REPORT ON NUCLEAR AND RADIATION SAFETY IN UKRAINE FOR 2015

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The SNRIU wants to express gratitude for the assistance in preparing the Report on Nuclear and Radiation Safety in Ukraine for 2015 to the *Energoatom* Company, Zaporizhzhya NPP, State Agency for Exclusion Zone Management, and O. Kosharna, Deputy Head of SNRIU Public Council.

Dear Readers!

European standards, requirements and values are the priorities for each economy sector of Ukraine. They identify the main activities of state authorities, including nuclear and radiation safety area. The year of 2015 was full of events that will not only affect nuclear and radiation safety in our country in the coming years, but will also have long-term consequences.

In connection with the signing of the EU-Ukraine Association Agreement, efforts on the adaptation of Ukrainian nuclear laws to EU legislation were intensified. The SNRIU developed and, at the beginning of 2015, the Government of Ukraine approved plans for the implementation of EU nuclear and radiation safety laws: Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure, Council Directive 2006/117/Euratom on the supervision and control over shipments of radioactive waste and spent nuclear fuel and Council Directive 2014/87/Euratom establishing a Community framework for nuclear safety of nuclear facilities.

The main step for Ukraine's transfer to EU standards in the regulation of nuclear and radiation safety was made on 26 March 2015 when the State Nuclear Regulatory Inspectorate of Ukraine became a full member of the Western European Nuclear Regulators' Association (WENRA). The participation in WENRA allows Ukraine to improve national legislation on nuclear and radiation safety in accordance with EU standards (WENRA reference levels) and to participate in their development. Ukraine has become the only state that is not an EU member, except for non-aligned Switzerland, which came into full membership of this Association.

In 2015, activities were underway to improve the authorizing procedures and bring them into compliance with adopted laws of Ukraine taking into account international documents and best practices of other countries. A number of draft laws have been developed with the aim of decreasing the regulatory pressure and eliminating the problems that occurred in the deregulation process that ignored the issues of nuclear industry.

Regulatory support of efforts on improving the operational safety of Ukrainian NPPs, long-term operation of SUNPP unit 2, ZNPP units 1 and 2 and RNPP unit 3 was rendered in 2015, as was envisaged by the Comprehensive (Integrated) Safety Improvement Program to ensure the energy safety.

Regulatory support to the diversification of nuclear fuel supplies for Ukrainian NPPs remains a strategic task. In 2015, the SNRIU reviewed a number of the operator's documents that justify extension of trial operation of Westinghouse nuclear fuel to other Ukrainian NPPs. This decision should be followed by positive results of fuel operation and inspection during the scheduled outage at SUNPP-3 in 2016.

One of the largest projects supported by the SNRIU has approached the final stage, namely the construction of the New Safe Confinement (NSC) above the destroyed ChNPP-4 and its transformation into an environmentally safe system. An important stage of the NSC project was to connect the Western and Eastern parts of the arch, which was completed in July 2015. The NSC is to be put into the design position in November 2016. The construction of the Dry Interim Spent Fuel Storage Facility is underway in the ChNPP Exclusion Zone, and shall be completed at the end of 2016. Activities related to the Centralized Spent Fuel Storage Facility to ensure storage of spent nuclear fuel of Ukrainian NPPs were boosted.

Taking into account the ongoing military actions in Eastern Ukraine, the SNRIU together with relevant ministries and institutions continued efforts on improving physical protection of nuclear facilities. The existing state security institutions are able to ensure NPP

protection against external threats, such as military aggression, sabotages, terroristic acts and criminal assaults. A number of exercises were held at all NPPs in 2015 to train the sequence of actions in case of sabotage in different situations. All special-purpose units at NPPs were involved with relevant rotation into anti-terroristic operations to gain combat experience during the missions. Documents on security of the most important facilities were revised and improved at all Ukrainian NPPs.

Unfortunately, loss of regulatory control in some areas of Donets'k and Luhans'k regions with military actions ongoing led to a situation where radiation sources pose threat to human health and life. The SNRIU does not have reliable information on radiation safety of enterprises located there, which use radiation sources in their production processes.

The SNRIU developed measures to improve monitoring over transfer of radiation sources and radioactive waste from territories beyond the control. This will reduce the threat of their illicit trafficking. For the emergencies affecting the public, we implemented mutual information exchange between the South-Eastern Regional Inspectorate and Regional State Administrations of Donets'k, Luhans'k and Zaporizhzhya regions.

We plan to appeal to Western partners with a proposal to implement the project "Countering Illicit Use and Trafficking of Radioactive Materials in Eastern Ukraine in the Area of Anti-Terroristic Operations" within the Initiative "Global Partnership against the Spread of Weapons and Materials of Mass Destruction" after completion of anti-terroristic operations in separate areas of Donets'k and Luhans'k regions.

I believe that in 2016 the SNRIU will continue establishing the all-European security system, ensuring regulatory support of projects aimed at improving energy independence of Ukraine, will successfully overcome challenges and threats arising in the use of nuclear technologies and will further be a reliable guarantor of nuclear and radiation safety in Ukraine.

Sincerely Yours

Chairman

State Nuclear Regulatory
Inspectorate of Ukraine **Serhii Bozhko**

2. YEAR 2015 IN DETAILS

Date	Month/Event
	January
26-27	International Round Table on the Emergency Preparedness and Response in Nuclear Sphere arranged by the SNRIU together with the All-Ukrainian Environmental Public Organization "MAMA-86" under the auspices of the European Public Network *Nuclear Transparency Watch* with support of the Swedish International Development Cooperation Agency.
28	Provision on the List of Documents to be Submitted by the Operator to Get a License for Taking Activities on a Certain Lifecycle Stage of Nuclear Facility approved by SNRIU Order No. 12 registered in the Ministry of Justice of Ukraine under No. 152/26597 dated 12 February 2015.
	February
18	Plans on Implementation of Some EU Regulatory Documents developed by the SNRIU were approved by the Ordinance of the Cabinet of Ministers of Ukraine No. 110-r.
	March
24	Concept for Regulation of Nuclear and Radiation Safety of Nuclear Facility put into force by SNRIU Order No. 52
26	Regulatory document of WENRA signed by Ukraine and WENRA member states and SNRIU entry into WENRA full membership
31	ChNPP issued individual permit OD No. 000040/8 to perform activities on the stage of final closure and temporary shutdown of ChNPP-1,2,3
	April
16	Forms of Registration Cards for Radiation Sources approved by SNRIU Order No. 69 registered in the Ministry of Justice of Ukraine under No. 716/27161 dated 18 June 2015
16	Procedure for Using the State Register of Radiation Sources approved by SNRIU Order No. 70 registered in the Ministry of Justice of Ukraine under No. 717/27162 dated 18 June 2015
17	General Requirements for Long-Term Operation of NPPs Based on Periodical Safety Review Results as amended by SNRIU Order No. 71 registered in the Ministry of Justice of Ukraine under No. 504/26949 dated 07 May 2015
	May
14	Requirements for Operator's Activity Management System as amended by SNRIU Order No. 90 registered in the Ministry of Justice of Ukraine under No. 781/27226 dated 03 July 2015
20	SNRIU Access Control Rules approved by SNRIU Order No. 668/27113 registered in the Ministry of Justice of Ukraine under No. 668/27113 dated 05 June 2015
27	Safety Requirements and Conditions (Licensing Conditions) for Uranium Ore Processing Activities approved by SNRIU Order No. 101 registered in the Ministry of Justice of Ukraine under No. 700/27145 dated 12 June 2015
11-22	National Report of Ukraine presented during the Fifth Meeting of the Parties on Compliance with Obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

	June
8	Order of the Ministry of Environmental Protection and Nuclear Safety of Ukraine and the Ministry of Industrial Policy of Ukraine No. 17/21 dated 18 January 2000 became ineffective by joint Order of the SNRIU and the Ministry of Economic Development and Trade of Ukraine No. 110/580 registered in the Ministry of Justice of Ukraine under No. 718/27163 dated 18 June 2015
15	Order of the Ministry of Environmental Protection and Nuclear Safety and the Ministry of Health of Ukraine No. 15/7 dated 18 January 2000 became ineffective by joint Order of the SNRIU and the Ministry of Health of Ukraine No. 111/337 registered in the Ministry of Justice of Ukraine under No. 719/27164 dated 18 June 2015
16	Reissued license No. OV 000932 for State Enterprise "Eastern Ore Mining and Enrichment Plant" for uranium ore processing activities
17	Commission on Harmonization of National Standards and Nuclear and Radiation Safety Rules of Ukraine with WENRA Reference Levels approved by SNRIU Order No. 115
	July
1	Opening of the Central Analytical Laboratory of the Measuring Center of Radiation and Environmental Monitoring and Dosimetric Control *Ecocenter*, ChNPP Specialized Plant
22	Nuclear and Radiation Safety Requirements for Instrumentation and Control Systems Important to NPP Safety approved by SNRIU Order No. 140 registered in the Ministry of Justice of Ukraine No. 954/27399 dated 06 August 2015
24	Successfully completed activities on the connection of Western and Eastern parts of the New Safe Confinement (the Shelter)
24	State Specialized Enterprise for Exclusion Zone Capital Construction Management completed activities on the construction and mounting of systems and equipment of the Centralized Long-Term Storage Facility for Spent Radiation Sources
	August
13	Safety Requirements and Conditions (Licensing Conditions) for Production of Radiation Sources are approved by SNRIU Order No. 148 registered in the Ministry of Justice of Ukraine under No. 1054/27499 dated 03 September 2015
19	Dnipropetrovsk SISP, amended license OV No. 000948 dated 26 January 2011 for radwaste processing and storage according to which there is authorized operation of the Mobile complex of technical means on safe discharge of spent radiation sources from biological shielding units BGI and E
	September
2-4	22nd Meeting of WWER Regulators Forum
10	Board Meeting devoted to "Improvement of State Nuclear and Radiation Safety Review System"
14-18	Ukrainian delegation participated in 59th IAEA General Conference Session
	November
23	Requirements for Defining Dimensions and Boundaries of NPP Observation Area as amended by joint order of SNRIU and the Ministry of Health of Ukraine No. 206/765 registered in the Ministry of Justice of Ukraine under No. 1567/28012 dated 15 December 2015

25	Public Hearings on Long-Term Operation of SUNPP unit 2
28	Possibility for SUNPP-1 operation at power levels defined by the design to 2 December 2023 justified by SNRIU Board Ordinance No. 17
	December
4	Workshop on urgent issues of nuclear and radiation safety devoted to 15th anniversary of SNRIU creation
7	Taking into account positive results of nuclear and radiation safety state review of the Report on Periodical Safety Review and Comprehensive Inspection of SUNPP unit 2, SNRIU Board recognized justification for safe operation of this unit to 31 December 2025
21	Procedure for State Inventory of Radioactive Waste as amended by SNRIU Order No. 228 registered in the Ministry of Justice of Ukraine under No. 83/28213 dated 16 January 2016
24	Requirements for Emergency Nuclear Fuel Cooling Systems and Heat Removal to the Ultimate Heat Sink approved by SNRIU Order No. 233 registered in the Ministry of Justice of Ukraine under No. 77/28207 dated 16 January 2016
24	Requirements for Power Supply Systems Important to NPP Safety approved by SNRIU Order No. 234 registered in the Ministry of Justice of Ukraine under No. 78/28208 dated 16 January 2016

3. OPTIMIZATION OF REGULATORY ACTIVITY

3.1. Optimization of Regulatory Activity

According to Article 6 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", state policy in the area of nuclear energy and radiation protection is exercised, in particular, through optimum regulation of nuclear and radiation safety. This optimality is achieved, among other, by safety requirements differentiation depending on potential hazard peculiar to specific activities at nuclear installations (sources). The same concerns physical protection and the Law of Ukraine "On Physical Protection of Nuclear Installations, Nuclear Material, Radioactive Waste and Other Radiation Sources" envisages the physical protection system that, in particular includes administrative and legal measures, shall be formed using the graded approach that ensures compliance of physical protection level of system objects with their categories and potential radiological consequences of illegal actions against them.

In addition, the Law of Ukraine "On Authorizing Activity in Nuclear Energy Use" envisages that one of the main authorizing principles is the graded approach to different activities and radiation sources taking into account potential nuclear and radiation hazards related to them. It may be specified as an example that such principle is applied in this Law under establishing legal standards to license activity with the use of radiation sources, namely, Article 7 of the Law envisages release of this activity from licensing under certain conditions associated with the graded approach taking into account potential radiation hazard related to the use of radiation sources.

