NASU experts conducted an immediate assessment of probable radiation consequences on the territory of Ukraine.

According to the results of additional observations that were conducted on 10 - 16 August 2019 using facility-level and departmental radiation monitoring systems, no changes within the measurement error were revealed in average daily radionuclide concentrations usually observed in the atmosphere, as well as no other artificial radionuclides in aerosol or gas form in the surface layer of atmospheric air over the territory of Ukraine. The information is available at <http://www.snrc.gov.ua/nuclear/uk/publish/article/431566>

On 29 October 2019, the Ukrainian Hydrometeorological Center at the SESU made expert comments on the requests of mass media representatives and sent notifications, particularly to the Cabinet of Ministers of Ukraine related to the revealed “orphan” radiation

sources on the territory of the Boris Sreznevsky Central Geophysical Observatory. Independent measurements of equivalent gamma-radiation dose rate were conducted during and after response measures with the involvement of SSTC NRS mobile laboratory.

In 2019, the SNRIU was also involved into the implementation of the priority tasks and activities of the Annual National Program under the auspices of the Ukraine-NATO Commission for 2019 in terms of measures aimed at developing the crisis management system in the energy sector and the national system for stability, critical infrastructure protection and efficient prevention of threats.

In particular, the international emergency exercises were held under the conditional accident scenario in the third country in order to improve information feedback procedures at the national and international levels in the event of nuclear and radiation accidents with a risk of transboundary impact in the framework of cooperation between the SNRIU and the Norwegian Radiation and Nuclear Safety Authority (DSA) on 7 November 2019.

See details of the exercises at <https://www.sstc.com.ua/news/dntc-yarb-vzyav-uchast-u-mizhnarodnomu-protiavarijnomu-trenuvanni>

Participation in the international exercises in developing the technologies and procedures for civil defense against the radiation factor of threat is consistent with the tasks and objectives of creating a positive attitude towards Ukraine as the state that has the democratic values that are common with NATO member states.



3. RADIOACTIVE WASTE MANAGEMENT

3.1 Management of Radioactive Waste in Exclusion Zone

The radioactive waste management system in the exclusion zone is established in the Strategy for Radioactive Waste Management and the National Target Environmental Program for Radioactive Waste Management and envisages:

- commissioning of near-surface radwaste disposal facilities of Vektor Stage 11;
- operation of engineered near-surface disposal facility for low- and intermediate level short-lived radwaste (ENSDF) constructed at the Vektor site;
- design and construction of pre-disposal long-term storage facilities (over 30 years) for long-lived high-level radioactive waste in geological repository within Vektor Stage 22 including vitrified radwaste resulting from spent fuel reprocessing to be returned from the Russian Federation, disused radiation sources and other long-lived high-level radioactive waste;
- maintenance of the existing management facilities for Chernobyl-origin radioactive waste constructed during the first years of Chernobyl accident mitigation: Buryakivka RWDS, Pidlisny RWDS, ChNPP Stage III RWDS, and RICS including their monitoring, upgrade, stabilization, safety improvement, inspection, safety review, remediation;
- surveys and research & development for siting a geological repository for long-lived high-level radioactive waste.

In order to implement the above activities, the Centralized Radioactive Waste Management Enterprise (CRME) was appointed as the only operating organization at all lifecycle stages of the radioactive waste disposal facilities.

Implementation status for 2019

1. Completion of radioactive waste disposal facilities SRW-1 and SRW-2 of Vektor Stage 1 was performed. SRW-1 was designed for radwaste disposal in reinforced concrete

¹ Vektor Stage 1 includes near-surface disposal facilities for low- and intermediate-level short-lived radwaste resulting from the Chernobyl disaster of two types: SRW-1 is a facility for disposal of radioactive waste in reinforced concrete containers; SRW-2 is a module-type disposal facility for unpacked large-size radioactive waste.

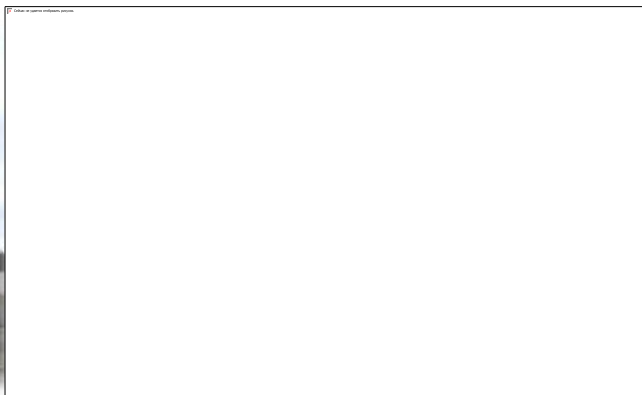
² Vektor Stage 2 includes long-term storage facilities for long-lived high-level radioactive waste; near-surface disposal facilities for low- and intermediate-level short-lived radioactive waste; treatment plants for Chernobyl radwaste and radwaste generated in non-nuclear sector.

containers; SRW-2 is a module-type disposal facility for unpacked large-size radioactive waste.

A process of licensing the activity related to operation of SRW-1 and SRW-2 at SSE “CRWTP” was started in April 2019.



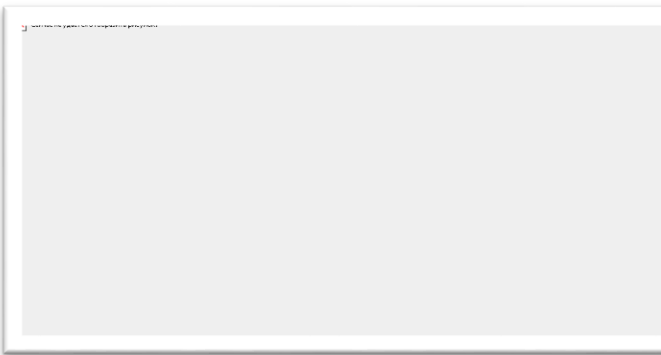
SRW-1



SRW-2

2. CRME operates the engineered near-surface disposal facility for low- and intermediate-level short-lived radioactive waste (ENSDF). ENSDF was constructed in 2009. The disposal facility consists of two parallel sections, each includes 11 reinforced concrete sections (modules) arranged with the central drainage gallery, two movable frame structures with bridge cranes. The capacity of the disposal facility is 50210 m³ of radwaste packages.

Filling of two symmetric modules in ENSDF (A1 and D1) was started in 2019. Since the beginning of the operation, ENSDF accepted for disposal 672.03 m³ of radwaste packages with total activity of 3,24E+12 Bq. 350.48 m³ of radwaste packages with total activity of 2.2E+12 Bq were accepted during 2019. The first layer of radwaste packages in D1 module was concreted.



ENSDF



Concreting of the first layer in ENSDF compartment D1

3. Operation of the centralized long-term storage facility for disused radiation sources (CLTSF) is ongoing, which includes CLTSF comprehensive (hot) tests with disused radiation sources. CLTSF operation includes acceptance, processing (conditioning) of radioactive waste, waste as disused radiation sources of different types and categories and placement of

prepared packages containing such radwaste according to radiation type for long-term storage



Centralized long-term storage facility for disused radiation sources (CLTSF)



Storage area for disused radiation sources in CLTSF

during 50 years.

21067 disused radiation sources with total activity of $1.29\text{E}+14$ Bq were accepted for storage since the beginning of CLTSF operation. 19108 disused radiation sources with a total activity of $5.89\text{E}+9$ Bq were accepted for storage during 2019.

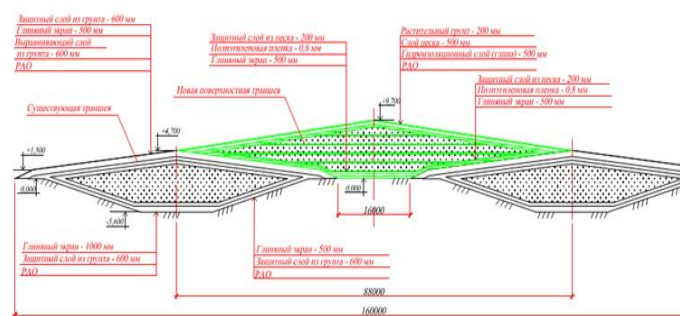
4. 30 trenches with total amount of radioactive waste of $690,000\text{ m}^3$ and total activity of $2.54\text{E}+15$ Bq were filled and preserved at Buryakivka RWDS.

Additional disposal facility 21A was constructed in 2018 to expand production capacities of Buryakivka RWDS. 13212.38 m^3 of radioactive waste with total activity of $1.25\text{E}+12$ Bq were accepted for disposal to disposal facility 21A at Buryakivka RWDS as of 31 December 2019.

In addition, in order to expand the production capacities of the Buryakivka RWDS in 2019, the SNRIU conducted a state review on nuclear and radiation safety and agreed the project “Reconstruction of Buryakivka RWDS in the exclusion zone of Ivankiv District in Kyiv region”.



Buryakivka RWDS



Buryakivka RWDS reconstruction project

5. CRME implements routine maintenance to ensure safety at Pidlisny and ChNPP Stage III RWDS in 2019. These disposal facilities were constructed in 1986-1988 under the primary measures aimed at Chernobyl accident6 mitigation.

In the long term, the issue related to retrieval of radwaste from Pidlisny and ChNPP Stage III RWDS and its reburial in appropriate disposal facilities should be solved. Preparation for radwaste retrieval from these RWDS is part of the long-term measures to be implemented stage by stage after the development of retrieval, handling and disposal technologies for this waste.



Pidlisny RWDS



ChNPP Stage III RWDS

6. Routine activities are being conducted by CRME to ensure safety in radioactive waste storage facilities on the territories of radwaste interim confinement sites (RICS).

RICS are territories adjacent to ChNPP with a total area of about 10 hectares on which trenches and pits for radwaste confinement were constructed during the emergency measures aimed at Chernobyl accident mitigation. Such radwaste are mainly building structures, household items, upper layer of the soil, etc., contaminated in emergency release. Nine RICS are located on the territory of the exclusion zone: Yaniv Station, Naftobaza, Pischane Plato, Rudy Lis, Stara Budbaza, Nova Budbaza, Prypiat', Kopachi and Chystohalivka. Estimated



quantity of RICS trenches and pits is from 800 to 1000. CRME conducts RICS survey considering the level of hazardous environmental impact in order to eliminate the most hazardous trenches and pits. First of all, the examination of RICS trenches and pits located near the Prypiat' river is conducted, as well as of those that may affect the safe transformation of the Shelter into an environmentally safe system, decommissioning of Chernobyl NPP in their territories, etc.

According to the investigation results, radwaste from the most hazardous RICS trenches and pits is redispersed in Buryakivka RWDS. Reburial is conducted according to the technical decisions agreed with the SNRIU.

7. The radioactive waste management strategy provides for the construction of a geological repository for radioactive waste disposal. In 2019, the activities under the project

“Development of the National Plan for the Geological Disposal of Radioactive Waste in Ukraine and its Implementation Schedule” launched in 2018 as part of the European Commission's Instrument for Cooperation in Nuclear and Radiation Safety were under continuation. The beneficiary under this project is the State Agency of Ukraine for Exclusion Zone Management; the end user is CRME that is the operating organization of radwaste disposal facilities.

3.2 Management of Radioactive Waste on Ukrainian Territory

Safe storage or disposal of radiation sources at the end of their lifetime is an important condition for their safe use in order to avoid their loss or access of the public. The reason is that disused radiation sources remain hazardous after expiration of their lifetime as they contain radioactive material that can cause significant damage to human health in case of distribution or inadvertent use.



Disused radiation sources are declared as radioactive waste and become the state property. Their further management is implemented in accordance with the safety requirements for radioactive waste management of the state specialized enterprises on radioactive waste management of the Radon Ukrainian State Corporation (Radon USC) subordinate to the State Agency of Ukraine on Exclusion Zone Management (SAUEZM).

Kyiv, Kharkiv, Dnipropetrovsk, Lviv, Odessa State Interregional Specialized Plants (SISPs) are currently operated on the Ukrainian territory.

These enterprises, on the territories of their assigned service areas, ensure collection, transport and safe placement of radioactive waste in storage/disposal facilities specially designed for this. At the same time, SISPs operate stations for decontamination of underwear, special clothes and personal protective means of medical and research institutions and enterprises.

In April 2019, the Ukrainian State Corporation Radon USC was liquidated by Order of the Cabinet of Ministers of Ukraine No. 233 dated 10 April 2019.

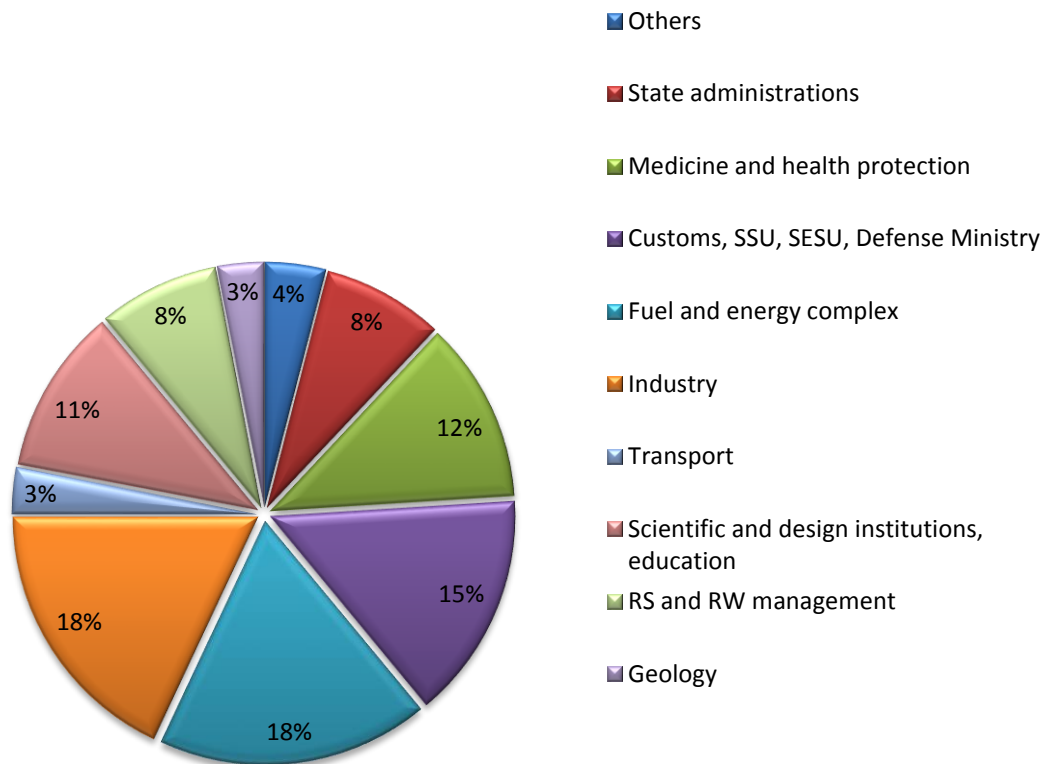
SAUEZM Order No. 122-19 dated 19 June 2019 assigned the State Specialized Enterprise Radon USC to specialize in the production of Radon (Chipboard Radon), whose main purpose is to realize the interests of the state in the field of radwaste management.

In July 2019, SAUEZM decided to reorganize the state interregional specialized plants (Kyiv, Kharkiv, Dnipropetrovsk, Lviv, Odesa SISPs) by joining them to Radon USC.

According to this reorganization, unbalanced branches were established that continue the activities of the specialized radioactive waste management enterprises, namely:

- Dnipropetrovsk SISP;
- Kyiv SISP;
- Lviv SISP;
- Odesa SISP;
- Kharkiv SISP.

In 2019, the interregional branches of Radon USC received radwaste from 66 subjects that was generated in their activities or mitigation of radiation accidents and incidents.



Main groups of radioactive waste suppliers to Radon USC SISPs in 2019

Radon SISP	Solid radwaste		Solid radwaste Disused radiation sources in biological shielding	
	Mass, t	Activity, Bq	Number, items	Activity, Bq
Dnipropetrovsk SISP	6.050	1.06E+10	26	5.22E+11
Kyiv SISP	3.098	1.78E+10	1 749	7.92E+14
Lviv SISP	0.008	1.07E+04	346	6.97E+10
Odesa SISP	1.718	1.15E+10	66	4.56E+11
Kharkiv SISP	88.937	6.46E+08	182	2.04E+14
Total	99.811	4.05E+10	2 369	9.97E+14

Information on radioactive waste supply to Radon SISP in 2019

Since the radioactive waste management facilities at these plants were constructed in the Soviet era in the 1960-1970s, the National Program for Radioactive Waste Management provided a number of measures to reequip Radon USC SISP. This includes measures to retrieve radioactive waste from old facilities and re-dispose it in the centralized disposal facilities at the Vektor site in the exclusion zone. This will allow cleanup of old radioactive waste disposal facilities that do not meet current safety requirements and mitigation of associated potential hazards of radionuclide spread in the environment. In each case, such decisions should be made upon safety review performed by specialized enterprises for radioactive waste management in accordance with the conditions of licenses issued by the SNRIU.



Radioactive waste storage in containers in SISP

As of 01 January 2020, Radon USC storage facilities include:

- low- and intermediate-level solid waste of 4 361.8 t, (6063.5 m³) with total activity of 1.56E+15;
- low- and intermediate-level liquid waste of 789 m³ with total activity of 1.07E+13;
- radioactive waste in the form of disused radiation sources stored in well-type disposal facilities: 57811 items with total activity of 3.68E+14;
- radioactive waste in the form of disused radiation sources stored in solid radioactive waste storage facilities and in containers: 583 319 items with total activity of 2.68E+16.

Radon USC SISP	Low- and intermediate level solid radwaste			Low- and intermediate level liquid radwaste		Disused sealed radiation sources			
						Sealed radiation sources in solid radwaste facilities and containers		Sealed radiation sources in well-type disposal facilities	
	Mass, t	Amount, m ³	Activity, Bq	Amount, m ³	Activity, Bq	Number, items	Activity, Bq	Number, items	Activity, Bq
Dnipropetrovsk SISP	354.6	622.9	5.93E+11	124	1.20E+10	212 376	6.06E+14	8 391	9.62E+13
Kyiv SISP	1 309.7	2 114.0	1.53E+15	480	1.06E+13	159 747	2.27E+15	6 609	1.08E+14
Lviv SISP	510.3	699.0	5.08E+12	0	0.00E+00	97 231	2.20E+14	8 151	3.63E+13
Odesa SISP	253.9	529.2	1.52E+13	183	1.10E+11	38 716	2.32E+16	19 312	5.16E+13
Kharkiv SISP	1 933.3	2 098.4	5.16E+12	2	7.51E+06	75 249	4.66E+14	15 348	7.60E+13
Total	4 361.8	6 063.5	1.56E+15	789	1.07E+13	583 319	2.68E+16	57 811	3.68E+14

Information on radioactive waste amounts in Radon SISP storage/disposal facilities as of 01 January 2020.

In 2019, radioactive waste in form of disused radiation sources was supplied from Radon USC SISPs for hot tests, namely:

- 8 disused radiation sources Cs-137 in blocks with total activity of 7.58E+09 Bq from Kyiv SISP;
- 19 100 disused radiation sources Pu-239 with total activity of 3.53E+09 Bq from Kharkiv SISP.

Kharkiv SISP also supplied 147.31 tons of radioactive waste with total activity of 1.74E+08 Bq (128 packages) for disposal to ENSDF.

Radon USC SISPs are also involved in urgent actions of competent authorities on mitigation of emergencies associated with revealing abandoned radiation sources or illicit trafficking of radiation sources. All these radiation sources are transferred to storage/disposal facilities of specialized enterprises where their safe and controlled storage, as well as localization from entry into the environment and places accessible for the public is provided.

Experts of Radon USC SISPs participated in the mitigation of 17 radiation accidents during the reporting period.

In 2019, the activities were conducted to improve the radiation monitoring and control system at the sites of Radon USC SISPs, in particular, the Integrated Automated Environmental Radiation Monitoring System (IAERMS) was implemented.

3.3 Legacy Radioactive Waste

Legacy radioactive waste in Ukraine are as follows:

- radioactive waste disposed in Soviet times at storage/disposal facilities in Radon USC SISPs;
- radwaste placed on the decontamination waste disposal sites and vehicle sanitary treatment sites (DWDS/VSTS), resulting from mitigation of the Chornobyl accident and located outside the exclusion zone in the Kyiv, Zhytomyr and Chernihiv regions;
- radwaste resulting from military programs of the former USSR.

Decontamination waste storage sites (DWDS) with topsoil, roofing materials, construction debris, etc., and vehicle sanitary treatment sites (VSTS) were constructed in settlements during accident mitigation at Chornobyl NPP in areas adjacent to the exclusion zone. In total, there are 53 DWDS/VSTS in Ukraine, 6 six of them are VSTS. The amount of contaminated materials in VSTS tanks is 574 m³ of solid waste, and 295 m³ of liquid waste.

Summary data on DWDS in regions

Regions	Number of DWDS	Decontamination waste volume, m ³	Activity, Bq
Zhytomyr	28	18720	2.68E+10
Kyiv	16	143708	5.07E+11
Chernihiv	3	9300	n.a.
Total	47	171728	5.34E+11

Summary data on DWDS according to categories of radiation contaminated zones

Category of radiation contaminated zone	Number of DWDS	Decontamination waste volume, m ³	Activity, Bq
Exclusion zone	8	141093	4.34E+11
Unconditional (mandatory) resettlement zone	21	15109	7.97E+10
Zone of guaranteed voluntary resettlement	18	15526	2.04E+10

The Kyiv SISP provides DWDS/VSTS maintenance, radiation monitoring and control. These facilities require additional inspection, safety assessment, making and implementation of decisions for their remediation.

The international technical assistance project for the remediation of Chornobyl waste storage sites beyond the exclusion zone is at the practical implementation stage. These

radioactive waste temporary storage sites were ranked according to their radiation hazard with financial support of the European Union under the “Instrument of Nuclear Safety Cooperation” Program.

In 2019, preparatory activities were started for radioactive waste retrieval from Pisky-1 DWDS according to the documents agreed with the SNRIU for the implementation of the pilot project “Pisky-1 Decontamination Waste Disposal Site” submitted by Kyiv SISP.

Pisky-1 DWDS was constructed and filled in 1987–1989 as a result of decontamination activities in the neighboring villages (Pisky, Karpylivka, etc.).

Site remediation is expected in the future, in particular, retrieval of about 300 m³ of decontamination waste, its sorting and placement in packaging (bags), decontamination waste transport to Buryakivka RWDS for disposal, trench backfilling and remediation of Pisky-1 DWDS territory.

3.4 Chornobyl NPP Decommissioning

The only operating organization in Ukraine having a license to perform activities at the stage of nuclear installation decommissioning is Chornobyl Nuclear Power Plant (ChNPP).

The following is subject to decommissioning under the License:

- ChNPP units No. 1, 2, 3;
- temporary storage facilities for liquid and solid radioactive waste;
- other plant facilities.

The presence of unit 4 that was destroyed in the accident in 1986 (the Shelter) at the site of this nuclear power plant is considered during the activities related to Chornobyl NPP decommissioning.

The “deferred dismantling” strategy implemented in accordance with the “Chornobyl NPP Decommissioning Program” was adopted for decommissioning of units No. 1, 2, and 3 by a successive implementation of the following steps:

- final closure and safe storage (FCSS) is a stage at which the installation is brought into the condition that excludes its use for the design purpose and long-term safe storage of parts of the installations and radioactive contaminated equipment is ensured;
- enclosure is a stage at which the installation is in preserved condition that ensures safe storage of radiation sources in it;
- dismantling is a stage at which all systems and components in the installation will be dismantled and removed, management of radioactive waste that will be generated at this stage will be ensured, as well as measures will be taken to clean the site from radioactive contamination.

In March 2015, the SNRIU issued individual License No. OD 000040/8 for activities at the stage of final closure and safe storage of Chornobyl NPP Units No. 1, 2 and 3 (FCSS stage).

With the issuance of this license, the operation termination stage was completed and the decommissioning of Chornobyl NPP units 1, 2, and 3 actually started.

ChNPP implements FCSS stage in compliance with the FCSS project, “The Program for the Implementation of the Final Closure and Safe Storage Stage at ChNPP Units 1, 2, 3” and the technical specifications for decommissioning of ChNPP units 1, 2 and 3 at FCSS stage.

In accordance with the approved projects and programs at ChNPP, the equipment not important to safety and not subjected to enclosure is dismantled under FCSS, the infrastructure for radioactive waste management is optimized, certain systems and technological processes are modernized, dosimetric control is provided, as well as other activities are performed.

A significant amount of radioactively contaminated materials and equipment (RCME) that can be further exempted from regulatory control is generated during dismantling. ChNPP identified the main measures for RCME management, in particular, the places of their temporary storage and further decontamination.

The installation to release materials from regulatory control after their decontamination is being currently designed at ChNPP.



The SNRIU allowed the Chornobyl NPP to put the installation into trial and commercial operation (following certain conditions) based on the consideration results of the design documents and the acceptance testing results.

The SNRIU reviews the Program for Trial and Commercial Operation of the Installation provided by Chornobyl NPP with the involvement of international experts.

In 2016, Chornobyl NPP started activities aimed at spent fuel pool decommissioning in accordance with the feasibility study (FS) for decommissioning of this installation.

According to ChNPP, in 2018-2019 the water level in the pool reached an equilibrium state, which was determined by the level of groundwater and precipitation. In addition, ChNPP noted that the criteria for the final status of the spent fuel pool were achieved according to the observation results in 2019. ChNPP submitted a request to SAUEZM to make a decision on changing the status of this installation and designating an organization responsible for the subsequent control of this territory.

It should be noted that the measures under the FCSS program are taken with certain delays, in particular, within start-up package 2 (construction stage 2): “Dismantling and Processing of Process Trains and CPS Trains”. The implementation terms under this construction stage affect the start and completion dates for other construction stages and measures under the FCSS program as a whole. The SNRIU drew ChNPP’s attention to the need for accelerating the implementation of relevant measures.

During 2019, the SNRIU continued the revision of ChNPP documents in the framework of the renewal of license EO No. 000040 for the right to perform activities related to Chornobyl NPP decommissioning.