These requirements of Ukrainian laws comply with IAEA recommendations. In particular, IAEA General Safety Requirements Part 1, Governmental, Legal and Regulatory Framework for Safety, envisages that national safety policy and strategy are based on a graded approach, taking into account radiological risks, to be considered to establish regulatory requirements, issue permits, conduct inspections and assess facilities and activities. In addition, such requirements in Ukrainian laws comply with EU regulations, such as Council Directive 2013/59/Euratom of 5 December 2013, laying down basic safety standards for protection against the dangers arising from exposure and cancelling Council Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.

The SNRIU as a state nuclear regulatory body applies the optimization principle in its activity.

The efforts started after analysis of the authorizing activity in 2014, in particular regarding compliance of the authorizing procedure with the Ukrainian legislation, international documents and practice of other countries were underway in 2015.

Within the abovementioned efforts, the SNRIU developed the Draft Law "On Amending Certain Laws of Ukraine in Nuclear Energy Use", which proposes to amend the Laws of Ukraine and, in particular:

- release from licensing some activities on radioactive material transport and entities having licenses for shipment of hazardous cargoes;
- release from licensing activity on processing, storage of radioactive waste by producers of radioactive waste before waste transfer to specialized enterprises on radioactive waste management and activity of contracting organizations rendering services on radioactive waste processing, storage to specialized enterprises on radioactive waste management, if services are rendered within the scope of licensed activity of these clients;
- it is also proposed to exclude activities belonging to the use of radiation sources to be licensed, receipt (purchase) and transfer (sale) of radiation sources including that for supply

purposes.

In addition, it is proposed to avoid the need to obtain authorization for the use of land and water bodies located in the controlled area. At the same time, standards of the Law on control of the products manufactured in these areas remain.

The Draft Law was submitted by the Cabinet to the Verkhovna Rada, No.4285 dated 22 March 2016.

The above measures will enable the SNRIU not only to focus on the most hazardous activities in terms of nuclear and radiation safety, but will reduce the regulatory burden on economic entities that complies with the state policy currently implemented in Ukraine.

In 2015, under deregulation of economic activity, the Cabinet of Ministers and deputies of Ukraine developed and adopted amendments to various laws, which to some extent concerned state regulation of nuclear safety, however, the peculiarities of activity in this area and peculiarities of state safety regulation for this activity in this area were not always considered.

On 2 March 2015, the Law of Ukraine "On Licensing Economic Activities" (in force since 28 June 2015) was adopted.

This Law envisages that nuclear energy related activity shall be licensed in compliance with this law taking into account peculiarities defined by the Law of Ukraine "On Authorizing Activity in Nuclear Energy Use".

Thus, procedures established to license business activity partly cover licensing procedures in nuclear energy use. The use of the above standards of the Law of Ukraine "On Licensing Economic Activities" for licensing in nuclear energy use will violate the national and international standards on independence of the regulatory body in decision-making.

On 15 July 2015, the Verkhovna Rada registered draft Law No.2360a developed involving the SNRIU and submitted by deputies. This draft law proposes to amend the Law "On Licensing Economic Activities" that eliminates the above issues. The draft Law was supported by the Governmental Committee of the Cabinet and the Parliamentary Committee. The SNRIU continues to support the adoption of this draft law.

Besides, as amended on 22 July 2014 the Law "On Basic Principles of State Oversight (Control) of Economic Activity" stipulates that state oversight of radiation safety shall be carried out according to the Law "On State Oversight (Control) of Economic Activity" and state oversight of nuclear safety in compliance with the Law of Ukraine "On Nuclear Energy use and Radiation Safety".

Thus, oversight of nuclear and radiation safety was divided into two types to be carried out following different procedures. This division by safety of nuclear energy use is not justified and oversight of safety of nuclear energy use by procedures of the Law regulating oversight of business activity does not consider provisions of the international standards. In particular, these provisions are as follows: independent nuclear regulatory body in decision-making, safety priority over others, including commercial interests, right of access to oversight facilities for state inspectors, and regarding the list of grounds for unscheduled inspections, the right to suspend activities not meeting the safety requirements.

On 15 July 2015, the Verkhovna Rada registered draft Law No.2360a developed involving the SNRIU and submitted by deputies. This draft Law suggests amending the Law "On Licensing Economic Activities" that resolves the above issue.

3.2. EU-Ukraine Association Agreement

Due to signing the EU-Ukraine Association Agreement between Ukraine, of the one part, and the European Union, the European Atomic Energy Community and its Member

States, of the other part and its ratification by the Verkhovna Rada of Ukraine and the European Parliament on 16 September 2014, the SNRIU intensified adaptation of Ukraine legislation to EU legislation in nuclear safety.

To fulfil the Action Plan approved by the Cabinet Ordinance No.847-r dated 17 September 2014 on implementation of this Agreement, the SNRIU developed plans, which were approved by the Cabinet Resolution No. 110-r dated 18 February 2015 for implementing some regulatory documents of the EU:

1. Council Directive 2013/59/Euratom of 5 December 2013, laying down basic safety standards for protection against the dangers arising from exposure and cancelling Council Directives 89/618/Euratom, 90/641/Euratom 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.

2. Council Directive 2006/117/Euratom of 20 November 2006, on the supervision and control over shipments of radioactive waste and spent nuclear fuel.

3. Council Directive 2014/87/Euratom of 8 July 2014, establishing a Community framework for nuclear safety of nuclear installations.

In 2015, the SNRIU took certain efforts to implement the EU regulatory documents. Thus, to fulfil the Action Plan for implementation of Council Directive 2013/59/Euratom, the SNRIU developed the Draft Law of Ukraine "On Amendments to Some Laws of Ukraine in Nuclear Energy Use", which suggests amending four Laws: "On Nuclear Energy Use and Radiation Safety", "On Authorizing Activity in Nuclear Energy Use", "On Human Protection Against Ionizing Radiation", and "On Mining and Processing of Uranium Ores".

In particular, the Draft Law envisages the following amendments:

- taking into account the peculiarities of process cycle of uranium concentrate production that includes both mining and processing of uranium ores, it is proposed to amend the above Laws and extend state regulation in nuclear energy use to uranium ore production and implement licensing for mining of uranium ore;

In addition, the Draft Law:

- proposes to establish the main dose limits for trainees and students who have contact with radiation sources during work or training;
- proposes to define characteristics of equipment containing radiation sources under which this equipment use for medical exposure is allowed (to significantly reduce exposure doses of patients);
- and proposes to supplement Cabinet powers with development and approval of the Action Plan aimed at decreasing public exposure by radon and its decay products..

The Draft Law was submitted by the Cabinet to the Verkhovna Rada, No.3858 dated 01 February 2016.

To fulfil the Action Plan on implementing Council Directive 2014/87/Euratom, the SNRIU:

- developed Ordinance "On Amending Procedure for Development and Approval of Standards, Rules and Regulations on Nuclear and Radiation Safety", which was approved by the Cabinet under No. 89 of 27 January 2016;
- in compliance with Directive requirements and to strengthen independence and institutional ability of the regulatory body, the SNRIU started developing the Draft Law of Ukraine on the body for state safety regulation in nuclear energy use, in particular a working group was established by SNRIU Ordinance, national and international legislation on establishment and functioning of state body for safety regulation in nuclear energy use were analyzed, Revision 1 of the Draft Law was under development.

Pursuant to the Action Plan on implementing Council Directive 2006/117/Euratom, the draft Cabinet Resolution "On Amending the Procedure to Issue Permit for International Transport of Radioactive Materials" was developed. This document establishes procedures to agree transport of radioactive waste and spent nuclear fuel by Ukraine and EU member states with competent bodies in the countries of origin, destination and transit that will contribute to oversight and control of such transport to ensure appropriate protection of the public and the environment.

4. SAFETY OF NUCLEAR FACILITIES

Ukraine operates 15 power units 13 of which are WWER-1000 and 2 are WWER-440. Ukraine ranks the tenth in the world for this indicator and takes the seventh place in the installed capacity that is 13.835 MW.

The only operator of all operating nuclear power plants in Ukraine is the National Nuclear Energy Generating Company *Energoatom*. The *Energoatom* Company includes four nuclear power plants.

In 2015, the NPPs generated 87.8 billion kWh representing 55.6% of total electricity production in Ukraine. Efficiency of the installed NPP capacity in 2015 was 72.3%.

Ukraine ensures stable and safe operation of NPPs under the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" and the Convention on Nuclear Safety. Safety improvement measures are under implementation at operating nuclear power plants of Ukraine on a systematic basis in compliance with national regulations and standards on nuclear and radiation safety and recommendations of the International Atomic Energy Agency (IAEA), taking into account best international practices.

Peer reviews of WANO1 and IAEA confirmed operational safety of Ukrainian NPPs and validity of safety upgrades implemented under safety improvement and long-term operation programs.

4.1. NPP Safety Improvement

The safety improvement measures at Ukrainian NPPs are under implementation in compliance with the "Comprehensive (Integrated) Safety Improvement Program for Operating Nuclear Power Units" (C(I)SIP), approved by a Cabinet Resolution No. 1270 of 7 December 2011. The Cabinet approved a Resolution No. 776 of 30 September 2015 "On Amending the Comprehensive (Integrated) Safety Improvement Program for Nuclear Power Units", which envisages extension of the C(I)SIP to 2010.

The C(I)SIP objectives are to:

- further improve operational safety of NPP units;
- decrease risks of NPP accidents during natural disasters or other hazards;
- improve the effectiveness in management of design-basis and beyond design-basis accidents at NPPs, minimize their consequences.

The C(I)SIP is based on safety improvement measures of the previous program "Concept for Safety Improvement of Operating Nuclear Power Units" (approved by a Cabinet Resolution No. 515-r of 13 December 2005) that were not implemented by the operating organization till the end of the Concept validity period and safety upgrades for Khmelnitsky-2 and Rivne-4 that were implemented during commissioning of these units.

The C(I)SIP also takes into account results and recommendations of the IAEA design safety review mission conducted at all NPPs under the Memorandum of Understanding in the Field of Nuclear Energy between Ukraine and EC.

After the Fukushima accident, the C(I)SIP included additional measures upon extraordinary in-depth safety reassessment for Ukrainian NPPs (stress tests) and additional fire safety measures. Safety improvement measures are among conditions for long-term operation of NPPs.

The design-basis lifetime of nine Ukrainian NPP units expires in a period from 2014 to 2020 (see Table 4.1).

Table 4.1. Data on NPP Units in Ukraine

NPP	Unit No.	Reactor Type	Expiration of design-basis/long-term operation period
ZNPP	**1**	**WWER-1000/320**	**23.12.2015**
	2	**WWER-1000/320**	**19.02.2016**

	3	**WWER-1000/320**	**05.03.2017**
	4	**WWER-1000/320**	**04.04.2018**
	5	**WWER-1000/320**	**27.05.2020**
	6	**WWER-1000/320**	**21.10.2026**
SUNPP	**1**	**WWER-1000/302**	**02.12.2013/02.12.2023**
	2	**BBEP-1000/338**	**12.05.2015/31.12.2025**
	3	**WWER-1000/320**	**10.02.2020**
RNPP	**1**	**WWER-440/213**	**22.12.2010/22.12.2030**
	2	**WWER-440/213**	**22.12.2011/22.12.2031**
	3	**WWER-1000/320**	**11.12.2017**
	4	**WWER-1000/320**	**07.06.2035**
KhNPP	**1**	**WWER-1000/320**	**13.12.2018**
	2	**WWER-1000/320**	**07.09.2035**

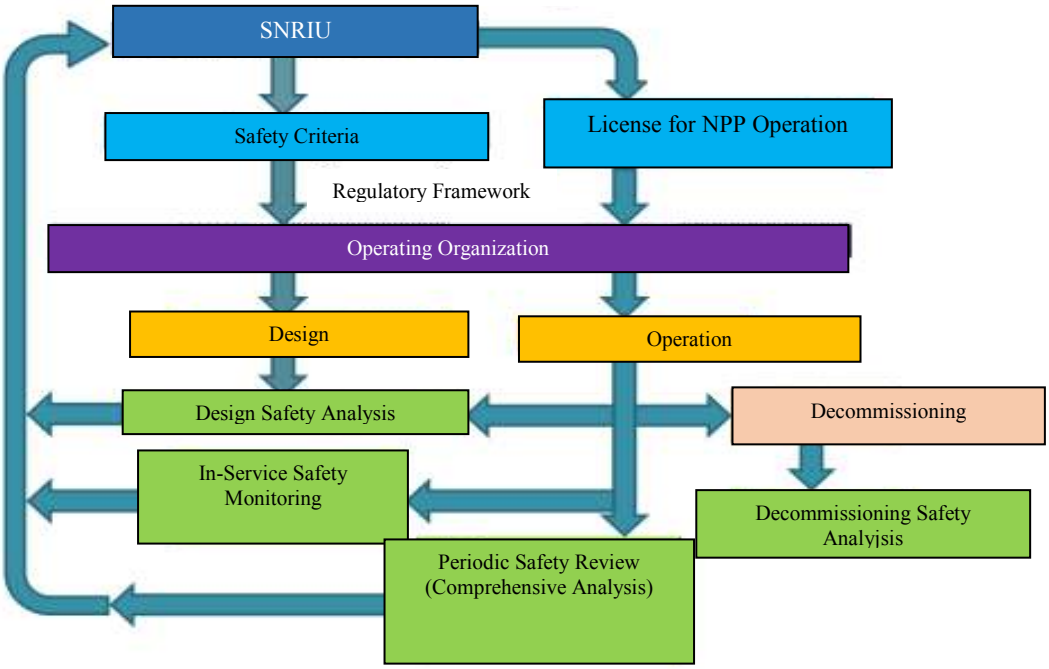
In 2014, within C(I)SIP regulatory support, the SNRIU agreed 54 reports on implementation of measures out of the 83 ones planned.