3.5 Radioactive Waste Management Facilities at Chornobyl NPP

Radioactive waste accumulated during Chornobyl NPP operation and accident mitigation in 1986 and generated during decommissioning of Units 1, 2 and 3 and Shelter transformation into an environmentally safe system is stored in radioactive waste storage facilities at the Chornobyl NPP site: solid radwaste storage facility, liquid radwaste storage facility, solid and liquid radwaste storage facility, or is transferred for disposal to Buryakivka RWDS disposal facilities.

In 2019, 5.60 m³ of liquid radwaste was generated at Chornobyl NPP and sent for temporary storage (disused sorbents).

As of the end of 2019, 13 445.90 m³ of evaporation bottoms; 4 114.82 m³ of spent ion-exchange resins; 2 297.78 m³ of filter perlite pulp; 145.31 m³ of contaminated oil-fuel mixture, 19.8 m³ of immobilized liquid radwaste (concreted evaporation bottoms) were accumulated in liquid radioactive waste storage facilities.

Low- and intermediate-level solid waste generated during decommissioning and Shelter transformation into an environmentally safe system was transferred to Buryakivka RWDS facilities for disposal. During 2019, 3 400.0 m³ (3 490.88 t) of low-level radioactive waste was transferred to Buryakivka RWDS.

High-level waste is collected into special containers (KTZV-0.2) and placed into the interim storage facility for solid high-level waste arranged in the former fresh nuclear fuel storage building. During 2019, 0.3 m³ (0.24 t) of mixed solid high-level radwaste was generated and transferred for temporary storage.

A series of radioactive waste management facilities were constructed and are being commissioned at the ChNPP site under international technical assistance projects. Commissioning of these facilities will allow processing of the accumulated and generated radwaste to bring it to the state acceptable for safe disposal.

One of these facilities is the liquid radioactive waste treatment plant (LRTP).



The technological process involves the treatment of liquid radioactive waste in the form of evaporation bottoms in evaporators, pulp of spent ion-exchange resins, perlite pulp and sludge.

ChNPP currently processes evaporation bottoms at LRTP and performs preparatory activities for reprocessing of ion-exchange resins. The packages with concreted liquid radioactive waste are transferred after reprocessing for disposal in the engineered near-surface disposal facility for solid radioactive waste (ENSDF) in the exclusion zone.

The construction of the facilities of the industrial complex for solid radioactive waste management (ICSRM) was also completed at ChNPP site and activities are underway aimed at their commissioning.

ICSRM design includes:

Lot 0 – temporary storage facility for low- and intermediate-level long-lived waste and high-level waste (HLW and LILW SF) in the building of liquid and solid waste storage facility (LSWSF) at ChNPP,

Lot 1: facility for retrieval of solid radioactive waste (SRRF),

Lot 2: solid radioactive waste treatment plant (SRTP),

Lot 3: engineered near-surface disposal facility for solid radioactive waste (ENSDF) constructed at the Vektor.

The SNRIU issued individual permit No. 000040/4 for operation of HLW and LILW SF dated 10 December 2010.

According to the terms of this permit, the source of radioactive waste coming to the storage facility is SRTP (Lot 2), which has not been put into operation yet.

Appropriate amendments were made in the above permit at the request of ChNPP in 2016, according to which Lot 0 accepts for storage high-level waste generated in the implementation of the Shelter projects. Such amendments were made in order to exclude delays in the project implementation of the new safe confinement of the Shelter.

Lots 1, 2.

The ICSRM commissioning program envisages three commissioning stages of SRRF and LRTP:

Stage 1: tests with radioactive waste in sealed packages with previously known characteristics (completed),

Stage 2: tests with radioactive waste without sealed packages (“unsealed” radioactive waste) with known characteristics (completed),

Stage 3: tests with radioactive waste retrieved from the sections of the solid waste storage facility at Chornobyl NPP (“hot tests”).

In accordance with the Action Plan for the ICSRM Commissioning, ChNPP takes measures aimed at the preparedness to Stage 3 of ICSRM “hot” tests.

3.6 Shelter Transformation into Environmentally Safe System

During 2019, the SNRIU implemented its priority activities such as safety assessment and licensing for the construction of the first startup package of the New Safe Confinement (NSC SP-1).

One of the main Shelter projects is the construction of the New Safe Confinement (NSC).

The design lifetime of the NSC is 100 years.

In the first six month of the reporting year, the activities at ChNPP site on NSC SP1 construction were completed. On 10 July 2019, the New Safe Confinement was solemnly transferred from the contractor (Novarka Joint Venture) to the client (State Specialized Enterprise Chornobyl NPP, ChNPP).

The new safe confinement is a protective structure in the form of an arch that is placed above the old Shelter and includes unit 4 at Chornobyl nuclear power plant that was destroyed in 1986. The NSC includes a series of process equipment to retrieve radioactive materials from destroyed unit 4 at Chornobyl NPP. The arch building is a metal structure that is 162m long and 108m high (larger than the Olympic Stadium in Kyiv).

The NSC structure is equipped with a powerful ventilation and climate control system in order to avoid corrosion. An automated crane system was installed under the Arch ceiling, by which the Shelter structures inside the confinement will be dismantled.

On 20 November 2019, the State Architectural and Construction Inspectorate of Ukraine provided ChNPP with Certificate Series IV No. 163193242320, which certifies the compliance of the completed NSC SP-1 with design documents and confirms its readiness for operation.



According to License EO 000033 for the Shelter operation issued by the SNRIU on 30 December 2001, ChNPP should receive an individual permit for NSC SP-1 commissioning.

The activities are performed at the Shelter under the license establishing the scope and conditions of the authorized activities to transform the Shelter into an environmentally safe system. The license is valid until the commissioning of the New Safe Confinement of the Shelter (NSC)

The nuclear and radiation safety of the Shelter is ensured by a system of administrative and technical measures during current operation of the facility and in implementing the projects for its transformation into an environmentally safe system.

The nuclear and radiation safety of the Shelter is assessed based on the results of routine measurements of parameters characterizing fuel-containing materials, radiation situation at

the work sites and in the adjacent territory, activity of contaminated water of the Shelter. Releases from the facility into the atmosphere and effluents into hydrogeological environment, the condition of the civil structures of the Shelter are also subject to control.

Radiation and dosimetric monitoring is provided during the activities at the Shelter, and the dose loads of personnel of ChNPP and contracting organizations are recorded.

According to ChNPP, in 2019 the average individual dose of ChNPP personnel who worked at the Shelter or visited the local zone and rooms in the facility made up 1.15 mSv and decreased by 20.14% compared to the previous year 2018. The average level of individual doses of contractor personnel was 2.69 mSv, which is approximately 87.34 % compared with 2018.

No exceeded reference levels of individual annual exposure doses to ChNPP and contractor's personnel were recorded. The external exposure reference level for ChNPP and contractor's personnel is 13 mSv/year.

Solid and liquid radioactive waste is generated during the activities at the Shelter and in the adjacent territory.

The main solid radioactive waste is soil, scrap metal, mixed construction debris; secondary waste includes used individual protective means and decontamination waste.

During the reporting period, ChNPP and contractors removed in total 132.3 m³ (89.84 t) with total activity of 6.66×10^{10} Bq from the Shelter territory to Buryakivka RWDS, which is lower than appropriate indicators for 2018 by about 1.7 times in volume and 1.9 times in weight of solid radwaste and higher by 3.8 times in terms of their activity. The main cause for the decrease in the amount of generated solid radioactive waste is the completion of the main construction activities under NSC.

The generation sources of liquid radioactive waste (radioactive water) are decontamination of rooms, equipment and tools, dust suppression, changing room operation.

During 2019, 311m³ of radioactive water with total activity of 3.898×10^9 Bq were collected and pumped from the Shelter rooms to prevent radioactive substance release into the groundwater and improve the radiation situation. The total volume of pumped water decreased compared with 2018, which can be related to the changes in temperature and humidity mode.

In order to receive data on the state and characteristics of fuel containing materials (FCM) of the Shelter, which are necessary to keep FCM in a safe state and in order to develop the final strategy for FCM retrieval, ChNPP involving the Institute for Safety Problems of Nuclear Power Plants of NAS of Ukraine developed the "Program for Monitoring Fuel-Containing Materials (FCM) of the Shelter (Shelter Nuclear and Radiation Safety)".

Upon the results of the nuclear and radiation safety review, the SNRIU approved the specified "Monitoring program..." and provided recommendations for consideration during the conduct of planned activities.

At the request of the State Agency of Ukraine for Exclusion Zone Management, SNRIU representatives participated in activities of the working group on the development of the Concept of the National Program for Chornobyl NPP Decommissioning and Shelter Transformation into Environmentally Safe System from 2021 to 2031.

The working group developed proposals on further measures that shall be performed at ChNPP, including those related to the Shelter: update of strategic decisions regarding the

completion of NSC, dismantling of unstable facility structures, monitoring of FCM, FCM transfer into a controlled state and further retrieval from the Shelter, other measures.

“The first stage of dismantling will be insignificant, about 10 tons of low-level waste - these are structures that were laid on the old destroyed parts of the power unit. These structures are quite suitable for defragmentation and disposal in the existing near-surface disposal facility - the Buryakivka radioactive waste disposal facility”, deputy chief engineer of the Shelter Serhii Kondratenko stated. “The first stage does not provide for generation of high-level waste (HLW), but if it was generated, ChNPP has a temporary storage for HLW for 30 years”.

The dismantling of unstable building structures (“early dismantling”) should be completed by the end of 2023. The scope of work under the recently signed contract includes three stages. The first and second stages provide for the inspection of the Shelter and design activities. Their implementation is necessary for careful planning of the dismantling of unstable structures, management of large amount of radioactive waste that will generate, as well as maximum personnel safety. The third stage of activities involves the purchase and installation of equipment for dismantling and handling of dismantled fragments, as well as early dismantling.

According to design calculations, the NSC will serve at least 100 years; this will allow complete dismounting of all the structures inside the Shelter.

3.7 Concept of Exemption and Clearance from Regulatory Control

IAEA international standard No. RS-G-1.7 “Application of the Concepts of Exclusion, Exemption and Clearance” and EU legislation regarding the establishment of levels and procedures for exemption from regulatory control of radioactive materials was implemented in the Ukrainian legislation; a differentiated approach to the regulation of installations and practices in nuclear energy use was implemented considering the level of their potential hazard.

The levels and procedures for exemption from regulatory control of radioactive materials were approved by SNRIU Order No. 84 of 01 July 2010. This concept is also currently applied to dismantled materials from Chornobyl NPP and exclusion zone, and pump and compressor pipes (after their decontamination).

The practice of applying the procedures for the exemption allows reducing the amount of radioactive materials that were subjected to regulatory control and that, reduced their characteristics as a result of natural decay processes or the use of processing or decontamination technologies according to the radiation hazard factor to such levels that the extension of the radiation protection and regulatory control requirements to them in full extent is inadvisable.

Such activity helps reducing the amount of radioactive waste accumulation, optimizes the processes of radioactive waste management, is economically viable and promotes the acceptance and spreading of available technologies for decontamination, processing and reuse of radioactive materials, if it was proved that their radioactive contamination levels are below certain established numerical values.

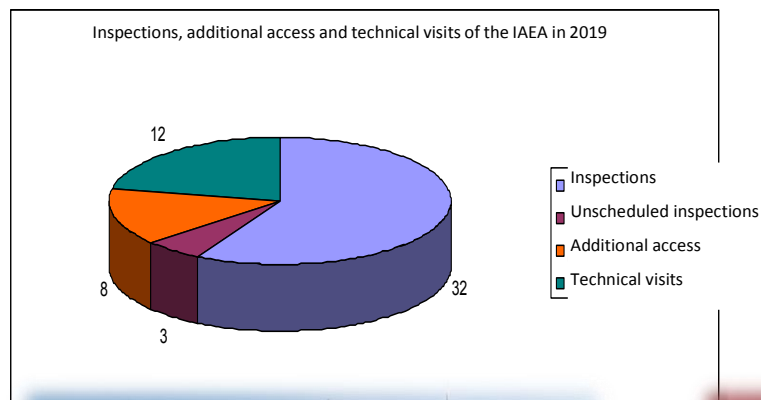


4 NUCLEAR SECURITY AND SAFEGUARDS

4.1 Nuclear Weapon Nonproliferation Safeguards

In 2019, Ukraine carefully fulfilled the obligations under the Agreement between Ukraine and the IAEA for the Application of Safeguards in Connection with the Treaty on the Nonproliferation of Nuclear Weapons. This is confirmed by the fact that Ukraine obtained a broader conclusion upon the results of using IAEA safeguards. This means that no undeclared nuclear activities have been revealed in Ukraine and all nuclear materials are used for peaceful purposes.

The IAEA carried out scheduled and unscheduled inspections, as well as additional access to Ukrainian enterprises (see the diagram) in 2019, to confirm the declared listing of nuclear materials and the absence of undeclared nuclear activities.



SNRIU State Inspectors participated in all IAEA visits.

In addition, IAEA inspectors and technical personnel arranged technical visits to NPPs. As a rule, installation, replacement and setup of remote monitoring equipment, testing of IAEA equipment were usually performed during such visits. In particular, testing handling operations using Holtec Company equipment for spent nuclear fuel transport were performed during a year at Rivne NPP, Khmelnytsky NPP and South-Ukraine NPP. The use of technical means for the purposes of safeguards significantly reduce the number of IAEA inspections in the state.

The state regulatory authority has been keeping the state information database of nuclear materials for 25 years to record information on the quantity and composition of nuclear materials in any balance area or in an individual enterprise. 218 reports on nuclear materials and 23 preliminary notifications on export/import of nuclear materials were received, processed and finalized in the database in the reporting period for sending to the IAEA. Other information under the Agreement was regularly submitted as well, namely: information about the structure, maintenance schedules, information of exposure doses of IAEA inspectors, etc.

The information on export supplies of agreed equipment and non-nuclear material from Ukraine was provided to the IAEA on a quarterly basis to implement the Additional Protocol to the Agreement. An annual information update was conducted under the Additional Protocol to the Agreement (28 declarations).

Every year the key issues of the implementation of the Safeguards Agreement and Additional Protocol are analyzed during the meetings of the joint Ukraine-IAEA High-Level Working Group on the consideration of safeguards application in Ukraine. On 22 May 2019, a meeting of the Working Group was held in the SNRIU office. Representatives of the IAEA, SNRIU, Ministry of Energy and Coal Industry of Ukraine, Ministry of Foreign Affairs, State Service of Export Control of Ukraine, State Agency of Ukraine on Exclusion Zone Management, Energoatom, Chornobyl NPP participated in the meeting. Haroldo Barroso Junior, IAEA Director of Division of Operations C, who headed the IAEA delegation, applied to extend the participation of state inspectors in putting or removing electronic seals of the IAEA during operations at nuclear facilities with spent nuclear fuel. The SNRIU management supported this request, if state inspectors are involved according to the established procedure after the relevant training. The procedure for handling of IAEA seals, which regulates the rules for putting and removing of IAEA seals at Ukrainian NPPs by state inspectors, was developed and put into force.

A training workshop was held in Kyiv in November 2019 under the International Nuclear Safeguards Engagement Program (INSEP) to improve qualification of SNRIU state inspectors. Twenty-three experts responsible for the interaction with IAEA inspectors participated in the workshop.

The SNRIU provided the IAEA with information on spelling of Ukrainian geographical names and addresses of all nuclear facilities and other enterprises. Since 2019, the IAEA applies updated names and addresses of Ukrainian enterprises in official documents. The efforts were taken to change the state structure of balance areas of nuclear materials with regard to the fact that the amount of nuclear materials in some regions exceeded limitations established in the Safeguards Agreement. New accounting areas were created upon agreement with the IAEA.

In addition to the IAEA, the SNRIU exchanged information about international transfers of nuclear materials in previous year with the Euratom according to the Agreement between the European Atomic Energy Community and the Cabinet of Ministers of Ukraine for Cooperation in the Peaceful Uses of Nuclear Energy, and submitted preliminary notifications and annual report on international transfer of nuclear materials to the Canadian Nuclear Safety Commission under the Agreement between the Government of Ukraine and the Government of Canada for Cooperation in the Peaceful Uses of Nuclear Energy.

Therefore, the SNRIU ensured efficient functioning of the state system of accounting and control of nuclear materials, which made it possible for Ukraine to comply with requirements of international agreements on nuclear weapons nonproliferation.

4.2 Measures to Improve Effectiveness of State Physical Protection System

Physical protection of nuclear installations and radioactive materials is an important area in the use of nuclear energy in Ukraine where nuclear energy infrastructure is highly developed.

The priorities of the state policy in the field of nuclear energy use in terms of security are aimed at fulfilling Ukraine's international obligations to achieve the main physical protection goals: minimizing the risks of sabotage, theft or any other unlawful withdrawal of radioactive materials and strengthening the regime of nuclear weapons nonproliferation.

Since January 2014, according to Resolution of the Cabinet of Ministers of Ukraine "On Approval of the Procedure for the Functioning of the State Physical Protection System" No. 1337 dated 21 December 2011, the SNRIU transferred the functioning of the state physical protection system to increased readiness. This was facilitated by the events in Ukraine and the complex socio-political situation, which required additional measures to maintain the physical protection regime.

The physical protection measures were arranged and taken in 2018 under real threats caused by the aggression of the Russian Federation in the east of the country, sabotage acts of the "LPR" and "DPR" combatants and a significant escalation of the socio-political situation in the state.

Within the oversight activities, SNRIU inspectors carried out scheduled inspections of the physical protection systems of all NPPs.

In addition, inspections were conducted to check compliance with the requirements for physical protection of three enterprises in the exclusion zone: Chornobyl NPP, the State Specialized Enterprise "Central Enterprise for Radioactive Waste Management", Institute for Safety Problems of Nuclear Power Plants, as well as inspections of NSC KIPT (within obtaining of an individual written permit for initial startup of the neutron source), National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" were carried out.

SNRIU physical protection experts constantly amended the interaction plans in case of sabotage, physical protection plants, physical protection level records, lists of employee positions requiring admission to the implementation of special activities and object design threats were considered and agreed in order to prevent a threat of sabotage, theft and other illegal actions of internal offenders. Admission permits were issued to 25 SNRIU inspectors

to carry out special activities.

4.3 Training of Physical Protection Experts

In connection with the liquidation in 2015 of the Sevastopol National Institute of Nuclear Energy and Industry in Ukraine, there was a need to organize training of specialists with higher education in the field of “physical protection and accounting of nuclear materials”. Due to this, upon the initiative of the Ministry of Energy and Coal Industry of Ukraine, with the involvement of representatives of the Ministry of Education and Science of Ukraine, the SNRIU, universities of Ukraine and interested organizations (Energoatom, etc.), a number of meetings were held, in which representatives of the Nuclear Security and Safeguards Department participated. As a result, it was decided to organize training of specialists in the form of master’s training within the specialty 143 Nuclear Energy at the Department of Nuclear Power Plants and Engineering Thermophysics of the Thermal Power Engineering Faculty in the Igor Sikorsky Kyiv Polytechnic Institute.

Based on positive results of expert assessment of applied documents of the Igor Sikorsky Kyiv Polytechnic Institute and inspection results, the SNRIU provided the Igor Sikorsky Kyiv Polytechnic Institute with a license for the right to perform activities on training, retraining of specialists on physical protection of nuclear facilities, nuclear materials, radioactive waste, other radiation sources for a period of five years.

4.4 Project for Improving Security of Radiation Sources

The engineering and technical means of the physical protection systems in cancer treatment centers, facilities using high-level radiation sources and radioactive waste disposal sites were modernized under the Project “Enhancing Security of Radiation Sources”. Activities were underway to eliminate drawbacks in the operation of the communication systems (data transmission lines) and to provide their operation in a testing mode. The primary inspection of physical protection systems of facilities was carried out to make decisions on modernization.

In addition, training courses were conducted to train response teams to act in case of unauthorized interference with radiation sources used in Ukraine on the basis of the Rivne Higher Vocational School of the Security Police Department of the Ministry of Internal Affairs and on the basis of the State Academy of the Ministry of Internal Affairs (Odesa).

A group of SNRIU duty officers ensured uninterrupted operation of the Central Monitoring Station to which 37 facilities are connected that use and store category I radiation sources.

According to the program to enhance security of radiation sources, the State Enterprise “UDVP Isotope” in Kyiv obtained the first special transport for transfer of high-level radiation sources, which is equipped with engineered and technical means of physical protection and monitoring of radiation source transfer. The transport monitoring station was established.

In April 2019, command and staff exercises were carried out at Zaporizhzhya NPP under the project of comprehensive training and exercise to ensure preparedness of response

forces, with the logistic support of the Defense Threat Reduction Agency of the United States Department of Defense. The exercises were aimed at mastering interaction of security and defense forces during anti-sabotage and antiterrorist response. Similar training was held at SUNPP and KhNPP in May 2019.

4.5 Detection of Radioactive Materials in Illicit Trafficking

Thirty-five information notifications on the cases of revealed illicit trafficking of radioactive materials in Ukraine were sent within the information exchange with the IAEA database on incidents and illicit trafficking of nuclear and other radioactive materials (ITDB) in 2019. There are still cases of revealing abandoned radiation sources at bankrupt enterprises or enterprises that have ceased their activities. Thus, four BGI-75 containers with Cs-137 radiation sources were revealed on the territory of the Pivnichna mine in Toretsk of the Donetsk region, which has been practically non-functioning since 2014, as it is located near the demarcation line and it has been in a closedown stage since 2017.



In September 2019, officers of the State Border Guard Service of Ukraine in the Kyiv Airport found and seized a stone weighing about eight kg in the luggage of a passenger traveling from Memmingen (Federal Republic of Germany) to Ukraine. The equivalent gamma radiation dose rate on stone surface was 1.3 $\mu\text{Sv/h}$.

In October 2019, a significant exceeding of gamma background in a separate building was recorded in the territory of Borys Sreznevsky Central Geophysical Observatory during equipment



testing. Upon examination results, two Cs-137 radiation sources were seized. The examination revealed no non-fixed contamination with radioactive substances.

The sources were seized and transferred for further storage (disposal) to the Kyiv Affiliate of Radon Ukrainian State Corporation.



On 29-30 August 2019, SNRIU representatives participated in special exercises on “Antiterrorist Operation in a Difficult Radiation Situation due to an Act of Nuclear Terrorism and Illicit Trafficking of Nuclear (Radiation) Materials” in Konotop of the Sumy region, which were organized with the assistance of the

Defense Threat Reduction Agency of the United States Department of Defense in the framework of an international technical assistance project.

As part of the improvement of regional cooperation, SNRIU experts take an active part in the events held with the support of international organization. Thus, together with representatives of the IAEA Department for Nuclear Safety, a preparatory meeting was held to implement the nuclear security response program for Georgia, the Republic of Moldova and Ukraine in combating the illicit trafficking of radioactive materials. A number of events is planned for 2020-2021.

The joint operation with a code name “Orion” was carried out with the support of European Union Border Assistance Mission to Moldova and Ukraine (EUBAM) and was aimed at countering illegal trafficking of firearm, explosives, chemical, biological and radioactive materials across the Ukraine-Moldova state border. The operation was coordinated by EUBAM in cooperation with the European Union Agency for Law Enforcement Cooperation (Europol), law enforcement agencies of Ukraine and Moldova. Border guard agencies of Slovakia, Romania and Poland including Frontex and SELEC participated in the operation.

According to EUBAM data, 300 items of small arms, about 1,500 items of light arms, more than 140,000 items of armament and more than 200 kg of explosives were retrieved during the Orion operation. The SNRIU recorded 12 cases of radioactive materials beyond regulatory control. Different types of clocks, including aviation clocks, which natural radionuclides Ra-226, where gamma radiation level exceeded legal standards, scrap metal, components of radioisotope devices for measuring soil moisture content and density VPGR-1 and PPGR-1 (equivalent dose rate on device surface was 6.8 $\mu\text{Sv}/\text{year}$) made a significant number of such items.

In addition, SNRIU employees as experts were involved by the IAEA and Interpol into measures on improving the revealing architecture in the sphere of nuclear security, arrangement of response to radioactive materials beyond regulatory control during missions

in the Republic of Kazakhstan, the Kingdom of Morocco, the Republic of Uganda, the United Republic of Tanzania.

4.6 Safe Transport of Radioactive Materials

Transport of radioactive materials is one of important individual types of activities on nuclear energy use, which is performed in all spheres of nuclear energy, industry, medicine, in radioactive waste management.

Transport of radioactive materials is carried out by public roads, so it is essential to ensure the safety of such transport. The state regulates safety of transport of radioactive materials, uses administrative and technical measures to reach this objective. The regulatory framework is developed and updated, authorizing and oversight activities are performed.

For this purpose, the activities on transport of radioactive materials are licensed. Import, export and transit of radioactive materials through the territory of Ukraine shall be provided with a permit to carry out international transport of radioactive materials. The designs of packaging and special conditions for transport of radioactive materials shall be approved.

The priorities of transport safety regulation include improvement of the regulatory framework in connection with the adoption of new IAEA standards in this area. In particular, this means harmonization of the Nuclear and Radiation Safety Rules for Transport of Radioactive Materials (PBPRM-2006) with requirement of IAEA standard “Regulations for the Safe Transport of Radioactive Material”, Specific Safety Requirements (SSR-6), IAEA, 2018”. It is also necessary to amend current regulations, which supplement the rules, in accordance with new revisions of IAEA documents.

In order to implement Council Directive 2006/117/Euratom on the Supervision and Control of Shipment of Radioactive Waste and Spent Fuel of 21 August 2019, the Cabinet of Ministers approved Resolution “On Amendments to the Procedure for Issuing Permit for the International Shipments of Radioactive Materials” No. 759. In connection with the above changes, the Procedure for Issuing Permit for the International Shipments of Radioactive Materials envisages the SNRIU to approve the form of a standard document. The development and approval of the form of a standard document is included in the Action Plan on Implementation of the Association Agreement between Ukraine and the EU approved by Resolution of the Cabinet of Ministers of Ukraine No. 1106 dated 25 October 2017.

In 2019, the SNRIU issued (amended, extended validity) of 182 permits for international transport of radioactive materials; of 10 licenses for the right to perform activities of transport of radioactive materials; of 16 certificates on approval of the package design and special transport conditions.

In addition, inspections of the Institute for Problems of Nuclear Power Plants of the National Academy of Sciences of Ukraine, Kyiv SISP, GEO-DELTA KB LLC were carried out. Moreover, the SNRIU participated in the comprehensive inspection of compliance of Kharkiv SISP with nuclear and radiation safety requirements with regard to compliance with legal requirements for transport of radioactive materials.