According to C(I)SIP scheduled, the main efforts of the operating organization in 2015 were focused on the development and implementation of measures for ZNPP units 1 and 2 within long-term operation activities. The experience in measures implementation obtained at the so-called pilot units is further extended to other power units.

Modifications important for safety of nuclear installations (change in nuclear installation configuration, bringing a nuclear installation into compliance with current regulations and standards, changes in operational documents, modification of the operating organization's structure) are implemented upon agreement with the SNRIU.

The State Nuclear Regulatory Inspectorate of Ukraine constantly monitors all stages of modifications implementation (concept development, installation and pre-commissioning, introduction into trial and/or commercial operation) through safety assessment of submittals and agreement of appropriate technical decisions, as well as through direct supervision over modifications, introduction of changes to operational documentation and staff training. The results are discussed at open meetings of the SNRIU Board involving all stakeholders, including the public and mass media.

Safety Assessment System for NPP units



During 2015, the SNRIU conducted comprehensive inspections of each NPP site, also involving international experts. One of the main tasks is to check implementation of safety improvement measures.

At the beginning of 2013, the SNRIU jointly with the Ministry for Energy and Coal Industry, Ministry of Defense, Ministry for Environment and Natural Resources and State Agency for Exclusion Zone Management developed the National Action Plan upon Stress-Test Results aimed at improving the safety of Ukrainian NPPs in full compliance with ENSREG recommendations.

EU states and neighboring countries that took part in the stress tests (Ukraine and Switzerland) reached agreements for further periodic exchange of information on the implementation of the National Action Plans and transparency and openness of the process.

The status of National Action Plans upon stress tests of the participating countries was presented during the ENSREG workshop in April 2015. In preparation for the ENSREG workshop, the National Action Plan upon Stress-Test Results (2013) was updated to take into account recommendations set forth in the "ENSREG Post-Fukushima National Action Plans Workshop 20÷24 April 2015. Terms of Reference". It should be noted that a number of measured planned for operating NPPs and Chornobyl NPP and the scope of measured remained unchanged in the updated National Action Plan. The updated National Action Plan specified the status of safety upgrades and their schedule.

Part I of "The Safety Improvement Measures" of the Updated National Action Plan presents the list of measures of the National Action Plan upon stress-test results (2013) both for operating power units and for Chornobyl NPP with updated information on status of measures and their schedule.

Part II of "The Safety Improvement Measures" of the Updated National Action Plan presents more detailed information on updates, namely: the information on planned implementation scope of a measure; its implementation status (more detailed information is presented for implemented measures) is specified on each planned measure; updated deadline.

The updated National Action Plan upon Stress-Test Results can be found on the SNRIU official website.

The National Report of Ukraine on the updated Action Plan, which included the information on bringing the Ukrainian nuclear and radiation safety standards to compliance with WENRA reference levels as it was proposed during the preliminary working meeting in 2013, interested the representatives of the EC, Austria, Sweden, and Finland.

A series of safety improvement measures at Ukrainian NPPs were defined before the tragic events at the Fukushima-Daiichi NPP and were a part of C(I)SIP and "Safety Improvement Plan of Nuclear Installations at Chornobyl NPP".

All countries participating in the ENSREG meeting expressed commitment to full implementation of the measures specified in their reports under supervision of regulatory bodies.

4.2. Safety Review and Long-Term Operation of Nuclear Facilities

4.2.1. Safety Review and Long-Term Operation of NPP Units

Most Ukrainian NPPs were commissioned in the 1980s and their design-basis life is to expire in the near future. The Government of Ukraine decided to continue operation of NPP units as reflected in the "Energy Strategy of Ukraine until 2030" and "Comprehensive Work Program for Long-Term Operation of Nuclear Power Plant Units". The *Energoatom* Company together with the WWER General Designer Hydropress revised the schedule for beginning of commercial operation and established the dates for completion of the design-basis life (see Table 4.1):

In a period from 2015 to 2020, the design-basis life of eight NPP units in Ukraine (see the schedule) expires. It will be required to take a decision from 2016 on life extension of two power units at the same time:

- completion of design-basis life

- last scheduled outage for implementation of long-term operation measures

- period of preparation for long-term operation

In accordance with the current legislation, a decision on long-term operation of a power unit is made by the SNRIU based upon conclusions of the state nuclear and regulatory

safety review of the periodic safety review report (PSRR) by amending the license for its operation. Long-term operation may be allowed only if the safety level of the NPP unit is not lower than that established by current regulations and rules on nuclear and radiation safety.

The PSRR is based upon a substantial scope of efforts, in particular, related to the following:

- assessment of current technical state of components and structures and their lifetime extension;
- elimination of deviations from nuclear and radiation safety regulations, rules and standards adopted during the last years;
- implementation of safety upgrades planned under C(I)SIP;
- implementation of measures upon results of the Fukushima NPP events and stress tests;
- equipment qualification for harsh environments and seismic events and seismic evaluation of NPP piping, buildings and structures;
- implementation of the ageing management program for NPP components and structures;
- in-depth safety analysis applying deterministic and probabilistic methods;
- enhancement of operational safety through improvement of operational and emergency documentation;
- improvement of the management system to be in compliance with nuclear and radiation safety regulations and rules, IAEA recommendations and best international practice;
- improvement of emergency preparedness system.

In accordance with nuclear and radiation safety regulations, rules and standards, the PSRR is finalized as individual reports based upon assessment of 14 safety factors:

- NPP unit design;
- current condition of systems and components;
- equipment qualification;
- ageing;
- deterministic safety analysis;
- probabilistic safety assessment;
- internal and external hazard analysis.
- safety performance;
- use of experience from other plants and research findings;
- organization and administration;
- operating procedures;
- human factor;
- emergency preparedness and planning;
- environmental impact.

This approach complies with IAEA recommendations and best international practice and allows a comprehensive assessment of the power unit safety to make a sound decision on further operation of the power unit, including long-term operation.

For SUNPP unit 2, ZNPP units 1, 2, 3, and RNPP unit 3 whose design-basis life expires in 2015÷2017, The *Energoatom* Company chose “another option” of long-term operation in compliance with NP 306.2.099-2004 in which a power unit is to be shut down after its design-basis life expires and organizational and technical measures are to be taken to continue and recommence operation.

For SUNPP unit 2, ZNPP units 1, 2, and RNPP unit 3, the SNRIU agreed long-term operation programs and licensing plans in accordance with which safety upgrades, equipment qualification and technical condition assessments are underway.

For ZNPP unit 3, licensing plan was agreed and state nuclear and radiation safety review of long-term operation program was provided.

Safety upgrades, equipment qualification and technical condition assessments are underway at these power units. The respective reports are submitted to the SNRIU for consideration and state nuclear and radiation safety review.

4.2.2. Long-term Operation of SUNPP Unit 2

Within safety review of SUNPP unit 2, all technical decisions on life extension for equipment, piping and building structures of the power unit and results of the following activities were completely agreed by the SNRIU:

- equipment qualification for harsh environment and seismic conditions and seismic impact;
- ensuring seismic resistance of equipment, piping, buildings and structures.

Results of the above activities were considered under making a decision on possible long-term operation of SUNPP unit 2.

On 7 December 2015, during open meeting of the SNRIU Board, the SNRIU considered the issue on “Long-term Operation of SUNPP Unit 2 upon Periodical Safety Review”. The meeting was attended by members of the Board and SNRIU staff, *Energoatom* Company management, authorized representatives of the Ministry for Energy and Coal Industry of Ukraine, Ministry of Ecology and Natural Resources of Ukraine, representatives of the SSTC NRS, Verkhovna Rada Committee on Fuel and Energy Complex, Nuclear Policy and Nuclear Safety, EBRD, public organizations, and mass media.

Taking into account positive results of the state nuclear and radiation safety review of the periodical safety review report and comprehensive inspection of SUNPP unit 2, the SNRIU Board considered that safe operation of SUNPP unit 2 until 31 December 2025 is justified.

Considering the above mentioned, on 19 December 2015, the SNRIU issued a license, series EO No.001047, for the operating organization (*Energoatom* Company) to perform activity at lifecycle stage "operation of SUNPP unit 2".

ЛІЦЕНЗІЯ

Серія АА № 000002

№ ЕО 001047

ДЕРЖАВНА ІНСПЕКЦІЯ ЯДЕРНОГО РЕГУЛЮВАННЯ УКРАЇНИ

Видана експлуатуючій організації - Державному підприємству «Національна атомна енергогенеруюча компанія «Енергоатом» Україна, 01032, м. Київ, вул. Назарівська, 3

Ідентифікаційний код юридичної особи 24584661

на право провадження діяльності на етапі життєвого циклу «експлуатація ядерної установки енергоблока № 2 Южно-Української АЕС»

Місце провадження діяльності 55000, Миколаївська область, м. Южноукраїнськ, межі майданчика ВП «Южно-Українська АЕС» згідно з Генеральним планом від 07 травня 2001 року

Технологічний комплекс у складі енергоблока № 2, об'єкти та будівлі, що технологічно з ними пов'язані, відповідно до Генерального плану проммайданчика «Южно-Українська АЕС» від 07 травня 2001 року

Перелік документів, на підставі яких прийнято рішення про видачу ліцензії - згідно з розділом 1

Переліки посадових осіб, до службових обов'язків яких належить здійснення організаційно-розпорядчих функцій, пов'язаних з забезпеченням ядерної та радіаційної безпеки, фізичного захисту ядерних установок, радіоактивних відходів, інших джерел іонізуючого випромінювання - згідно з розділом 2

Умови провадження діяльності - згідно з розділом 3

найменування підрозділу або органу, до повноважень здійснювати контроль за дотриманням умов та правил провадження вказу діяльності, що ліцензується

Державна інспекція з ядерної безпеки на Південно-Українській АЕС Державної інспекції ядерного регулювання України

Дата видачі 09 грудня 2015 року

Строк дії ліцензії до до видачі ліцензії на здійснення діяльності на етапі життєвого циклу «зняття з експлуатації ядерної установки»

Голова С. Бакаєв

М.П.

Сторінка 1 з 9

4.2.3. Preparation of ZNPP Unit 1 for Long-Term Operation

On 17 December 2015, during open meeting, the SNRIU Board considered the issue "On Status of Long-Term Operation Efforts for ZNPP unit 1".

Taking into account that long-term operation efforts for ZNPP unit 1 were not completed to the full extent, the SNRIU Board decided to amend the license (series EO

l000196) to perform activity at lifecycle stage “operation of SUNPP unit 1” regarding operation of ZNPP unit 1 in shut down state with complete fuel unloading from the reactor core to the spent fuel pool for the period of administrative and technical measures to justify its possible long-term operation, and determined conditions under which reopening the issue on long-term operation of ZNPP unit 1 at power levels is possible.

4.2.4. Preparation of other NPP units 1 for Long-Term Operation

The efforts on consideration and agreement of technical decisions on life extension for equipment, piping and building structures at other NPPs continued during 2015.

As of 01 January 2016, the SNRIU agreed:

- summary reports on equipment qualification for harsh environment conditions of ZNPP unit 2;
- results of seismic hazard research at ZNPP site (using deterministic and probabilistic methods);
- initial data for efforts to confirm seismic resistance of equipment, piping, buildings and structures at ZNPP unit 2.

In 2015, based on the periodic safety review:

- regulatory decisions on SUNPP unit 2, ZNPP units 1 and 2, RNPP unit 3 were made;
- reports on safety factor assessment for SUNPP unit 2, ZNPP units 1, 2 and 3, RNPP unit 3, 4 were considered.