5. SAFE USE OF RADIATION SOURCES

5.1 Safety Regulation of Radiation Sources

Radiation sources are used in Ukraine in most sectors of economy, in particular: in medicine for the diagnosis and treatment of cancer, in agriculture for irradiation and research of cereals, in industry for X-ray analysis, radiographic and technological control, measurements (weight, quantity, density, etc.), geophysical research of wells, sterilization of products, scientific research, etc.

Each of the industries has its own characteristics of using radiation sources, requires radiation protection of personnel, the public and the environment. Radiation protection of personnel, the public and the environment in using radiation sources is a priority area of state regulation of nuclear and radiation safety.

Any activities with radiation sources are allowed, if the ability of an entity to comply with nuclear and radiation safety requirements is confirmed and safety of these radiation sources is justified.

According to the national legislation, activities with radiation sources related to the following aspects may not be allowed: use of radioactive substances in food, animal feed, beverages, cosmetics, children's toys or other products intended for human consumption; use of radiation sources for visualization of a person for the purpose of advertising or art, for the detection of theft or visualization of a person for professional, legal or insurance purposes, without the availability of medical records.

All radiation sources that are not cleared from regulatory control in the manner prescribed by law are subject to state regulation in Ukraine, as in other European and developed countries.

The state regulation system consists of three main interrelated components: regulation (establishing of safety criteria and standards), oversight and authorizing activities.

The authorizing system consists of three stages:

- 1) notification about the intent to perform activities on use of radiation sources.

Depending on potential hazard of radiation sources, physical and radiological characteristics, the SNRIU shall inform on compliance of the applied radiation source with levels for clearance from regulatory control (in case of its compliance with levels specified in Annexes 1 and 2 to Resolution of the Cabinet of Ministers of Ukraine No. 1174 of 16 November 2011) or use one of the following authorizing procedures:

2) registration of radiation sources: owner of radiation sources is exempted from the licensing procedure, but must carry out activities in compliance with regulations and rules of nuclear and radiation safety, and due to the registration, the radiation source is placed on state registration and control. In this case, the authorizing document is a registration card for a radiation source (issued based on the results of registration performed by the SNRIU). Inspections of such entities are carried out every 5-7 years.

3) licensing that is performed according to requirements of the Law of Ukraine “On Authorizing Activities in Nuclear Energy Use”. Radiation sources with high and intermediate level of potential hazard are subject to licensing.

Criteria for exempting activities of using radiation sources from licensing are approved by Resolution of the Cabinet of Ministers of Ukraine No. 1174 dated 16 November 2011: Category 5 radiation sources and other, the activity of which does not exceed 15 levels of clearance from regulatory control.

The state regulation system on nuclear energy use introduced in Ukraine complies with EU legislation and international safety standards, in particular Council Directive 2013/59/Euratom of 5 December 2013 and International Fundamental Safety Standards GSR Part 3, IAEA, 2014.

In 2019, the SNRIU performed regulatory control over activities of 4065 entities using radiation sources. In particular, this included 3531 entities involved in activities using radiation sources that are not exempt from licensing and have relevant licenses. In 2019, 241 radionuclide sources were imported to Ukraine.

The main producers and senders of radionuclide radiation sources imported to Ukraine in 2019 were enterprises of Poland, Belarus, Germany, the Netherlands, and the USA.

The direct intermediaries of radiation sources supply to Ukraine were the State Enterprise “UDVP Isotope”, Severodonetsk Research and Production Association “Impulse”, Schlumberger Services Ukraine, ShimUkraine Ltd., UKRIZOTOPSERVIS Ltd.

According to the sphere of application, the imported radiation sources are intended to be used in industry, customs and other controls (70 %), medicine and veterinary (about 30 %), etc.

837 sources (407 radionuclide sources and 430 non-radionuclide devices) were removed from register in 2019.

Improvement of radiation protection in using radiation sources in medicine

Over the last decade, medical technologies using radiation sources have been developing rapidly.

Special attention is paid to medical irradiation. Over the past ten years, the contribution of this component to the collective dose of the public has increased several times. Today, radiation sources are widely used not only in radiation therapy and X-ray diagnostics, as it was 10-15 years ago, but also in other fields of medicine. Interventional radiology, computer diagnostics and other new diagnostic, therapeutic radiation technologies have proceeded to a new stage of development.

In order to increase the level of radiation protection in medicine, the SNRIU initiated the creation of the Interdepartmental Expert Workgroup for Radiation Protection in Medicine, which included representatives of five professional medical organizations, higher educational

establishments, leading medical institutions, representatives of National Academy of Medical Sciences of Ukraine, Ministry of Health of Ukraine and scientific institutes.

In 2019, experts of the above Interdepartmental Workgroup developed and approved the following proposals to improve radiation protection in medicine:

- proposal for higher educational establishments to use “Recommendations for the Development of Master’s Programs on Medical Physics” developed by the Ukrainian Association of Medical Physicists;
- studies were conducted to establish diagnostic reference levels for computer tomography, which were organized by the S.P. Grigoriev Institute for Medical Radiology of the National Academy of Medical Sciences of Ukraine;
- medical institutions were recommended to use the methodological guide “Quality Control Program for X-ray Diagnostic Equipment in Projection X-Ray Diagnostics” developed by the S.P. Grigoriev Institute for Medical Radiology of the National Academy of Medical Sciences of Ukraine;
- criteria were developed for making decisions to terminate operation of film fluorographic X-ray machines that do not meet safety criteria. The criteria are applied in the implementation of oversight measures;
- recommendations were sent to the Ministry of Health of Ukraine, regional administrations, Kyiv City State Administration regarding termination of operation of film fluorographic X-ray machines in health care facilities of Ukraine, the technical state of which does not meet safety requirements;
- the algorithm of actions approved for the cases of receiving negative results was reflected in the Provision on Arrangement and Conduct of National TLD-Audit of Quality of Calibrating Radiation Streams of Radiotherapy Devices;
- the list of international protocols and recommendations for medical physicists in X-ray therapy developed by the Ukrainian Association of Medical Physicists was published.

More detailed information on performed activities is published on the following website: <https://www.uatom.org/>.

5.2 Improvement of Radiation Protection of the Public against Radon Exposure

According to information of leading scientists of the State Institution “O.M. Marzeev Institute of Hygiene and Medical Ecology” of the National Academy of Medical Sciences of Ukraine, more than 70 % of the total dose of the public in Ukraine are due to radon, which is accumulated in the air of houses. Radon is a radioactive gas formed by the fission of natural radionuclides of uranium series.

The problem of radon is one of the main problems in the practice of radiation protection for most countries of the world, as evidenced by the considerable attention paid to this issue by the International Commission on Radiation Protection (ICRP) and the IAEA.

In 2019, Resolution of the Cabinet of Ministers of Ukraine approved “Action Plan to Reduce Exposure of the Public by Radon and Its Fission Products, Minimize Long-Term Risks of Radon Spreading in Residential and Non-Residential Buildings, Workplaces for 2020-2024”.

According to the Plan, the implementation of tasks in the following three main areas is envisaged:

1) implementation of reference levels for radon in indoor air (300 Bq/m³) and at workplaces (1000 Bq/m³) and approval of procedures for radon measurements, algorithm for implementation of anti-radon measures and assessment of their efficiency, accreditation of institutions, which will work for separate areas, definition of people responsible for monitoring implementation of measures in state buildings and houses and control of employers regarding radon activity at workplaces;

2) improvement of the country's capacity to measure radon levels in indoor air (monitoring) and soil (anti-radon measures), development and approval of measurement protocols and building regulations, a quality system for measurements, arrangement of national databases on radon levels indoor and at workplaces, analysis of measurement results, assessment of radiation risks, mapping of territories and determination of radon hazardous territories, etc.;

3) training of radon experts and other experts, implementation of anti-radon measures and assessment of their efficiency.

Study of radon problem in Ukraine began in 1989. Currently, the experts of the above institute surveyed more than 30 thousand houses and determined radiation doses for the public. In 2010-2015, more than two thousand schools and kindergartens were surveyed. Anti-radon measures were carried out in 289 schools of standard design in Ukraine and their efficiency was assessed. On average, radon activity became half as high in these schools and kindergartens.

A systemic approach to solving this problem throughout Ukraine through the implementation of the Action Plan will systematically solve the problem of radon and reduce the risk of lung cancer and leukemia among the public of Ukraine.

5.3 Safety of Uranium Mines

In 2019, activities on mining and processing of uranium ores in Ukraine for obtaining natural uranium concentrate were performed by the State Enterprise "Eastern Mining and Enrichment Combine" (Skhid GZK). The activities on uranium ore processing with regard to their termination in the territory of the former Production Association "Prydniporvsky Chemical Plant" are performed by the State Enterprise "Barrier" (Barrier).

These enterprises are included into the list of state-owned facilities of strategic importance for the economy and security of the state approved by Resolution of the Cabinet of Ministers of Ukraine No. 83 dated 4 March 2015.

Skhid GZK includes the following main facilities, which may pose radiological impact on the public and the environment: Smolinska mine; Novokostiantynivska mine; leaching plant; Scherbakivska tailing pit (in operation); and tailing pit in the former quarry of brown iron ores (under temporary shutdown stage).

The monitoring of radiological impact of the specified facilities on the environment at industrial sites, in control areas and observation areas is performed by laboratories certified for the right to carry out measurements in the field of state metrological supervision distribution.

The data on accumulated waste of processing uranium ores in tailing pits of the leaching

plant as of 1 January 2020 are presented in the Table.

Table 1

Waste of uranium ore processing in tailing pits of the leaching plant as of 1 January 2020

Tailing pit	Design capacity, m ³	Category	Amount of accumulated waste of uranium ore processing as of 1 January 2020			
			Quantity, ×10 ⁶ t (×10 ⁶ m ³)	Activity, ×10 ¹² Bq	Nuclide composition	Capacity margin, %
Tailing pit in Scherbaki vska wash	47,3×10 ⁶ m ³	Tailing of uranium ore processing, slurry tailings, group 2 (low-level)	45922,3×10 ³ t (41,234×10 ⁶ m ³)	460,785×10 ¹² Bq	U, ²²⁶ Ra, ²³⁰ Th, ²¹⁰ Po, ²¹⁰ Pb	13 %
Tailing pit in brown iron ore quarry	12,4×10 ⁶ m ³	Tailing of uranium ore processing, slurry tailings, group 2 (low-level)	15,94×10 ⁶ t (12,4×10 ⁶ m ³)	93,3×10 ¹² Bq	U, ²²⁶ Ra, ²³⁰ Th, ²¹⁰ Po, ²¹⁰ Pb	Tailing pit at a temporary shutdown stage

Six tailing pits, three storage facilities for uranium mining waste and the most radioactively contaminated buildings and structures of the former Production Association “Prydniprovsky Chemical Plant” are on the Barrier balance. The security of these facilities is ensured by the State Enterprise “VITCh-38” (38 Department of Engineering and Technical Units).

According to license OV 001063 for conducting activities on uranium ore processing with regard to activities on reconstruction and conversion of Sukhachivske tailing pit section II, the Barrier carries out activities on the tailing pit according to the working project “Reconstruction and Conversion of Sukhachivske Tailing Pit Section II of the Dnipropetrovsk Region”.

Measures on radiation protection of personnel, the public and the environment from radiological impact of the Prydniprovsky Chemical Plant uranium facilities in 2019 were performed by the Barrier according to requirements of Part 4 of Article 16 of the Law of Ukraine “On Authorizing Activities in Nuclear Energy Use”. The technical oversight of the state of Prydniprovsky Chemical Plant uranium facilities was performed according to the approved schedule.

Within oversight activities, inspections of radiation safety and compliance with conditions of the license for conducting activities on uranium ore processing at Skhid GZK and Barrier were carried out in 2019.

Regulatory support of the National Target Environmental Program of Priority Measures for Bringing the Facilities and Site of the Former Uranium Production Association “Prydniprovsky Chemical Plant” into Safe State for 2019-2023” approved by Resolution of the Cabinet of Ministers of Ukraine No. 756 of 21 August 2019 was continuously provided.

The implementation of international technical assistance projects “Implementation of the Urgent Measures to Mitigate the Emergency Situation in the Prydniprovsky Chemical Plant in the city of Kamianske (former Dniprodzerzhynsk) in Ukraine” under support of the

European Commission and “Risk Reduction, Radioactive Contamination Control and Improvement of Environmental Monitoring System at Prydniprovsky Chemical Plant in Ukraine” under support of Norwegian Government continued in 2019.



6. NUCLEAR AND RADIATION SAFETY IN UKRAINIAN REGIONS

NORTHERN REGION

The northern region covers the territory of Kyiv, Chernihiv, Zhytomyr, Vinnytsia, Cherkasy regions and the city of Kyiv.

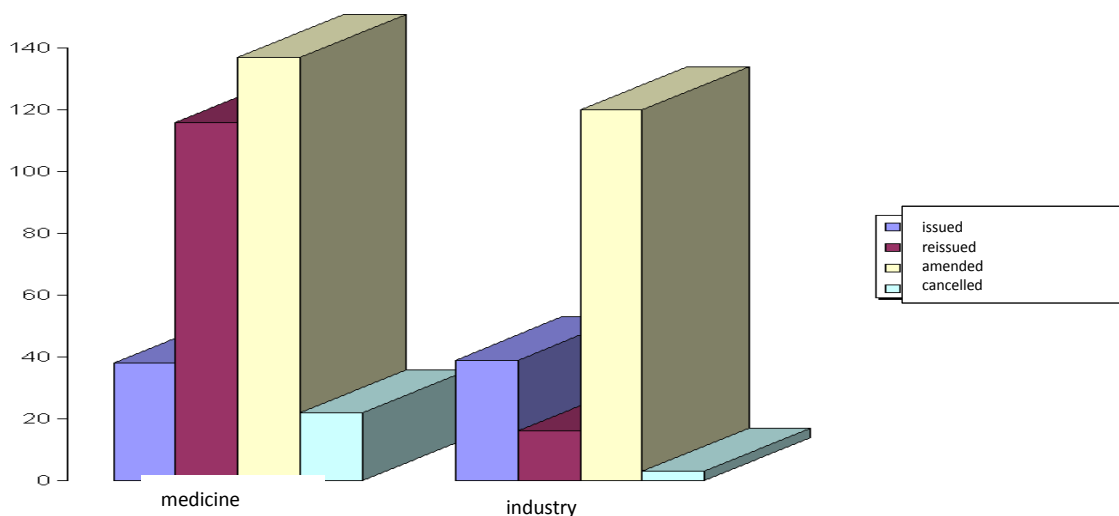
The state regulation of safe nuclear energy use in the specified territory is carried out by the Northern Nuclear and Radiation Safety Inspectorate of the SNRIU.

The radiation safety state in the Northern region is satisfactory. Constant interaction and information feedback was ensured throughout the year between the SNRIU Northern Inspectorate and the territorial bodies of the SESU in the field of emergency prevention and response to it, interactions with the regional and district state administrations in subordinate regions and the Kyiv City State Administration related to the preparations for the 7th state radioactive waste inventory.

733 entities that are licensed by the SNRIU perform activities on the use of radiation sources in the territory controlled by the Northern Inspectorate.

493 authorizing procedures were performed in 2019.

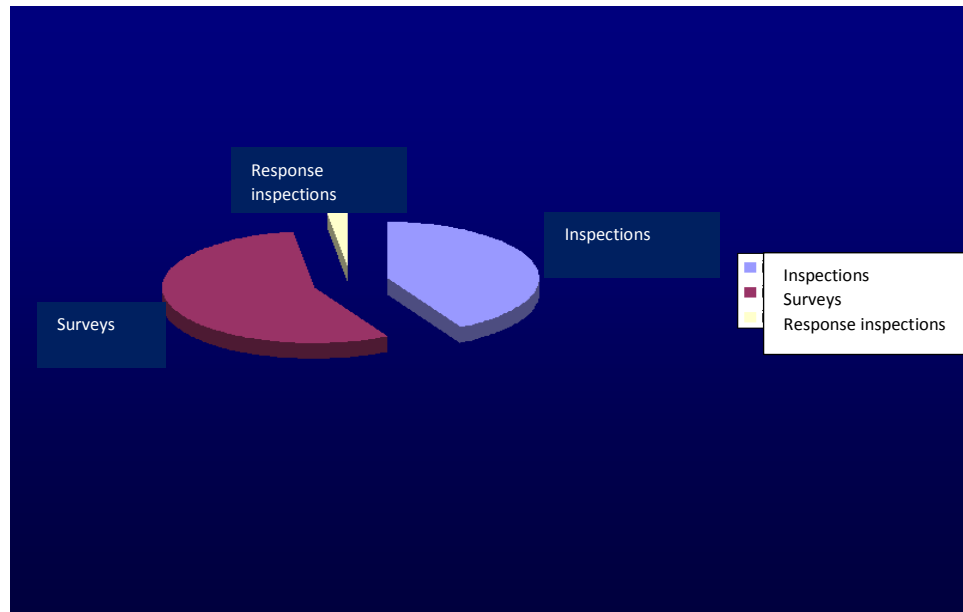
Number of issued, reissued and amended licenses in 2019.



In 2019, the Northern Inspectorate conducted 264 state oversight activities: inspections, surveys and response inspections.

111 inspection inspections, 147 inspection inspections, 6 response inspections, 4 orders were issued, 556 annual reports on safety analysis of the use of radiation sources.

111 certificates of inspections, 147 certificates of surveys, 6 certificates of response inspections were drawn up, four prescriptions were issued, and 556 annual safety analysis reports on the use of radiation sources were assessed.



Number of the state oversight measures in 2019.

102 radionuclide radiation sources and 340 non-radionuclide radiation sources were registered in the State Register of Radiation Sources in 2019. There are two nuclear entities on the controlled territory that store spent radiation sources: USIE IZOTOP State Enterprise and the Energoatom.

Six cases of detecting radiation sources in illicit trafficking were registered in 2019.



Radiation sources on the territory of the Boris Sreznevsky Central Geophysical Observatory of the Ukrainian Hydrometeorological Center at the SESU
Radiation sources revealed and seized from illicit trafficking

Watch, radium-226

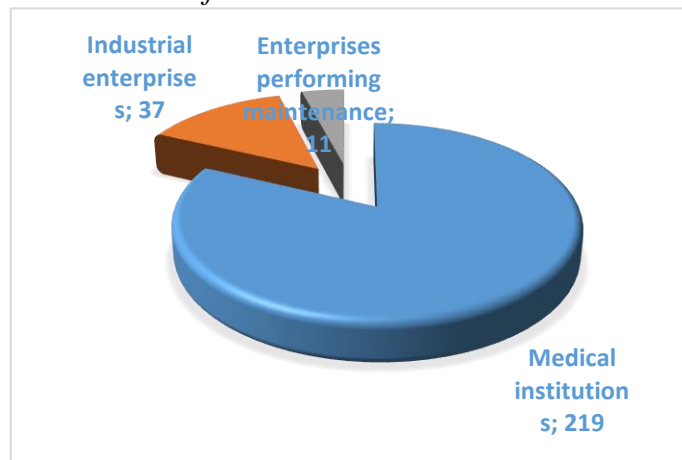
SOUTHERN REGION

The southern region of Ukraine includes the territory of the Odesa, Mykolaiv and Kherson regions.

The Southern Nuclear and Radiation Safety Inspectorate of the SNRIU performs the state regulation of the safe nuclear energy use in the specified territory.

267 enterprises, organizations and institutions conduct activities on the use of radiation sources in the southern region.

Distribution of radiation source users



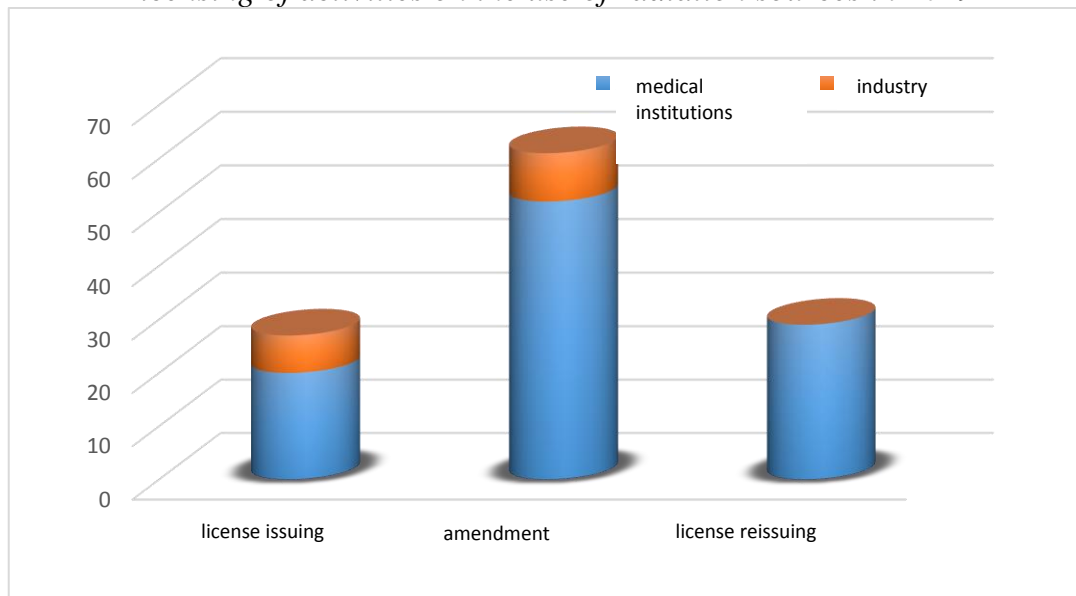
Most enterprises are located in the Odesa region.

The most radiation hazardous facilities in the Southern region are the South Ukrainian Nuclear Power Plant subjected to the Energoatom, Odesa SISP of Radon USC, the Enterprise for the Production of Medical Products of Polymer Materials PJSC Hemoplast, as well as medical oncological centers.

As of 01 January 2020, 267 enterprises, organizations and institutions have valid licenses for the right to conduct activities related to the use of radiation sources.

In 2019, the Southern Inspectorate licensed the activity on the use of radiation sources. 117 applications and document packages of the enterprises, organizations and institutions of the Southern region for the issuance (reissuance) and amendments to the licenses (Fig. 2) were considered.

Licensing of activities on the use of radiation sources in 2019



At the same time, there was a trend towards a decrease in the number of nuclear entities in the industry in 2019. During the year, three enterprises stopped their activities in using radiation sources.

In 2019, the Southern Inspectorate carried out the state oversight of compliance with the requirements of the legislation of Ukraine, the standards, rules and regulations on nuclear and radiation safety, the conditions of licenses issued in the field of nuclear energy use by enterprises, institutions and organizations of the Southern Region. Inspections and surveys of 91 enterprises, organizations and institutions were conducted, 47 of them were inspections, and 44 were pre-licensed surveys.

The most typical drawbacks in the implementation of activities related to radiation sources by medical institutions are:

- failure to provide maintenance of X-ray diagnostic equipment;
- insufficiency of individual protective means, as well as failure to control the effectiveness of individual protective means;
- failure to check X-ray diagnostic equipment for compliance with the State standards, including checking of the radiation output of X-ray equipment using direct measurements.



The main cause of these issues is the lack of funding for medical establishments at the state and local levels.

In 2019, the Southern Inspectorate took appropriate measures to influence enterprises, organizations and institutions according to the revealed facts of offenses in order to ensure the protection of personnel, the public and the environment, two officials were brought to administrative responsibility for a total amount of UAH 1,360.0.

In order to strengthen control over the use of radiation sources, prevent emergencies and their consequences, the enterprises that implemented rehabilitation (liquidation) procedures, and economically inactive enterprises with sealed radionuclide radiation sources on their balance sheets, in particular, the Black Sea Shipyard were under special control of the Southern Inspectorate. The enterprise transferred radionuclide radiation sources and nuclear materials in the form of products including depleted uranium to the specialized enterprise for radioactive waste management; the activities on the use of radiation sources were completed in full extent.

SOUTH-EASTERN REGION

The south-eastern region includes the territories of the Donetsk, Zaporizhzhya and Luhansk regions. The South-Eastern Nuclear and Radiation Safety Inspectorate of the SNRIU exercises regulatory control over the activities of 877 nuclear entities in this region.

232 licensees perform activities with radiation sources in the territory controlled by Ukrainian authorities in the south-eastern region in 2019. During the year, seven new licenses were issued, 108 licenses were reissued and amended, and four licenses were cancelled. Administrative services were provided in the amount of 119.00 thousand UAH. 54 inspections and surveys were conducted, 26 of them in the anti-terrorist operation zone, 54 reports were drawn up, prescriptions were issued to eliminate of violations of the law.

The main inconsistencies revealed during the state oversight activities were failure to provide maintenance and repair of radiation sources, as well as failure to pass testing and knowledge examination on radiation safety of personnel and officials.

It was established, based on the state oversight results, that the safety level in using radiation sources in 2019 generally improved compared to the previous year. X-ray diagnostic equipment is being modernized in medical institutions, activities are also underway to commission the first linear medical accelerator Electra Infinity in the territory of Zaporizhzhya region, and 19 state reviews on nuclear and radiation safety on the designs of new radiation sources were conducted.

The seventh state inventory of radioactive waste was conducted in the region in order to improve radiation safety; transfer of disused radiation sources to specialized enterprises for radioactive waste management was ensured, in particular, 25 radiation sources with cesium-137 radionuclide and three radiation sources with nickel-63 radionuclide with a total activity of 17.95×10^{11} Bq were seized (State Enterprise Toretskvuhillia and PJSC Severodonetsk Azot Association), G2R-RZTK radon generator (bubbler) containing radium-226 with an activity

of 7.0×10^8 Bq that has not been used after military actions in the East since 2014 was seized in the Private Foundation Metalurh Health Center and transferred for storage.

The following information entered the database of the State Register of Radiation Sources:

- 54 new radiation sources were registered (13 radionuclide sources and 41 radiation generators);
- 34 radiation generators were decommissioned;
- lifetime of 102 radionuclide sources was extended;
- regulatory control was ensured for four radionuclide sources of BGI-75A type with cesium-137 radionuclide that were revealed in illicit trafficking at the Pivnichna Mine of the State Enterprise Toretskvuhillia.