In addition, as of the end of 2015, the SNRIU performed the state nuclear and radiation safety review of the following:

- reports including results of assessing all 14 safety factors and Chapter “Comprehensive Safety Analysis”, PSRR for SUNPP unit 2. When comments of the state nuclear and radiation safety review were considered by the operating organization, the SNRIU agreed the reports with the results of assessing 14 safety factors and Chapter “Comprehensive Safety Analysis”;
- reports including results of assessing all 14 safety factors and Chapter “Comprehensive Safety Analysis”, PSRR for ZNPP unit 1. When comments of the state nuclear and radiation safety review were considered by the operating organization, the SNRIU agreed the reports with the results of assessing 11 safety factors;

- reports including results of assessing all 14 safety factors and Chapter "Comprehensive Safety Analysis", PSRR for ZNPP unit 2. When comments of the state nuclear and radiation safety review were considered by the operating organization, the SNRIU agreed the reports with the results of assessing 9 safety factors;
- reports including results of assessing 6 safety factors out of 14, PSRR of ZNPP unit 3;
- reports including results of assessing 7 safety factors out of 14, PSRR of RNPP unit 3. When comments of the state nuclear and radiation safety review were considered by the operating organization, the SNRIU agreed the reports with the results of assessing 7 safety factors;
- reports including results of assessing all 14 safety factors and Chapter "Comprehensive Safety Analysis", PSRR for RNPP unit 4. When comments of the state nuclear and radiation safety review were considered by the operating organization, the SNRIU agreed the reports with the results of assessing 9 safety factors;
- reports including results of assessing all 14 safety factors and Chapter "Comprehensive Safety Analysis", PSRR for KhNPP unit 2. When comments of the state nuclear and radiation safety review were considered by the operating organization, the SNRIU agreed the reports with the results of assessing 8 safety factors

Safety review of Ukrainian NPP units and activity of the operating organization on long-term operation is under regulatory control of the SNRIU.

4.3. NPP Operational Events in Ukraine (2000-2015)

One of key tools for ensuring safety of NPP operation and its further improvement is consideration of operating experience, which includes accounting and analysis of NPP operational events, corrective measures to eliminate detected causes and prevent recurrence of events.

NPP event is one of the most important indicators of operational safety level.

During 2015, 15 events occurred at 15 power units with water-cooled water-moderated reactors (WWER) under commercial operation. Events were not registered at Chornobyl NPP units that are at the decommissioning stage.

Figure 4.3.1 presents distribution of operational events at operating Ukrainian NPPs (without considering Chornobyl NPP) during 2000-2015.

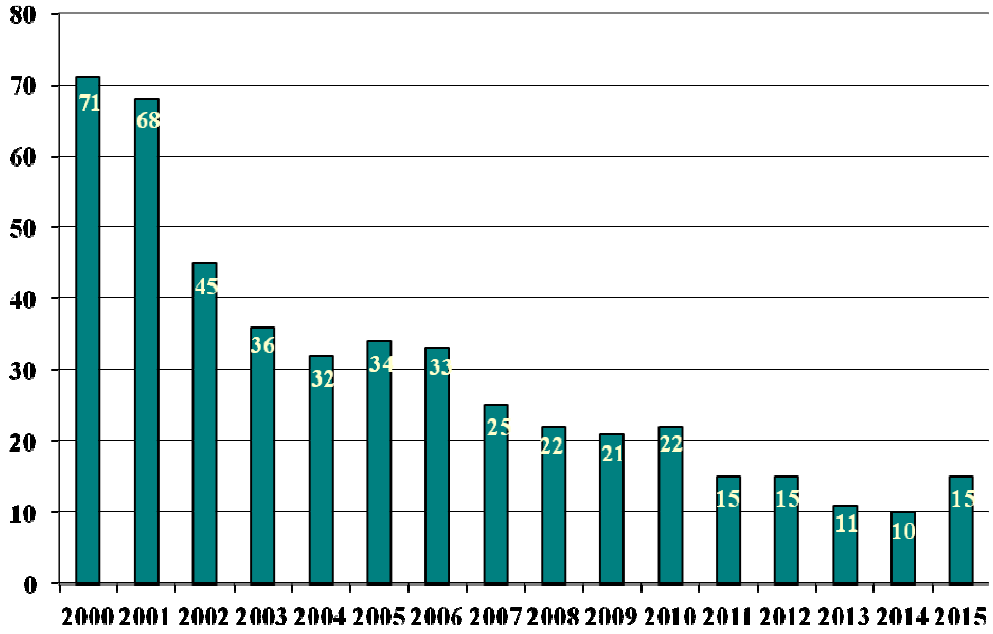


Figure 4.3.1. Number of operational events at Ukrainian NPPs in 2000-2015.

Figure 4.3.2 presents the distribution of events by NPP sites in 2000-2015.

The number of operational events in 2015 increased twice at ZNPP and KhNPP (and is the highest one at these sites for the last 5 years), at SUNPP increased thrice compared to the previous year. At RNPP in 2015, events did not occur.

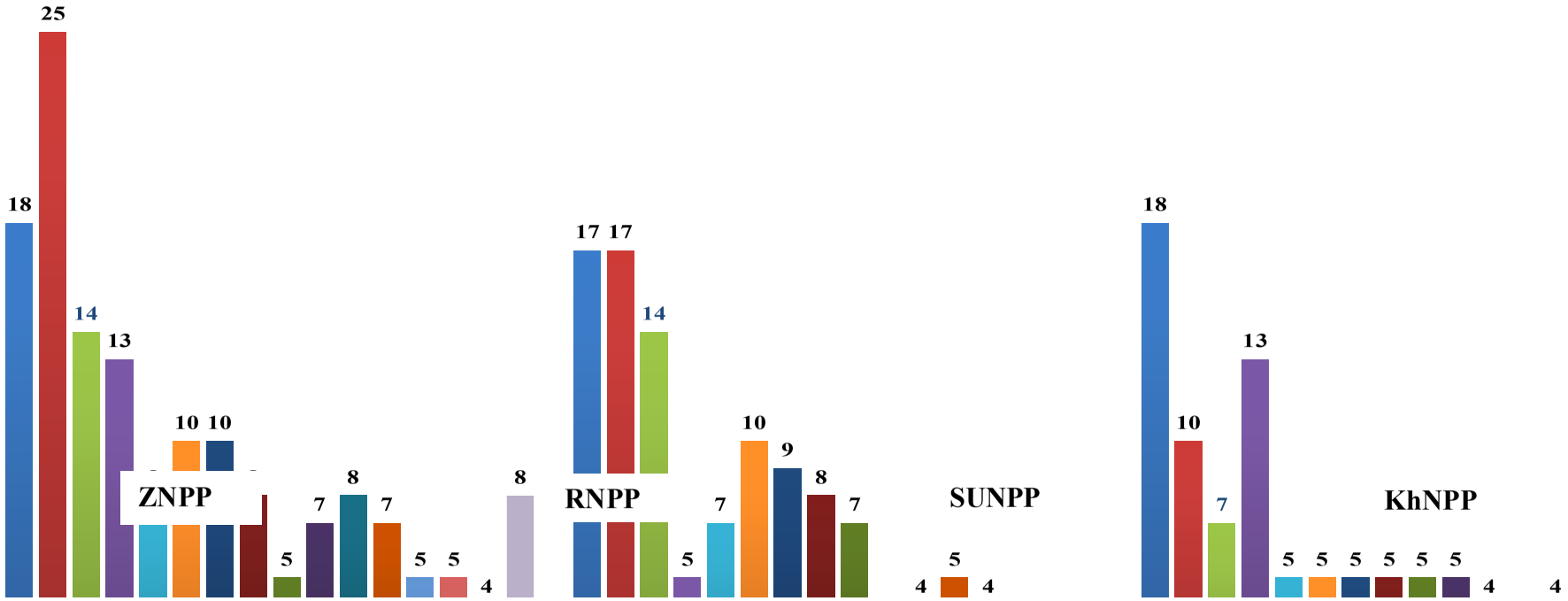


Figure 4.3.2. Distribution of events by NPP sites in 2000-2015.

According to the INES, the worldwide instrument developed to inform the public on significance of nuclear and radiological events for safety, Ukraine had no events higher than "below scale/level 0" (insignificant for safety) in 2015. Figure 4.3.3. presents the distribution of events at operating Ukrainian NPPs in 2000-2015 classified according to the INES.

Events resulting in personnel overexposure or release of radioactive materials to the environment, incompliance with safe operation boundaries and conditions did not occur in 2015. In addition, events related to inoperability of systems important to safety and events resulting in fall and/or damage of fuel assemblies and fuel rods did not occur.

Depending on features and consequences, NPP operational events in 2015 included the following:

- NPP unit unloading by 25 % and more – 7 events (47%);
- reactor shutdown with scram, preventive protection, power limiter – 2 events (13 % of general event number in 2015);
- power unit disconnection from the grid by emergency automatics – 3 events (20 %);
- failures of equipment and piping important to NPP safety – 3 events (20 %).

During an NPP operational event, there is deviation from normal operation (abnormal event) that may be caused by equipment failure, external hazard, human error or procedural drawbacks.

Figure 4.3.4 presents the distribution according to systems that failed or were affected during abnormal events in 2015.

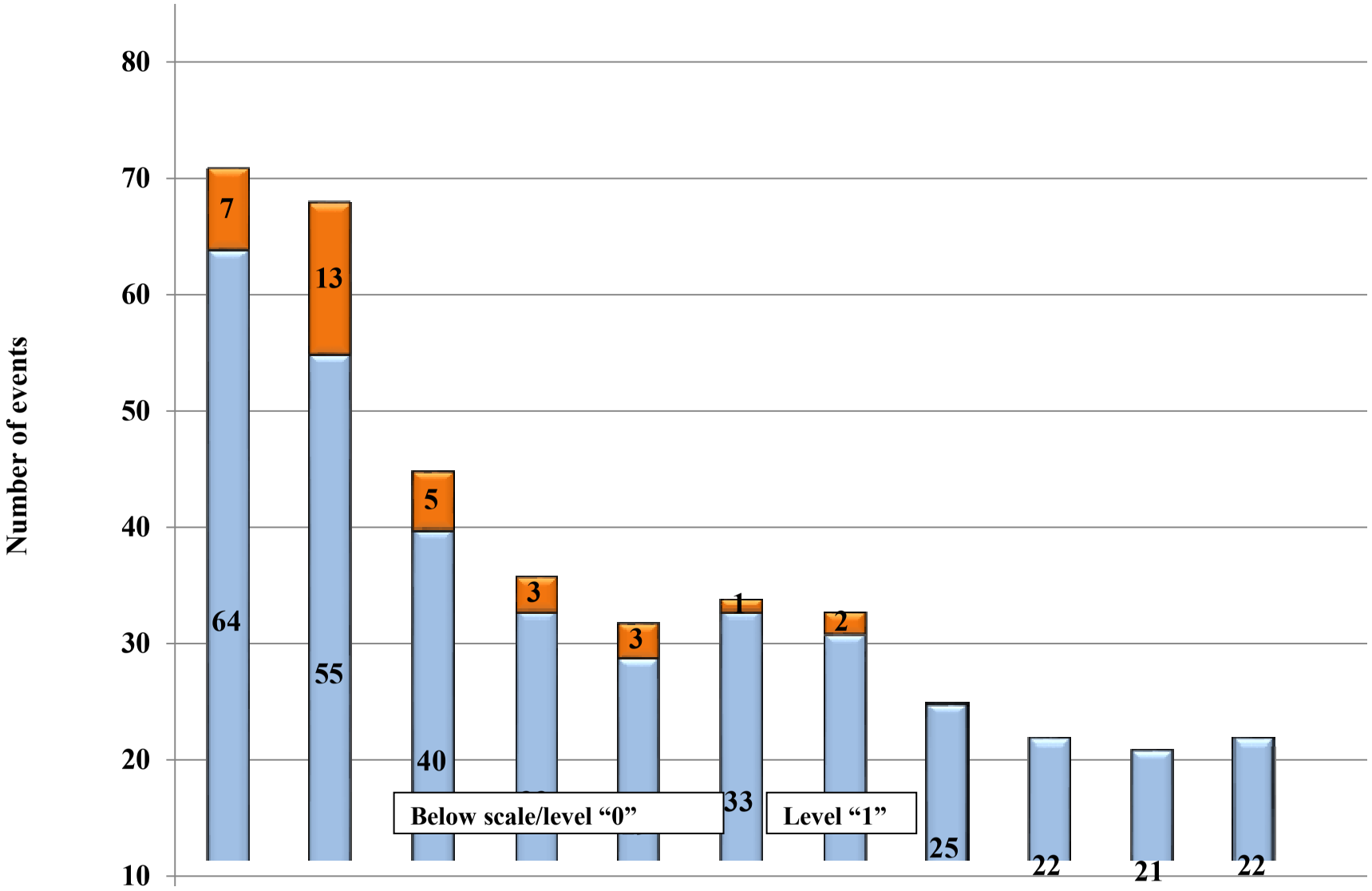


Figure 4.3.3. Distribution of event number at operating Ukrainian NPPs by the INES in 2000-2015.