During 2019, seven radiation incidents were detected in the area of South-Eastern Inspectorate responsibility during scrap metal operations on the territory of the PJSC Azovstal Iron and Steel Works and PJSC Zaporizhstal, namely: 5 cases of supply of radioactively contaminated scrap metal to the enterprises and 2 cases of removal of process equipment fragments from the scrap metal with radium-226 radionuclide. All seized radiation hazardous installations were transferred to the Dnipropetrovsk SISF for temporary storage.

Pursuant to the Meeting Minutes of the Working Group on the analysis of challenging issues in the environmental area and search for solutions in both the controlled and non-controlled territories of the Donetsk and Luhansk regions established under the Ministry for Veterans Affairs, Temporarily Occupied Territories and Internally Displaced Persons of Ukraine, the environmental situation was monitored at nuclear entities in the territories of the Donetsk and Luhansk regions controlled by the Ukrainian authorities. In implementation of the above measures, no facts were revealed that would indicate deterioration of radiation safety state in the region resulting from the use of radiation sources.



Radiological survey of arrested cargo with scrap metal in PJSC Zaporizhstal



Radiation hazardous fragment withdrawn from scrap metal



Radiation hazardous fragments withdrawn from scrap metal



One of four suspected objects revealed at the Pivnichna Mine of the State Enterprise Toretskvuhillia

WESTERN REGION

The western region of Ukraine includes the territories of Transcarpathian, Ivano-Frankivsk, Lviv, and Chernivtsi regions.

The Western Nuclear and Radiation Safety Inspectorate exercises the authority of the SNRIU in the above-mentioned territory of the Western region.

As part of the implementation of the priority areas of the state nuclear and radiation safety regulation in Ukraine in 2019, the Western Inspectorate performed the following:

- 610 input documents were addressed;
- 962 output documents were developed most of which are correspondence with licensees;

- 122 applications for issuing, re-issuing and amending licenses for the implementation of activities on the use of radiation sources were considered;

- 77 inspections were conducted including 45 scheduled inspections and 32 surveys.

The electronic document management system of the SNRIU is used in full extent.

State inspectors drafted 13 protocols on administrative offenses during the reporting period; 13 decisions on imposing an administrative penalty (fine) were issued according to the protocols. The main offenses in using radiation sources is the failure to comply with the general radiation safety rules in the use of radiation sources in medicine. According to the inspection results, 58 instructions were issued to the heads of institutions, 32 of which were completed, and 26 are under the implementation (the deadline established in the prescription was not exhausted).

193 annual reports on radiation safety were reviewed.

In 2019, three cases of detection of radioactive materials in illicit trafficking were registered in the territory under control when citizens crossed the state border of Ukraine. The seized radioactive materials were transferred for long-term storage to Radon USC.



Radioactive material revealed in illicit trafficking at the Maly Berezny checkpoint in Transcarpathian region



Mitigation of a radiation accident with IBN-8-5 (Pu-Be) radiation sources in well No. 73 of Zaluzhansky gas condensate field at LvivGasVydobuvannya Gas Production Division

During the reporting period, one case of a loss of radiation sources was recorded during the logging by PJSC Carpathian Geophysical Exploration Department in the Lviv region, there was a breakdown of the equipment in the well that caused loss of control over radiation source IBN-8-5 No. 386 (Pu-Be). The regulatory control over the source was renewed as a result of the implementation of the emergency plan.

Seven state nuclear and radiation safety reviews of projects for radiation sources were performed; most of them were developed to modernize existing rooms for equipping interventional cardiology departments with the installation of up-to-date angiographs.

The Western Inspectorate periodically conducts the information and educational events for students of Ivano-Frankivsk and other educational institutions in order to ensure openness and accessibility of information on the radiation safety situation and improve safety culture in the region.

In the Western region, there are no nuclear entities, which store disused radiation sources beyond the period established by special license conditions (more than 6 months). In case of the need to use radionuclide radiation sources further, their design service life is extended by

licensing organizations upon leak test results. 19 radionuclide radiation sources were transferred to Radon USC for long-term storage in 2019.

In 2019, the information on service life extension for 112 radionuclide radiation sources was included into the database of the radiation source register, 16 radionuclide radiation sources and 196 radiation generators were registered.

CENTRAL REGION

The central region includes two administrative and territorial units of Ukraine: Dnipropetrovsk and Kirovohrad regions.

The Central Nuclear and Radiation Safety Inspectorate of the SNRIU ensures state regulation of safe nuclear energy use in the specified territory.

269 entities licensed for activities on the use of radiation sources (64 entities in industry, 205 entities in medicine and 24 entities performing activities related to the maintenance of radiation sources) conduct the activities on the use of radiation sources in the territory of the central region.

During 2019, 48 inspections and surveys were conducted upon whose results the following was issued: 29 certificates of scheduled inspections, 23 of them have prescriptions; 19 certificates of inspection, two of them have prescriptions. Nine protocols on administrative offense were drawn up.

During 2019, 108 authorizing procedures were performed, of which: 16 licenses issued for the use of radiation sources (6 in industry, 10 in medicine), 46 licenses were reissued (3 in industry, 43 in medicine); 46 licenses were amended (9 in industry, 37 in medicine), one license (in medicine) was canceled.

In 2019, 12 state reviews on nuclear and radiation safety of the radiation source designs were conducted, nine of them are for medical establishments and tree of them are for industrial enterprises.

During 2019, 168 radiation sources obtained or operated, stored at facilities of the Dnipropetrovsk and Kirovohrad regions were additionally registered in the Register Automated System.

The number of registered radiation sources in the central region of Ukraine

Registered	Dnipropetrovsk region		Kirovohrad region	
	Registered in total	Registered in 2019	Registered in total	Registered in 2019
Total number of radiation sources	2513	158	373	10
Radionuclide	1173	14	38	-
Generating devices	1340	144	335	10

In 2019, Dnipropetrovsk SISP conducted the screening analysis of environment

contamination in the areas under the impact of the enterprise.

The results of radiometric observations on radionuclide content in soil, air, water and vegetation in the control area and observation area do not show increasing trends and have no noticeable differences from the background values typical for this area. Index fluctuations are not beyond the statistical limits typical for accumulated set of values.

The concentration of man-made nuclide cesium-137 in soil samples of RWDS, control and observation areas are not beyond the values typical for this territory due to global fallout. Man-made radionuclides in the air, water and vegetation of the control and observation areas were not detected at the sensitivity level of available measuring tools. Radionuclides resulting from RWDS process activities were not detected in air fallout indexes.

The Dnipropetrovsk SISP received equipment for the automated environmental monitoring system at RWDS in the framework of international assistance. This system automatically measures gamma-radiation dose rate on the perimeter of the conditionally “contaminated” area and measures aerosols in the air of the conditionally “contaminated” area in alpha- and beta-channels in real time. The system also includes an automatic meteorological station. The system is currently in trial operation. The cases of radiation incidents were recorded in the territory of the central region in 2019:

Preparation of seized fragments of contaminated scrap metal for transfer to Dnipropetrovsk SISP



PJSC 'ArselorMittal Kryvyi Rih' revealed by means of the Kordon automated control the fragments of pipes (30 units) with a total weight of 1180 kg contaminated with radium-226 radionuclide with a total estimated activity of $1,71 \times 10^9$ Bq. The pipes withdrawn from the railway car were transported to RWDS of Dnepropetrovsk SISP for long-term storage.

A car with a cargo was detained at the exit from the territory of the Prydniprovskiy Chemical Plant, the maximum EDR of γ - radiation at a distance of 0.1 m from cargo surface was $3.40 \mu\text{Sv/h}$. The cargo consignor and consignee is Megalom LLC. The car with the cargo was sent to the loading place (building No. 95) for unloading.

PJSC ArcelorMittal Kryvyi Rih revealed IGI-Ts3 industrial γ - radiation source with the design activity of 8.0×10^7 Bq by the Kordon automated control system. The cargo consignor was UkrMetAlliance LLC. The cesium-137 radionuclide ampoule withdrawn from scrap metal was transferred to the Dnipropetrovsk SISP for storage.



*Cesium-137
radiation source
withdrawn from
railway car with
scrap metal*

The automated radiation monitoring system at metallurgical enterprises is an important component of the *national system for preventing, detecting and responding to orphan radioactive sources in scrap metal, minimizing the risk of any threat scenario and reducing the country's losses.*

NORTH-WESTERN REGION

The North-Western region covers four administrative and territorial units of Ukraine: the Volyn, Rivne, Ternopil and Khmelnytsky regions.

The state regulation of nuclear energy use safety and state oversight of compliance with regulations, rules and standards on nuclear and radiation safety in the territory of the region is performed by the North-Western Nuclear and Radiation Safety Inspectorate of the SNRIU.

394 entities with different ownership forms carry out activities on using radiation sources in the territory of the region.

The specific feature of the North-Western region is the use of the vast majority of radiation sources in medicine: X-ray and radionuclide diagnostics, X-ray therapy. Non-medical industrial enterprises and facilities make only about **10%** of the total number of economic entities.

At the same time, such radiation hazardous objects as Rivne Nuclear Power Plant of Energoatom, Khmelnytsky Nuclear Power Plant of Energoatom, four regional medical oncology centers are located in the territory of the North-Western region.

The reform of the medical sector in Ukraine promotes the introduction of the latest modern technologies in medical institutions in the region. In particular, the number of interventional radiological equipment and angiographic systems has increased.

In 2019, five economic entities of the North-Western region purchased angiographic equipment. Projects on reconstruction of the premises for placement of these equipment have

passed the state review of nuclear and radiation safety and received positive conclusions based on its results.

According to the authorizing principle of conducting activities on nuclear energy use, as of 31 December 2019, 236 economic entities of the North-Western region carried out activities on using radiation sources on the basis of existing licenses.

During 2019, the North-Western Inspectorate of the SNRIU reviewed 149 applications for issuing (reissuing) and amending of licenses and sets of documents attached to them.



In 2019, the North-Western Inspectorate of the SNRIU continued state oversight of compliance of North-Western region economic entities with legal requirements of Ukraine, regulations and rules on nuclear and radiation safety, as well as conditions of licenses for the right to perform activities on using radiation sources. **80** oversight measures were performed at facilities using radiation sources of economic entities: **44** inspections, **36** examinations. 80 certificates were drawn up and 49 prescriptions were submitted on the elimination of revealed drawbacks and inconsistencies.

In order to ensure the registration of radiation sources in 2019, registration data on 105 items of new radiation sources (52 generating devices, 53 radionuclide radiation sources) and on 16 items of radiation sources (generating devices) after change of owner were included into the database of the North-Western region of the State Register of Radiation Sources. 12 items of radionuclide sources transferred for storage to the Radon Ukrainian State Corporation and 56 items of decommissioned generating devices were removed from the register.

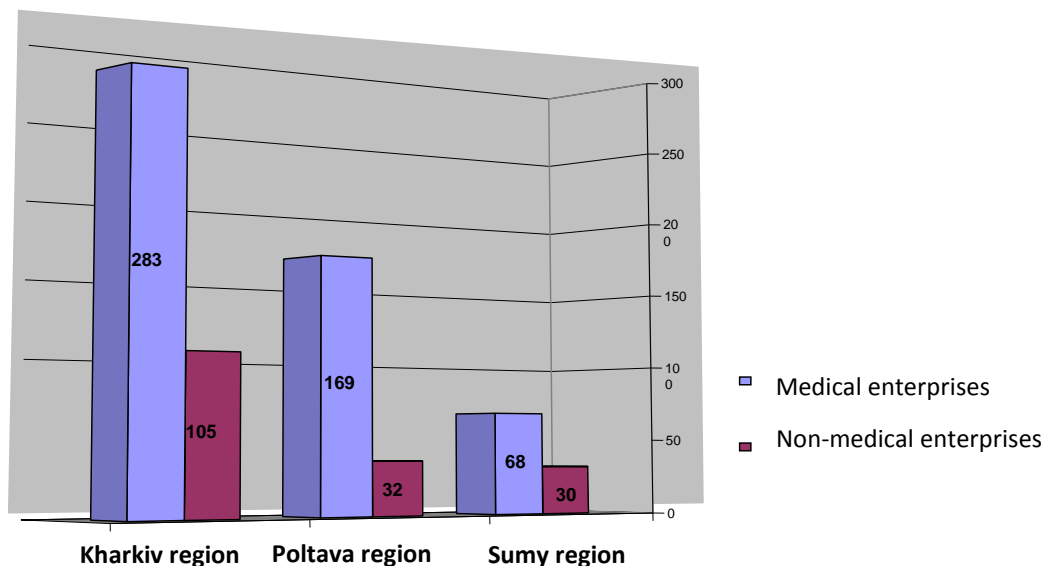
EASTERN REGION

The Eastern region of Ukraine covers the territories of the Kharkiv, Poltava and Sumy regions.

The state regulation of nuclear energy use safety in the specified territory is performed by the Eastern Nuclear and Radiation Safety Inspectorate of the SNRIU.

687 enterprises, organizations and establishments, including 520 medical institutions using radiation sources in X-ray therapy, X-ray and radionuclide diagnostics, and 167 non-medical enterprises, organizations and establishments perform activities on using radiation sources in the territory of the Eastern region.

Distribution of nuclear entities in the territory of Kharkiv, Poltava and Sumy regions



Most enterprises are concentrated in the Kharkiv region.