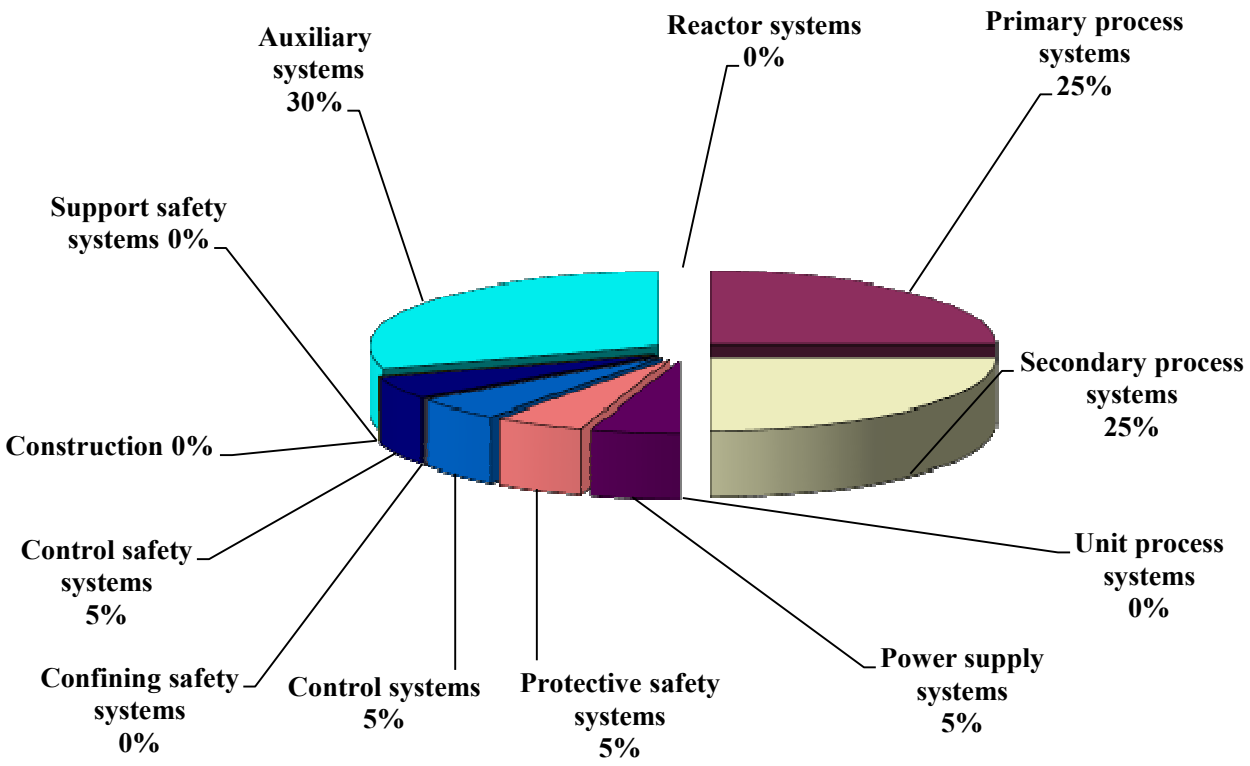


Figure. 4.3.4. Distribution according to systems that failed or were affected during abnormal events

In 2015, the most failures (30%) refer to auxiliary systems ensuring operability of the main systems' equipment. In addition, significant part (25% each) includes failures of secondary process systems, turbine building, and failures of primary process, reactor building.

Investigation of 15 NPP operational events occurred in Ukraine this year registered 20 abnormal events whose 25 root causes were determined. Figure 4.3.5 presents the contribution of each root cause group to general number of events in 2000-2015.

Causes related to equipment failures (52 %) contribute the most. A part of root causes related to documentation quality increased significantly (by 3.2) compared to the last year. Two causes in 2015 were not identified under event investigation (8%) and would be determined during scheduled outage. Although causes related to personnel and the management system has decreased (from 28 % in 2014 to 24 % in 2015) this index is still high enough.

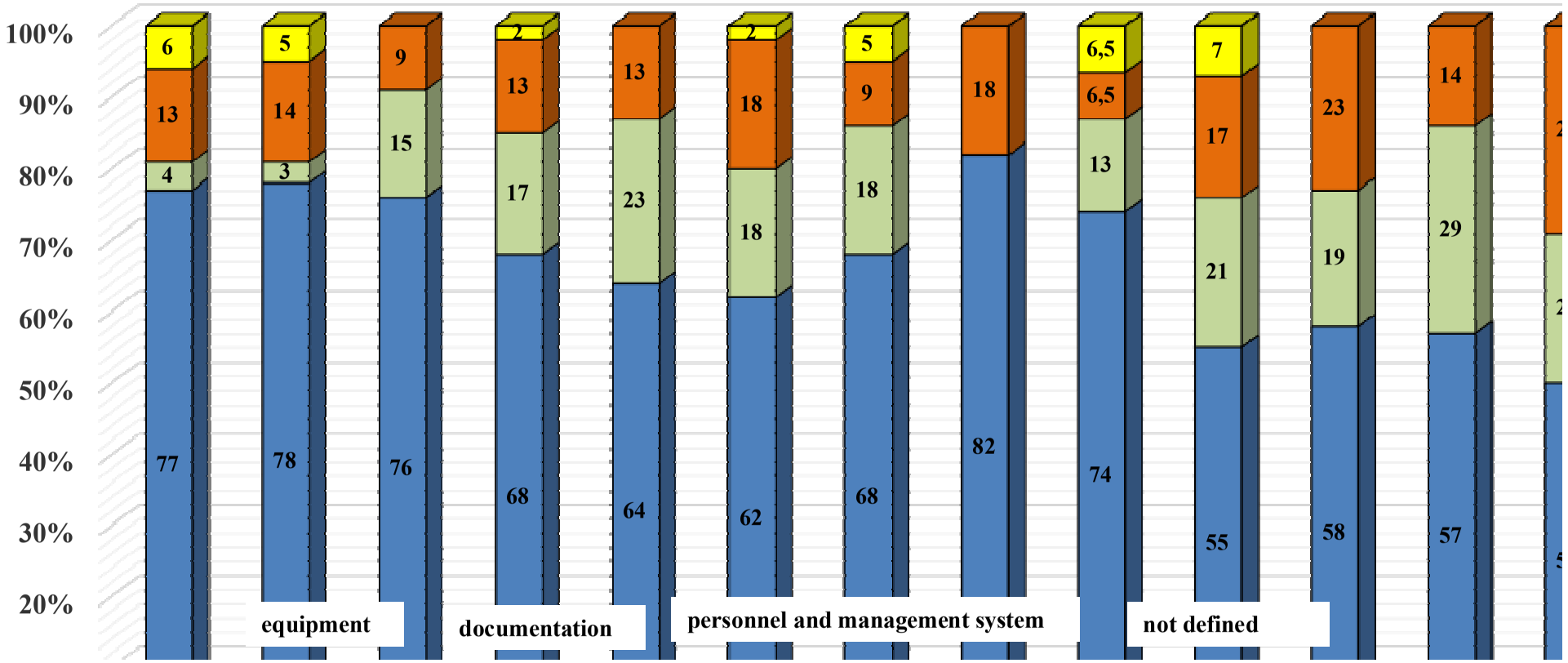


Figure 4.3.5. Distribution of root causes of abnormal events in 2000-2015.

4.4. Releases, Discharges into the Environment and Monitoring of Personnel Exposure Doses

4.4.1. NPP Radiation Impact

Impact of NPP radiological factors is assessed based on information on airborne releases and water discharges into the environment, internal and external doses of NPP personnel and radiological state of environmental objects in the NPP location area.

Radiation safety involves compliance with permissible limits of radiation impact on personnel, the public and the environment established in safety regulations, rules and standards. Radiation protection is a series of radiation health & safety, design & engineering and technical & and organizational measures aimed at ensuring radiation safety. Thus, radiation safety is a goal whose achievement is obligatory in NPP operation and radiation is means to achieve this goal.

NPP radiation protection includes a series of protective barriers on the path of radionuclides toward the environment. The values of airborne releases and water discharges from NPP characterize the state of protective barriers.

Effectiveness of NPP radiation protection is assessed by the following parameters of radiation safety:

- airborne release per 1000 MW of installed capacity;
- water discharge of radionuclides per 1000 MW of installed capacity;
- indexes of radioactive releases and discharges to the environment.

4.4.2. Radioactive Airborne Releases to Atmosphere

According to dynamics analysis, the total indexes of airborne radioactive releases from NPPs operated in 2015 to the environment remain minimally low being no more than one percent of permissible limits during last years.

RNPP and KhNPP mastered the guidance for a facility for monitoring of airborne tritium releases to the environments through NPP ventilation stacks and accepted it into commercial operation. The contribution of this radioisotope to the total release indicator was ~ 67% at RNPP and ~ 38% at KhNPP.

Fig. 4.4.1 graphically represents total index dynamics of airborne radioactive releases into the environment at NPPs operated during last 5 years.

Release indexes, %.

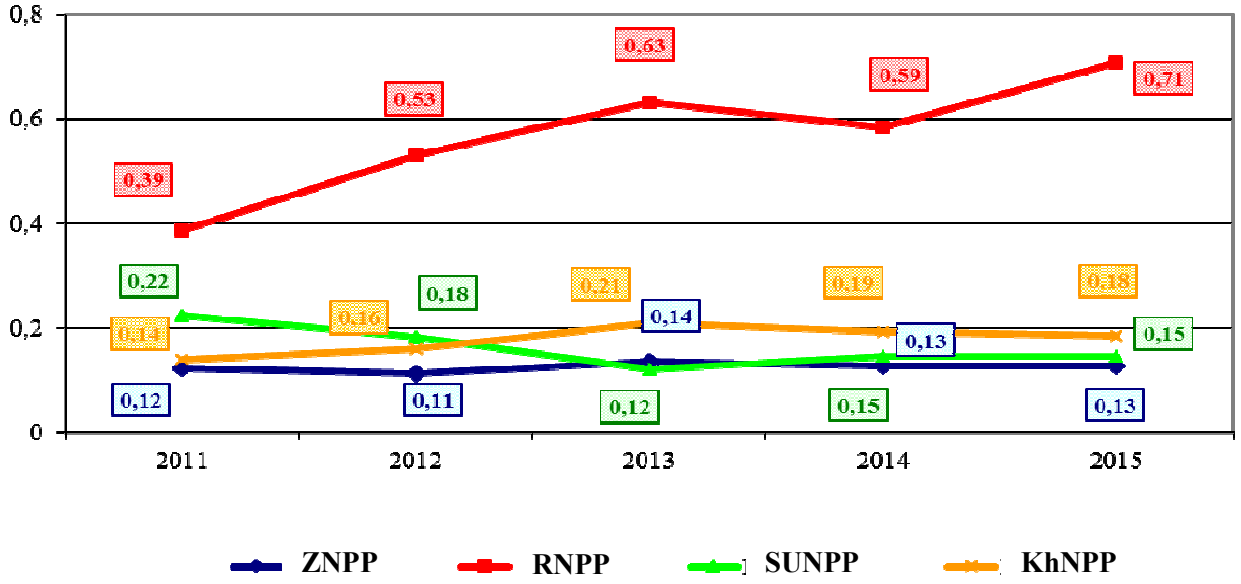


Fig. 4.4.1 Total index dynamics of airborne radioactive releases into the environment at NPPs operated during 2011 -2015

4.4.3. Radioactive Discharges to External Water Bodies

Radioactive discharges of radionuclides from operating nuclear power plants to external water bodies (cooling ponds) are mainly formed by residual waters from chemical demineralization tanks and blowdown essential spray ponds.

Table 4.4.1. presents the reference levels and boundaries of radioactive discharges to open water bodies that were valid at operating NPPs this year.

Table 4.4.1. Reference levels/boundaries for water discharges of reference radionuclides to open water bodies of operating NPPs (MBq/year)

Radionuclide	ZNPP	RNPP	SUNPP	KhNPP
^{137}Cs	364 / 91 000	2 640 / 83 000	1 188 / 16 000	170 / 41 000
^{60}Co	4 400 / 1 100 000	252 / 52 000	252 / 31 000	220 / 55 000
^{3}H	104 E+6/1900 E+6	26E+4 / 2400 E+6	31E+6 /120 E+6	8.0E+6/ 2000E+6

Figure 4.4.2. graphically represents total index dynamics of radionuclide discharges reliably recorded at NPPs during the last years.

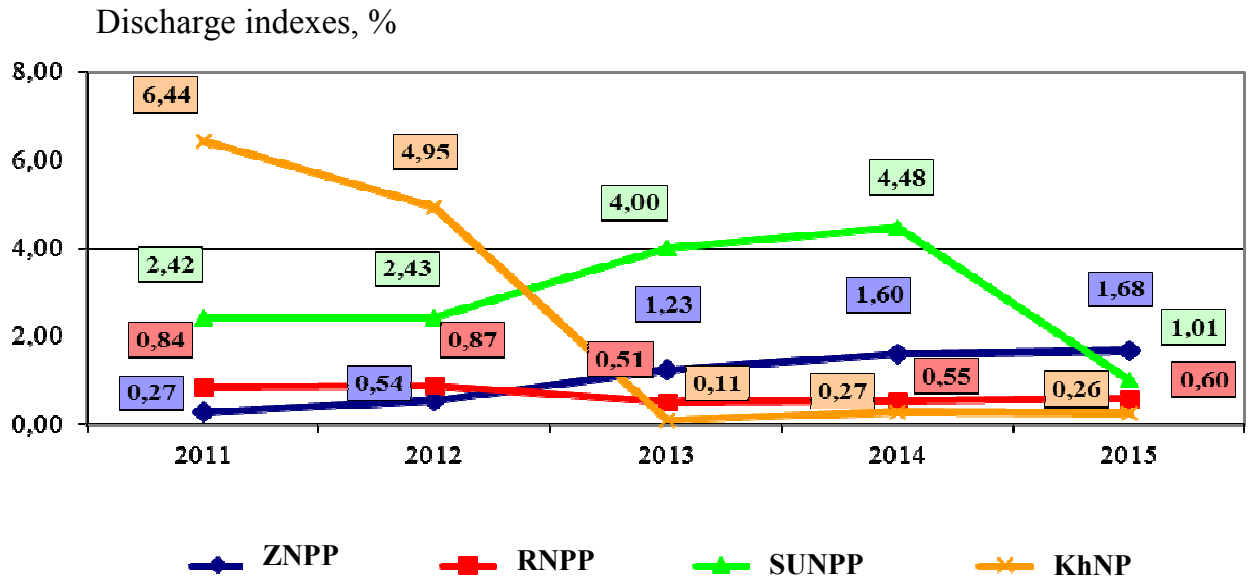


Figure 4.4.2 Total index dynamics of radionuclide discharges reliably recorded at operating NPPs during 2011-2015.

Table 4.4.2. presents indexes of separate radionuclides and total indexes of water discharges at operating NPPs into external water bodies in 2015.

Table 4.4.2. Indexes for water discharges of reference radionuclides to external water bodies in 2015 (%)

NPP	^{3}H	^{137}Cs	^{134}Cs	^{60}Co	^{90}Sr	^{54}Mn	*Total index*
ZNPP	1.495	0.059	0.089	0.006	0.027	0.002	***1.680***
RNPP	0.305	0.193	0.048	0.016	0.028	0.002	***0.595***
SUNPP	0.403	0.099	0.059	0.038	0.401	0.005	***1.007***
KhNPP	0.203	0.034	0.012	0.001	0.005	0.000	***0.255***

Radioactive water discharges to open ponds were not exceeded at any *Energoatom* NPP for 2015. The maximum index of radionuclide water discharge among operating NPPs was at ZNPP (1.68%).

4.4.4. Monitoring of personnel external doses

Individual dosimetry control is a part of radiation monitoring performed according to health and safety assessment of working conditions for personnel in the field of ionizing radiation.

Individual external doses of ZNPP, RNPP and SUNPP personnel were measured with the RADOS dose measurement system with RE-2000 readers and thermoluminescent dosimeters (with MCP-N gamma and beta detectors and MCP-6,7 neutron detector) and with Harshaw 8814/0110 thermoluminescent dosimeters at KhNPP.

For prompt monitoring of external doses, NPPs used DMC-2000S electron dosimeters (MGPI, France) in 2015.

Table 4.4.3. Administrative process (administrative) levels for individual effective doses of NPP personnel and reference levels for annual collective doses of NPP personnel with individual doses higher than 6 mSv/y (RL_6) and 15 mSv/y (RL_{15})

Plant	Administrative process levels for individual doses of personnel		Reference levels for annual collective doses of personnel, man Sv/year	
	Personnel, mSv/y	Women to 45 years of age, mSv	RL_6	RL_{15}
ZNPP	15.0 (18.5*)	-	4.50	1.80
RNPP	15.0 (19.0*)	1.90 (for two months)	3.60	0.83
SUNPP	15.0	1.40 (for two months)	3.30	0.48
KhNPP	14.0 (18.0*)	1.40 (for two months)	1.60	0.32

** - for personnel involved in hazardous radiological work*

For more informative comparison of collective exposure doses for NPP personnel during several years, and to minimize the impact of peak doses during scheduled outage on annual fluctuations of this index, Figure 4.4.3. presents the dynamics of collective exposure doses for one NPP unit as average values of this index for three years with trend line. The data cover the last ten years.

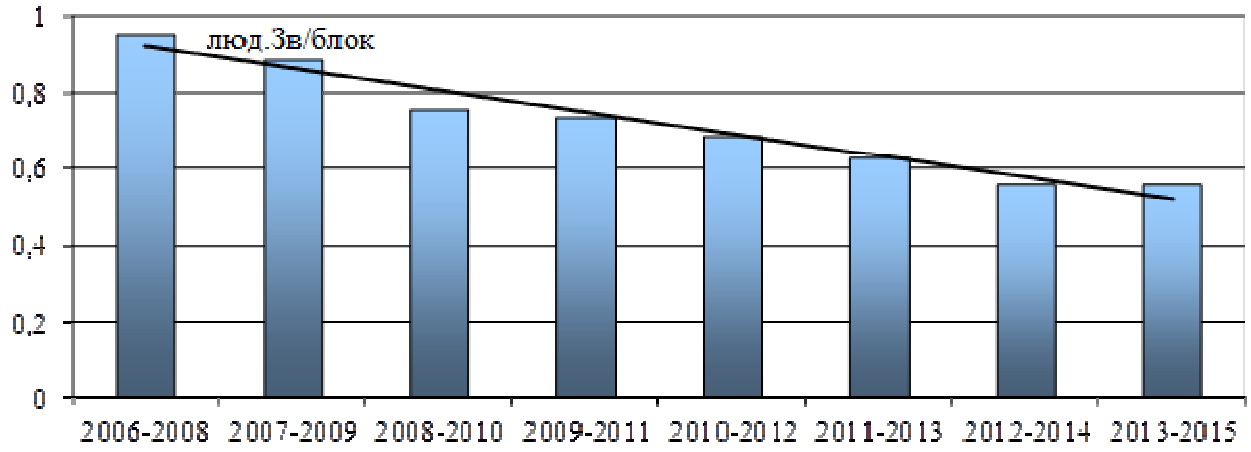


Figure 4.4.3. Dynamics of collective exposure doses for one NPP unit (*Energoatom* Company) as average values of this index for three years with trend line in 2006 – 2015

Diagram trend line shows general stable trend to decrease the index of average annual collective exposure doses for one NPP unit during the last ten years.

Average individual exposure doses for personnel at operating NPPs in 2015 were: ZNPP – 0.635 mSv/person per year, Rivne NPP – 0.512 mSv/person, SUNPP – 0.970 mSv/person, KhNPP – 0.343 mSv/person.

In 2015, the maximum average annual individual exposure dose for *Energoatom* personnel as in previous years was registered at SUNPP: 0.970 mSv/person per year representing 4.9% of the general annual limit for individual effective exposure dose for personnel, category A DL20 (20 mSv/year).

At ZNPP in 2015, the levels of collective and average individual exposure doses for personnel increased by 29.4 % compared to the previous year and represented correspondingly 3051.41 man mSv (2014 – 2154.29 man mSv) and 0.635 mSv/person per year (2014 – 0.448 mSv/person). Increase of collective exposure dose level for ZNPP personnel in 2015 is almost

caused by major repairs of unit 2 and 5, as well as repair of sealed surface of the main reactor connector. These activities were performed at ZNPP for the first time. In addition, a significant contribution to the total collective exposure dose for ZNPP personnel in 2015 was made by activities to remove leaks of the primary equipment at unit 1, spent fuel pool at unit 4 and other radiation hazardous activities during the year.

At RNPP, the level of personnel collective dose increased in 2015 (by 320.69 man-mSv) compared to the last year and was 2033.33 man-mSv, the level in 2014 was 1712.64 man-mSv. Average annual individual dose for RNPP personnel in the reporting year is 0.512 mSv/person per year and 0.459 mSv in 2014. Increase of RNPP personnel dose level results from four scheduled repairs of the NPP while in 2014 three repairs were performed, i.e. that increased scope of radiation hazardous activities were conducted.

The level of collective dose for SUNPP personnel increased in 2015 by 39.3 % compared to 2014 and was 3257.02 man-mSv (2014 - 1978.26 man-mSv). Average annual individual effective dose for SUNPP personnel also increased to 0.970 mSv compared to the previous year (0.642 mSv – 2014). Such increase of collective dose for SUNPP personnel in 2015 was caused by implementing a large scope of reconstruction activities aimed at long-term operation of unit 2 and resulted in involving significant number of SU NPP personnel and personnel of contracting organizations to conduct these activities.

In 2015, the level of annual collective doses for KhNPP personnel decreased by 35.7 % in 2015 compared to the last year and was equal to 935.09 man-mSv (1454.58 man-mSv – 2014). At the same time, average individual dose for KhNPP personnel in the reporting year was 0.343 mSv/person per year (2014 – 0.519 mSv/year).

During the reporting year, administrative and process levels of personnel individual doses, as well as reference levels of annual collective doses for personnel were not exceeded at any of the operating NPPs.

4.4.5. Monitoring of Personnel Internal Doses

Internal exposure was monitored by direct measurement of radionuclide activity in human body (critical organ) using human radiation spectrometers based on scintillation and semiconductor detectors with subsequent conversion of the results into expected effective dose according to a model proposed by ICRP-30.

Permissible levels of individual annual inhalation of radionuclides (ALI_A^{inhal}) established by NRBU-97 for category A personnel are 400 kBq/y for ^{131}I, 200 kBq/y for ^{60}Co, 100 kBq/y for ^{137}Cs and 200 kBq/y for ^{134}Cs.

Content of ^{137}Cs and ^{60}Co radionuclides in human body and lungs and of 131I in thyroid gland was monitored at all NPPs.

Table 4.4.4. shows distribution of individual internal doses and collective internal dose of operating NPP personnel in 2015.

Table 4.4.4. Number of persons who passed biophysical examination by SVL installation (taking into account personnel of outside organizations), distribution of annual individual doses and collective internal doses for personnel of NPPs and outside organizations in 2015

NPP	Number of monitored persons, persons/year	Number of persons with dose received in 2015 (mSv), persons					Collective internal dose, man-mSv
		< 1	1 - 2	2 - 6	6 - 20	> 20	

ZNPP	7319 (2130)*	7319	0	0	0	0	1.20
RNPP	4987 (509)	4987	0	0	0	0	-
SUNPP	3624 (1168)	3624	0	0	0	0	-
KhNPP	3837(1222)	3837	0	0	0	0	0.16
Energoatom	**19767 (5029)**	**19767**	**0**	**0**	**0**	**0**	**1.36**

( ) - personnel of other organizations*

Annual collective internal dose for these personnel at ZNPP in the reporting period was 1.20 man-mSv that was higher than in 2014 (1.08 man-mSv per year).

At RNPP, 789 cases of cesium-137 content and 95 cases of cobalt-60 content in critical organs above the MBA were registered for NPP personnel and personnel of outside organizations. Internal doses for these personnel were not calculated, since radionuclide content did not exceed the derivative monitoring level.

The annual collective internal dose for SUNPP personnel in 2015 was not calculated also, since the registered levels of cesium, cobalt-60 and iodine-131 content in monitored human organs did not exceed the MBA level.

At KhNPP in 2015, content of cobalt-60 in lungs above the MBA level was registered for ten persons from operating and repair personnel. Regarding eight of them, radionuclide intake was registered in previous years, as for the remaining two, cobalt in organism was detected for the first time. The annual collective internal dose for two persons of KhNPP personnel was 0.16 man-mSv (1.45 man-mSv in 2014).

4.4.6. Content of radioactive substances in the environment

Research regarding content of radioactive substances in environment objects within NPP location areas was conducted at all NPPs: water of surface water bodies, air, ground coating of adjacent settlements.

Analysis of cesium and strontium in water of NPP surface water bodies compared to "zero background" shows that these concentrations are values of the same order and may vary due to natural conditions: season, floods, drought, etc.

In 2015, tritium was monitored in water of ZNPP cooling ponds and adjacent water area of Kahovskyi reservoir, at RNPP, SUNPP and KhNPP in the Styr, Pivdennyi Bug and Goryn rivers.