The most radiation hazardous objects of the Eastern region include the National Science Center “Kharkiv Institute of Physics and Technology”, State Specialized Enterprise “Kharkiv State Interregional Special Plant”, V.N. Karazin Kharkiv National University, National Scientific Center “Institute of Metrology”, Poltava Mining and Enrichment Plant, Sumy Machine-Building Science and Production Association, State Enterprise “S.P. Grigoriev Institute for Medical Radiology of the National Academy of Medical Sciences of Ukraine”, Regional Oncology Center, Poltava Regional Clinical Cancer Center, Sumy Regional Clinical Cancer Center.

As of 1 January 2020, 417 enterprises, organizations and establishments in the Eastern region have valid licenses for the right to perform activities on using radiation sources.

In 2019, 13 licenses were issued, 18 licenses were reissued, 48 licenses were amended, 124 licenses were reissued and amended, 8 licenses were cancelled.

During 2019, the Inspectorate performed current analysis of radiation safety of enterprises, organizations and establishments of the Eastern region according to reporting documents submitted by the licensees.

According to analysis results, it was stated that required level of radiation safety in performing activities with radiation sources was in general ensured in 2019. No radiological accidents and incidents with radiation sources occurred in the reporting period.

During 2019, the Eastern Inspectorate performed state oversight of compliance of enterprises, establishments and organizations of the Eastern region with legal requirements of

Ukraine, regulation, rules and standards on nuclear and radiation safety, conditions of issued licenses on nuclear energy use. 124 enterprises, organizations and establishments were subject to inspections (61) and examinations (63 prelicensing examinations).

The state of radiation safety in the Eastern region caused by the presence of enterprises, organizations and establishments that use radiation hazardous technologies and substances, their impact on service personnel, the public and the environment is satisfactory.



7. INTERNATIONAL ACTIVITIES

SNRIU international cooperation is an integral part of the development of the national system of nuclear and radiation safety regulation and is aimed at reaching world standards of ensuring nuclear and radiation safety in Ukraine.

Multilateral conventional mechanisms and instruments joined by Ukraine including the membership in international organizations and associations occupy an important place among the various areas of international cooperation.

The SNRIU also ensures implementation of a number of intergovernmental and interagency international agreements in nuclear and radiation safety regulation both with leading countries, which operate nuclear power plants and with countries that only launch implementation of nuclear power programs. During many years of the Ukrainian regulatory authority activities, stable partnership with the regulatory authorities of the United States of America, Sweden, Norway, Germany, Hungary and other countries was established.

7.1. Cooperation with European Institutions

With signing the Association Agreement in 2014, cooperation with the EU and its authorities and institutions has become a priority in the SNRIU international activities. During 2019, the implementation of two projects of the **European Commission** under the INSC (Instrument for Nuclear Safety Cooperation) Program was continued:

- Safety Radioactive Waste Management at Vektor Industrial Site in the Chornobyl Exclusion Zone, Support for Licensing of New Nuclear Subcritical Facility – Neutron Source Based on Electron Accelerator-Driven Subcritical Assembly, and Oversight and Assessment of Nuclear and Radiation Safety in Terms of the Licensee Management System and Human Factor (U3.01/12 (UK/TS/48-50));
- Strengthening the State Nuclear Regulatory Inspectorate of Ukraine Capabilities for Regulation of Nuclear Activities, Nuclear Installation Licensing and Severe Accident Analysis (U3.01/14-15 (UK/TS/51-57)).

In 2019, the implementation of a new project of the European Commission INSC U3.01/18 “Support of Ukrainian Regulatory Authority” (UK/TS/58 Component H) has started. This Project is aimed at the development of a strategy on completing regulatory framework, capacity building and resource planning of the SNRIU, implementation the HERCA-WENRA approach to improve interstate coordination of protective actions during

nuclear accidents, support of the regulatory activities during nuclear accidents, support of the regulatory activities for radioactive waste management, decommissioning, remediation and support in licensing of diversified nuclear fuel supplies for Ukrainian NPPs.

In 2019, the SNRIU experts took active part in the implementation of the EU Project for the Republic of Belarus in providing support and assistance in strengthening the capabilities of the Belarusian regulatory authority in licensing and oversight in the construction of a nuclear power plant.

In 2019, the SNRIU continued active cooperation with the **Western European Nuclear Regulators Association (WENRA)**; the nuclear regulator became a full WENRA member on 26 March 2015. The activities were underway in three WENRA working groups: Reactor Harmonization Working Group on Waste and Decommissioning (WGWD), Working Group Waste and Decommissioning (WGWD), Working Group on the Development of Safety Reference Levels for Research Reactors (WGRR).

In 2019, with regard to the participation in the first topical review on “ageing management” held under the auspices of the **European Nuclear Safety Regulators Group (ENSREG)**, the SNRIU together with Energoatom and Nuclear Research Institute of the National Academy of Sciences of Ukraine developed and approved the National Action Plan on Ageing Management according to ENSREG recommendations.

During the year, the two **Grant Agreements with the European Bank for Reconstruction and Development (EBRD)** were implemented: Grant Agreement (Chornobyl NPP Nuclear Safety Project) between the European Bank for Reconstruction and



Development (as Grant Manager of the Nuclear Safety Account), Cabinet of Ministers of Ukraine and the State Nuclear Regulatory Inspectorate of Ukraine (as the Recipient), which was signed on 8 July 2009 and ratified by the Law of Ukraine No. 1813-VI dated 20 January 2010, and Grant Agreement

“Chornobyl Shelter Fund: Licensing Consultant”, which was signed on 11 May 1998 between the EBRD as the Administrator of Grant Funds provided from the Chornobyl Shelter Fund and the Nuclear Regulatory Administration of the Ministry of Environmental Protection and Nuclear Safety of Ukraine.

7.2. Compliance with Obligations under International Conventions

In 2019, the eighth review cycle within the **Convention on Nuclear Safety** started. SNRIU Board approved and submitted the Eighth National Report of Ukraine on compliance with the obligations of the Convention on Nuclear Safety to the Convention Secretariat in August 2019.

7.3. Participation in Programs and Projects of the International Atomic Energy Agency

The implementation of four national projects within the **IAEA** Technical Cooperation Program for 2018 – 2019 continued in 2019.

On 18 – 21 March 2019, the IAEA mission visited Ukraine to update the Ukrainian Integrated Nuclear Security Support Plan (INSSP) for 2019 – 2021.

On 4 – 6 June 2019, IAEA expert mission “Approaches to Independent Neutronic Calculations Used for Technical Assessment of Safety Justification Documents for Mixed Core” worked in the SNRIU and SSTC NRS. According to IAEA expert mission results, the report was developed to present calculations used for technical assessment of safety justification documents for mixed core operation with regard to the implementation of alternative supplier’s fuel to Ukrainian NPPs, as well as to provide recommendations for improvement.

In November – December 2019, the SNRIU hosted three groups of representatives of the Kyrgyz Republic with the scientific visit. The internships was supported by the IAEA to share Ukrainian national experience in the establishment and operation of a nuclear and radiation safety regulatory authority according to the IAEA standards.

In 2019, Ukrainian experts made a significant contribution into the improvement of IAEA safety standards through the active work in the Nuclear Safety Standards Committee (NUSSC), Radiation Safety Standards Committee (RASSC), Waste Safety Standards Committee (WASSC) and Nuclear Security Guidance Committee (NSGC).

During the year, the SNRIU ensured active interaction and information exchange with the IAEA Illicit Trafficking Database (ITDB).

On 17 – 20 June 2019, 26th Annual Meeting of the Forum of Nuclear Safety Authorities of the Countries Operating VVER Type Reactors (**VVER Forum**) took place in Pravets (Bulgaria). The heads of the regulatory authorities presented the national reports on the development of the regulatory infrastructure and urgent nuclear and radiation safety issues for the period since the previous meeting of VVER Forum during the event. VVER Forum working groups reported on the activities performed in 2018 – 2019.



7.4. Bilateral Cooperation Programs

In 2019, the SNRIU together with the SSTC NRS and the **Norwegian Radiation and Nuclear Safety Authority (DSA)** implemented six cooperation projects.

During 2019, the SNRIU actively cooperated in the field of nuclear and radiation safety with the **Swedish Radiation Safety Authority (SSM)** under the Agreement between the State Nuclear Regulatory Inspectorate of Ukraine and the Swedish Radiation Safety Authority on Cooperation in the Field of Nuclear and Radiation Safety.

The following projects were implemented:

- Information Support to the State Nuclear Regulatory Inspectorate of Ukraine, Development and Filling of the Independent Web Resource on Nuclear Safety, Radiation Protection and Nuclear Nonproliferation – www.Uatom.org.
- Upgrade of Applied Software for the Information System of the State Register of Radiation Sources.
- Technical Support to the SNRIU in keeping the Database on Nuclear Material Accounting (STAR).

With the support of the Swedish Radiation Safety Authority, antivirus software was purchased for 2020 – 2021, SNRIU experts participated in trainings and workshops on the implementation of safeguards, the new cooperation project “Information Support of SNRIU Authorizing and Oversight Activities” was initiated.

Within the 63rd session of the IAEA General Conference, which took place on 16 – 20 September 2019 in Vienna (Austria), SNRIU Chairman Hryhorii Plachkov met Nina Cromnier, Head of the Swedish Radiation Safety Authority to discuss bilateral cooperation

between Ukraine and Sweden on radiation safety. SNRIU Chairman thanked Swedish counterparts for the fruitful cooperation and support provided for the development of nuclear regulation system in Ukraine and invited Nina Crommier to visit Ukraine in 2020 to familiarize with the results of bilateral cooperation and nuclear infrastructure objects of Ukraine.



In 2019, the SNRIU actively cooperated with the **United States of America**. On 14 March 2019, Hryhorii Plachkov, SNRIU Chairman and Kristine Svinicki signed the Memorandum of Meeting between the State Nuclear Regulatory Inspectorate of Ukraine and the United States **Nuclear Regulatory Commission**, which defines areas of bilateral cooperation for 2019-2020.

In cooperation with U.S. Nuclear Regulatory Commission, the CAMP and CSARP agreements on computer codes were implemented. On 4 June 2019, the

SNRIU and U.S. NRC signed the Executive Agreement on the Participation in the Program of Analysis and Support of Computer Codes in Radiation Protection.

In 2019, the projects of cooperation with the **U.S. Department of Energy** were initiated: “Cybersecurity Improvement at the State Nuclear Regulatory Inspectorate of Ukraine” and “Combating Illegal Use and Illicit Trafficking of Radioactive Material in the Eastern Region of Ukraine. Task 1. Extraordinary Inventory of Radioactive Material (INVENTORY)”.

In 2019, the cooperation with the **U.S. Department of Energy** continued under the Executive Agreement between the State Nuclear Regulatory Committee of Ukraine and the U.S. Department of Energy on Cooperation to Improve the Safety of Radiation Sources Used in Ukraine since 23 June 2006. The implementation of the Project “Improvement of Security of Radiation Sources Used in Ukraine” was ensured, the objective of which is to enhance capabilities of Ukraine to prevent unauthorized use of radiation sources, which can pose threat to the public in case of their use for malicious purposes.



On 17 – 20 February 2019, the information workshop for Hungarian experts on the state licensing practice and trial operation of Westinghouse fuel assemblies at Ukrainian NPP units was held in Budapest (Hungary) within the bilateral cooperation with the **Hungarian Atomic Energy Authority**. The workshop objective was to share experience of state regulatory authorities for nuclear and radiation safety on the organization and implementation (licensing) of new nuclear fuel modifications and/or nuclear fuel of another producer for nuclear plants.

Within the 63rd Annual Regular Session of the IAEA General Conference, which was held from 16 to 20 September 2019 in Vienna (Austria), Hryhorii Plachkov, SNRIU Chairman, held a bilateral meeting with Gyula Fichtinger, Head of the Hungarian Atomic Energy Authority. During the meeting, they discussed the diversification of fuel supplies to Ukrainian and Hungarian NPPs, experience of Hungary in using ASME standards, promising issues of the implementation of risk-informed approaches to NPP scheduled outages. The heads of Ukrainian and Hungarian regulatory authorities agreed to carry out regular bilateral meeting in Ukraine in 2020 with the involvement of technical experts to discuss issues of mutual interest.

List of Abbreviations

C(I)SIP	–	Comprehensive (Integrated) Safety Improvement Program for Nuclear Power Plants
ChNPP	–	Chornobyl Nuclear Power Plant
CRME	–	Centralized Radioactive Waste Management Enterprise
CSFSF	–	Centralized Spent Fuel Storage Facility
IAEA	–	International Atomic Energy Agency
ICSRM	–	Industrial Complex for Solid Radioactive Waste Management
INES	–	International Nuclear and Radiological Event Scale
ISF	–	Interim Spent Fuel Storage Facility
KhNPP	–	Khmelnitsky Nuclear Power Plant
LRTP	–	Liquid Radioactive Waste Treatment Plant
NPP	–	Nuclear Power Plant
NRS	–	Nuclear and Radiation Safety
NSC	–	New Safe Confinement
Radwaste	–	Radioactive Waste
RNPP	–	Rivne Nuclear Power Plant
RWDS	–	Radioactive Waste Disposal Site
SISP	–	State Interregional Specialized Plant
SP	–	Startup Package
SUNPP	–	South Ukraine Nuclear Power Plant
WWER	–	Water-Cooled Water-Moderated Power Reactor
ZNPP	–	Zaporizhzhya Nuclear Power Plant