The maximum values of tritium volume activity in ZNPP cooling pond was 98.6 kBq/m^3 representing the average level during the last years. At SUNPP, the maximum tritium values were registered in the Pivdennyi Bug river in front of the NPP 16.3 kBq/m^3, at the back of the NPP (control section) 20.0 kBq/m^3, in ZNPP cooling pond the maximum tritium concentrations were registered at the level of 133.0 kBq/m^3; in KhNPP cooling pond at the level of 91.0 kBq/m^3, in the Goryn river (in front of the NPP) 32.0 kBq/m^3, at the back of the NPP 54.5 kBq/m^3, and in the Styr river (Rivne NPP) in front of the NPP 7.1 kBq/m^3, at the back of the NPP 25.3 kBq/m^3.

The registered levels almost comply with the data in publications of the National Research Center for Radiation Medicine of the NAS of Ukraine whose experts monitor tritium in the country during the last years.

4.4.7. Content of Radioactive Materials in the Air and Surface Soil Layer

At all *Energoatom* NPPs, the air contamination by radioactive aerosols was monitored by the aspiration technique using filtering installations mounted at radiation monitoring points. Aerosol sampling was performed by air pumping through filter fabric.

Table 4.4.5. Density of surface ground layer contamination by cesium-137 at radiation monitoring points at a distance from operating NPPs in 2015, Bq/m^2

NPP	*"Zero background"*	Control area	Control area 10 km	10-20 km	> 20 km
ZNPP	*1180*	190	170	110	100
RNPP	*444 – 5070*	1050	3790	4770	2710
SUNPP	*1376*	291	235	277	324
KhNPP	*1180*	187	358	278	455

As the table shows, the density levels of soil contamination are within "zero background" values. The highest levels of soil contamination were registered in NPP location area that may be explained by uneven nature of the radioactive fallout caused by the Chernobyl accident.

Radiation parameters characterizing operation of NPPs in 2015 did not exceed the standard values and radiation protection of personnel and the public was provided at appropriate level.

5. IMPLEMENTATION OF NEW NUCLEAR FACILITY DESIGNS

Ukraine currently implements construction projects of several new nuclear facilities:

- Khmelnytsky NPP Units 3 and 4;
- Nuclear Fuel Fabrication Plant;
- Neutron Source Based on a Subcritical Assembly Driven by a Linear Electron Accelerator;
- Centralized Spent Fuel Storage Facility (see para. 6.2.);
- Dry-type Interim Storage Facility for Spent Fuel at Chornobyl NPP (see para. 6.2.).

5.1. Construction of Khmelnytsky NPP Unit 3 and 4

Taking into account that Ukraine almost two years has been confronting Russian aggression, the efforts on the construction of Khmelnitsky NPP units 3 and 4 according to Russian design have been suspended.

The construction of Khmelnytsky NPP units 3 and 4 was suspended after the feasibility study for construction of these units had been developed and approved in accordance with the established procedure by Cabinet Resolution No. 498-r dated 4 July 2012 and the Verkhovna Rada of Ukraine had adopted Law No. 5217-VI dated 06 September 2012 "On Siting, Design and Construction of Units 3 and 4 of Khmelnytsky Nuclear Power Plant".

This is related to the fact that the mentioned documents were based on the Russian design of the reactor for KhNPP units 3 and 4.

Taking into account the political relations between Ukraine and the Russian Federation, the Verkhovna Rada of Ukraine adopted the Laws of Ukraine (the drafts were approved by the SNRIU) on 16 September 2015:

- "On Declaring Invalid the Law of Ukraine "On Siting, Design and Construction of Units 3 and 4 of Khmelnytsky Nuclear Power Plant";
- "On Cancellation of the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Russian Federation to Cooperate on Construction of Khmelnytsky NPP Units 3 and 4".

After approval of the "Conceptual Decision on Construction of Khmelnytsky NPP Units 3 and 4" on 17 October 2014, *Energoatom* Company performed efforts in 2015 on the construction of Khmelnytsky NPP units 3 and 4 using WWER-1000/V-320 design of AT Skoda JS a.s. (Czech Republic):

- feasibility study revision;
- preparation of the draft Law of Ukraine on Amending the Law of Ukraine No. 5217-VI "On Siting, Design and Construction of Units 3 and 4 of Khmelnytsky Nuclear Power Plant";
- development of technical requirements for the reactor.

According to results of the above measures, *Energoatom* Company developed the document "Technical Requirements for WWER-1000 for Khmelnytsky NPP Units 3 and 4", whose state review was performed in 2015 by the SNRIU. At the same time, the stated document is under review to check completeness and correctness regarding comments of the state review of nuclear and radiation safety.

5.2. Construction of Nuclear Fuel Fabrication Plant

In compliance with legislation, construction of a nuclear fuel fabrication plant (and any other nuclear installation) can be started only under a license issued by the SNRIU for construction and commissioning. In turn, two main conditions for issuing this license is agreement of the preliminary safety analysis report (PSAR) by the SNRIU and approval of the design for this nuclear installation by the Cabinet of Ministers of Ukraine.

PSAR of the Plant was approved in accordance with SNRIU Board Resolution No. 18 of 4 December 2013, and in spite of the positive expert review report on the design documentation "Construction of Nuclear Fuel Fabrication Plant", No. 00-1085-13/PB, submitted by Ukrderzhbudekspertyza on 12 December 2013, the design of this nuclear installation was not approved in 2014-2015.

Considering the above mentioned and expired maximum deadline for consideration of applications of 24 November 2015, the SNRIU did not issue the license for construction and commissioning of the nuclear fuel fabrication plant since the design of this nuclear installation has not been approved and thus, there were no bases to issue such a license.

5.3. Construction of Neutron Source Based on Subcritical Assembly Driven by Linear Electron Accelerator

The Neutron Source Based on a Subcritical Assembly Driven by a Linear Electron Accelerator (Neutron Source) is being constructed on premises of the National Scientific Center "Kharkiv Institute of Physics and Technology" (KIPT) in accordance with the agreement reached at the Washington Security Summit and outlined in the Joint Statement of the Presidents of Ukraine and USA in April 2010 and Memorandum of Understanding between the Government of Ukraine and the Government of the United States of America on nuclear safety cooperation signed on 26 September 2011. The Neutron Source is under construction with support of the U.S. Argonne National Laboratory.

The Neutron Source is intended for scientific study and applied research in the fields of nuclear physics, radiation material science, biology, chemistry and production of medical radioisotopes. The Neutron Source was described in detail in the "Report on Nuclear and Radiation Safety in Ukraine for 2012".

This nuclear installation is created under SNRIU License EO No. 001018 for construction and commissioning issued on 10 October 2013.

According to the conditions of the above license, NSC KIPT as the operator, performed during 2013-2016 construction and mantling, development and agreement with the SNRIU of technical specifications for equipment important to safety and operating documentation of the Neutron Source.

In addition, the operator should obtain three individual permits within this license for:

- the first import of nuclear fuel for the Neutron Source to the territory of NSC KIPT industrial site;
- initial criticality of the Neutron Source;
- trial and commercial operation of the Neutron Source.

6. NUCLEAR FUEL MANAGEMENT

6.1. Diversification of Nuclear Fuel Supply

In order to diversify the supply of nuclear fuel and avoid dependence on the monopoly supplier, Energoatom has taken measures since 2000 on the development, delivery and qualification of an alternative supplier of nuclear fuel, compatible with Russian-design fuel. These measures are taken within the Implementing Agreement between the Government of Ukraine and the Government of the United States of America on "Nuclear Fuel Qualification Project for Ukraine" signed on 5 June 2000.

In preparation for the implementation of the Qualification Project, in 1999, the Core Design Center was established on the premises of KIPT, to which Westinghouse transferred technologies for design of nuclear fuel and reactor cores and guidance for safety analysis. Experts of the center successfully passed training and internship in the USA.

In the first phase of the Qualification Project in 2005–2009, trial operation of six pilot fuel assemblies manufactured by Westinghouse (FA-W) was conducted at SUNPP unit 3 during four fuel campaigns. In addition, the computer system for the in-core monitoring system was assembled and put into operation.

Since March 2010, in the framework of the second phase of the Qualification Project, trial operation of the reload batch consisting of 42 FA-W was started.

On 30 March 2008, a contract for supply of nuclear fuel for annual reloading of three WWER-1000 units in 2011 ÷ 2015 was signed between Energoatom and Westinghouse Electric Sweden AB (Västerås, Sweden).

In 2011 ÷ 2012, under the contract and with potential extension of the FA-W trial operation, four batches of nuclear fuel were supplied; two of them were loaded into the reactor cores of SUNPP units 2 and 3 in 2011.

In 2012, during scheduled outages, certain complications occurred during reloading of mixed cores at SUNPP units 2 and 3, which were caused by design features of fuel assemblies from both suppliers (TVEL and Westinghouse) that formed the core, namely:

- FA-W with damaged spacer grids were revealed;
- reactor cores could not be loaded as planned.

In this connection, further extension of Westinghouse fuel operation under the contract was suspended. Beginning from 2013, FA-W operation continued only in the SUNPP-3 core. According to the work program for FA-W trial operation, all fuel assemblies in the core were subjected to visual examination and integrity check using regular instrumentation of the power unit during each scheduled outage. Part of FA-W was inspected in more detail with use of the inspection and maintenance test bench supplied by Westinghouse.

At the end of 2014, four-year operating cycle expired for a number of FA-W, i.e., the full cycle envisaged by design documentation. Inspection of these fuel assemblies, including integrity check, revealed no issues.

Therefore, it can be noted that no loss of integrity was revealed during operation of Westinghouse reload batch during 2010÷2014, in spite of the damage of spacer grids during handling operations.

After the events in 2012, in order to recommence FA-W trial operation, Energoatom and Westinghouse, upon agreement with the SNRIU, identified a series of measures, including required upgrades and modification of fuel assembly design.

In 2013÷2014, Westinghouse upgraded the fuel assembly design and conducted comprehensive testing of the upgraded assembly (FA-WR).

Licensing of the upgraded assemblies was started in parallel. For this purpose, Energoatom and Westinghouse developed a full package of justification documents, which was strictly required by Ukrainian NRS regulations, and submitted it to the SNRIU for review. The first stage of this processes completed with an authorization issued by the SNRIU for loading of batch consisting of 42 FA-WR into the SUNPP-3 core in 2015.

The first phase of this process resulted in receiving SNRIU permit for loading of a reload batch of 42 FA-WR into the core by the operator at SU NPP unit 3 in 2015 according to the established procedure.

Thus, trial operation of 42 FA-WR (the first year of operation) and 36 FA-W (the fourth year of operation) was conducted during 2015 at SUNPP unit 3.

It is necessary to note that the capability of Westinghouse Electric Sweden AB to ensure required quality of production to be supplied to Ukrainian NPPs was confirmed by the Energoatom commission that provided in August 2014 the audit of quality control system of this company and acceptance of the FA-WR batch for SUNPP unit 3. A representative of SSTC NRS, technical support organization of the regulatory body, was delegated to the commission board according to the SNRIU order.

During the reporting period, Energoatom also developed and agreed with the SNRIU a set of documents justifying possible extension of trial operation of this fuel for 2016-2017 at Zaporizhzhya NPP units 1, 3, 4, 5 and South Ukraine NPP unit 2. Final decision will be made only conditioned that FA-WR inspection results are positive after the first year of operation (during scheduled outage in 2016) at South Ukraine NPP unit 3.

6.2. Spent Nuclear Fuel Management Facilities

Spent nuclear fuel (SNF) generated during electricity production in nuclear reactors is an important component of the NPP process cycle.

The period for which nuclear fuel is used in the reactors is determined by allowable burnup of fissile isotopes. After planned burnup is reached, nuclear fuel is unloaded from the reactor and is considered spent fuel since it cannot be used directly to produce electricity.

After unloading from the core, SNF is placed into spent fuel pools (SFP). SNF is cooled down in these pools for a period needed to decrease residual heat resulting from radioactive decay of fission products to allowable values. When SNF is stored in SNP for a limited time, spent fuel assemblies (SFAs) are to be removed from the NPP unit and sent for storage (disposal) or processing. This is done because the capacity of NPP SFPs is limited and they must always have free volume for nuclear fuel unloading from the core or periodic inspections of the WWER reactor pressure vessel and internals.

At the same time, factors that are determined by specific features of SNF are to be taken into account in its management: high radioactivity and presence of valuable elements in SNF (uranium, plutonium, germanium, erbium, palladium, zirconium etc.), which can be used prospectively, including that in other nuclear cycles (nuclear fuel for fast neutron reactors, MOX fuel for light-water reactors). Considering the above mentioned, SNF is not considered radwaste.

The state of nuclear energy all over the world shows that, given the current development of technologies, one cannot make ultimate conclusions on economic feasibility of SNF reprocessing or disposal, i.e., on the final stage in the nuclear fuel cycle (NFC). In this regard, Ukraine, like most countries with developed nuclear energy, accepted the so-called deferred decision, providing for long-term SNF storage. The postponed decision allows deciding on the final NFC stage later to benefit from the development of global technological and national economic feasibility.

Ukraine currently operates two interim spent fuel storage facilities: wet-type spent fuel storage facility – ISF-1 at the Chornobyl NPP – and dry-type spent fuel storage facility – Zaporizhzhya ISF.

In addition, two other storage facilities are under construction in Ukraine: dry-type interim spent fuel storage facility – ISF-2 at Chornobyl NPP – and centralized spent fuel storage facility of national NPPs with WWER – centralized ISF.

6.2.1. Management of WWER Spent Nuclear Fuel

The ZNPP was the first plant that had to deal with a lack of space for spent fuel in NPP SFP. To solve this issue, ZNPP started implementation of Zaporizhzhya ISF project in 1996.

Zaporizhzhya ISF design is based on the licensed and repeatedly tested spent fuel storage technology of Duke Engineering & Services (USA). SNF is stored as follows: 24 fuel assemblies with low decay heat (<1 kW) after five-year cooling in SFP are placed into a special canister, which is filled with helium (inert gas with high thermal conductivity) and sealed, then the canister is placed into a ventilated concrete storage cask (VSC). The storage facility is designed for 380 VSC, which may contain 9000 spent fuel assemblies.

The first stage of Zaporizhzhya ISF for 100 VSC was commissioned in 2001, and the second stage for 280 VSC - at the end of 2011.

Zaporizhzhya ISF

As of 01 January 2016, **131** VSC are placed at Zaporizhzhya ISF site.

During 2015, the SNRIU reviewed and approved six technical decisions “On the Content of Multiple Sealed Canisters with Spent Nuclear Fuel”.

Besides, in October 2015, the SNRIU started review of the periodical safety review Report of Zaporizhzhya ISF.

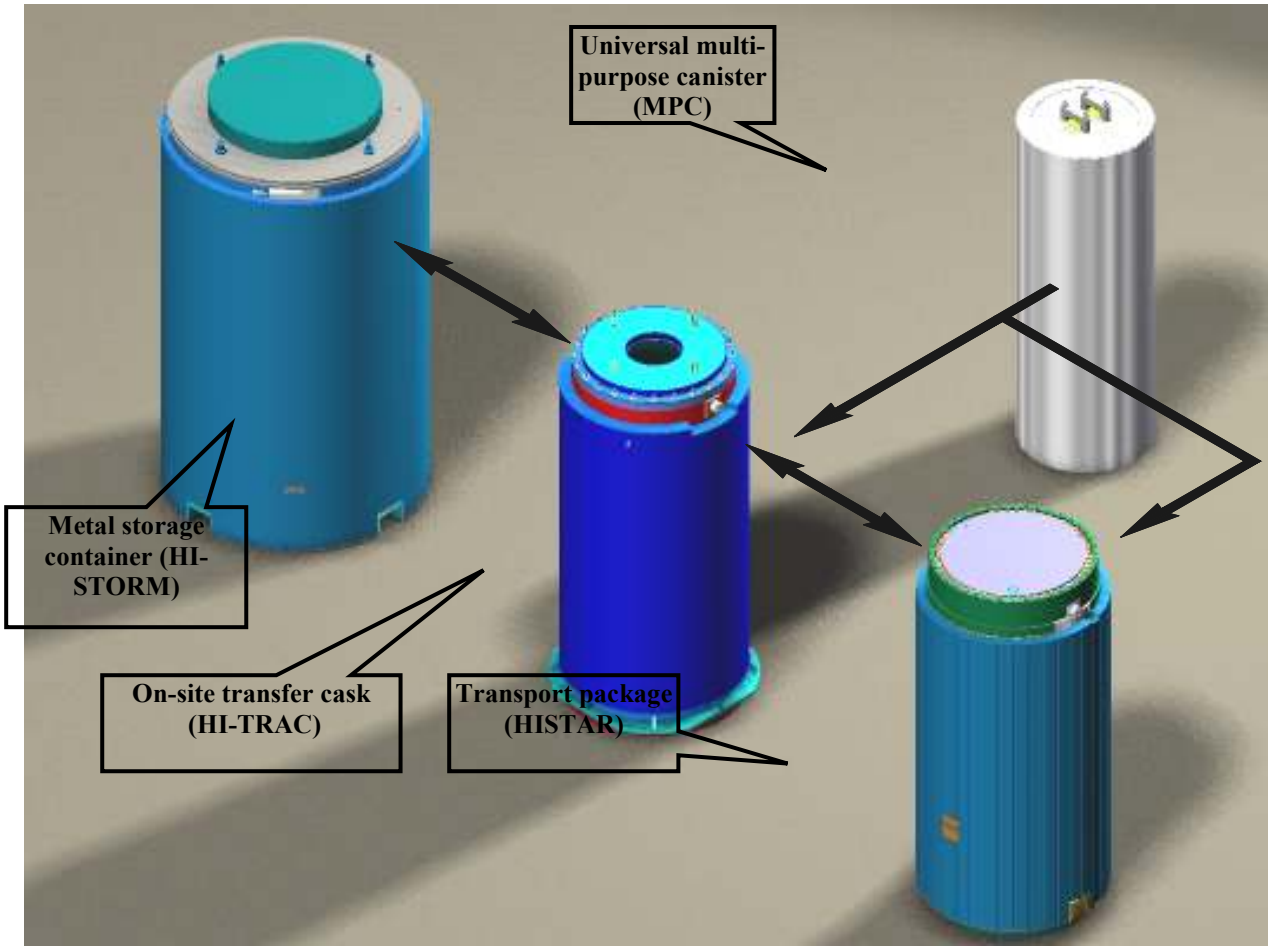
SNF from the Rivne, Khmelnytsky and South Ukraine NPPs is currently transported to the Russian Federation. WWER-1000 spent fuel was sent for storage and WWER-440 spent fuel (RNPP-1, 2) for reprocessing.

To implement the “Action Plan for 2006-2010 for Implementation of the Energy Strategy of Ukraine until 2030” (approved by Cabinet Resolution No. 427 of 27 July 2006), Energoatom concluded a contract with U.S. Holtec International for construction of a

centralized storage facility in Ukraine to accept spent fuel from the Rivne, Khmelnytsky and South Ukraine NPPs employing the dry storage technology proven at the Zaporizhzhya NPP.

In compliance with legislative requirements, Energoatom developed the "Feasibility Study for Investments into Construction of the Centralized Spent Fuel Storage Facility (centralized ISF) of the National WWER Nuclear Power Plants". The Feasibility Study was approved by Cabinet Resolution No. 131-r of 4 February 2009 after comprehensive regulatory review.

The Feasibility Study proved that long-term spent fuel storage in Ukraine was economically sound as compared to fuel transfer to the Russian Federation and justified the construction of one centralized spent fuel storage facility as compared to any other spent fuel storage options.



Centralized ISF main equipment

It is planned to store 12.500 WWER-1000 spent fuel assemblies and WWER-440 4000 spent fuel assemblies for 100 years in the centralized ISF.

On 9 February 2012, the Verkhovna Rada of Ukraine made a decision on centralized ISF siting in the Exclusion Zone and its design and construction by adopting Law of Ukraine No. 4383VI "On Management of Spent Nuclear Fuel in Siting, Design and Construction of Centralized Spent Fuel Storage Facility of National WWER Nuclear Power Plants".

On 30 April 2013, the SNRIU agreed the Energoatom document "Statement of Work on Upgrading the Technology of Spent Nuclear Fuel Unloading from WWER-1000 (M V-320) for Transfer to centralized ISF".

On 23 April 2014, Cabinet Resolution No. 399-r authorized Energoatom to develop a land utilization project and to allocate lands with a total area of 45.2 ha between the former villages of Stara Krasnitsa, Buryakivka, Chystohalivka and Stechanka of the Kyiv region in the

Exclusion Zone affected by the Chornobyl area to transfer them subsequently to Energoatom for permanent use with change of their purpose for the construction of centralized ISF and access railway.

On 22 July 2015, the SNRIU agreed the amended "Licensing Plan for Construction of the Centralized Spent Fuel Storage Facility" (PN-D.0.46.527-15) developed instead of PN-D.0.46.527-11.

On 23 July 2015, the SNRIU agreed the Operator's proposals on the content of the explanatory note "Construction Project for the Centralized Spent Fuel Storage Facility for Ukrainian NPPs with WWER" and submitted recommendations for centralized ISF design.

On 12 October 2015, a management committee was formed according to Energoatom Ordinance No. 926 for implementation of Holtec International technology for SNF management at Rivne, Khmelnytsky, South Ukraine NPPs that includes one representative from the SNRIU and SSTC NRS.

On 24 December 2015, the SNRIU sent to the State Enterprise "Specialized State Expert Organization - Central Service for Ukrainian State Construction Review" UKRDERZHBUDEXPERTYZA a Conclusion of the State NRS Review on the design of "Access Railway from Current Branch Railway Line Vilcha-Yaniv to the Construction Site of the Centralized Spent Fuel Storage Facility (centralized ISF)".

Since 28 December 2015, the SNRIU started review of technical specifications for the systems and equipment important to safety at the centralized ISF submitted by Energoatom according to the "Licensing Plan for Construction of the Centralized Spent Fuel Storage Facility".

In addition, SNRIU experts participated during 2015 in meetings of the management committee for implementation of Holtec International technology for SNF management at Rivne, Khmelnytsky, and South Ukraine NPPs that was formed according to Energoatom Ordinance No. 926 of 12 December 2015.

6.2.2. Management of RBMK Spent Nuclear Fuel

The RBMK design envisaged the following sequence of spent fuel management:

- after operation in the reactor, fuel was to be reloaded into SFPs to be cooled down for at least 1.5 years to reduce radioactivity and decay heat;
- after cooling in SFP, RBMK fuel should be sent to a wet-type spent fuel storage facility.

As of 01 January 2016, 21.284 spent fuel assemblies are stored on the Chornobyl NPP site. Among them:

- 21,231.5 spent fuel assemblies stored in ISF-1 SFP;
- 32 damaged fuel assemblies stored in unit 1 SFP;
- 20.5 damaged fuel assemblies stored in unit 2 SFP.

ChNPP unit 3 has no spent fuel, and further use of its SFP for spent fuel is not envisaged. In this connection, on 7 December 2012, the SNRIU agreed the ChNPP decision "On Recognition of Power Unit 3 as Radioactive Waste Management Facility". Therefore, ChNPP unit 3 has been regarded as a radwaste management facility since 8 December 2012.

There is no fresh nuclear fuel on the ChNPP site.

ISF-1 is operated under SNRIU License EO No. 000859 for operation of the nuclear installation – spent fuel storage facility of 25 June 2008.

ChNPP ISF-1

The Chornobyl NPP operator currently makes efforts to implement:

- Action Plan to Improve ISF-1 Safety, agreed by the SNRIU on 24 June 2008;
- Action Plan to Improve Safety of ChNPP Nuclear Installations approved by the SNRIU on 12 December 2011;
- Action Plan for Stabilization, Transfer and Storage of Special Canisters with Damaged Spent Nuclear Fuel agreed by the SNRIU on 25 March 2014 (in accordance with this Action Plan, it is planned to transfer and store damaged fuel assemblies from unit 1 and 2 SFPs to ISF-1 SFP in 2015-2016).

ISF-1 SFP room

In the framework of the stated above in 2015, the SNRIU reviewed and agreed the following documents:

- "Technical Decision for Modification of Storage Diagram for Damaged Spent Nuclear Fuel in Spent Fuel Storage Facility (ISF-1)";
- "Technical Decision for Modification of Mounting Diagram of Stocks for Damaged Spent Nuclear Fuel Management in 2 Assembly Cooling Pool-2 at ChNPP Unit 2";
- "Technical Decision on Modification of Diagram for Spent Fuel Storage in ISF-1 in Leak of Trench or One of Spent Fuel Pool Sections".

Resulting from these measures implementation, the operator performed ISF-1 safety review. The review results were presented in ISF-1 Safety Analysis Report Version 3.02, the conclusion of its state NRS review was approved by the Resolution of SNRIU Board No. 5 of 02 June 2015.

At the same time, the ISF-1 lifetime determined upon safety review in 2011 expires at the end of 2025. Therefore, a new dry-type interim storage facility (ISF-2) is under construction to ensure long-term safe storage of all spent fuel on the ChNPP site.

ISF-2 is being constructed under SNRIU License EO No. 001002 for construction and commissioning of the nuclear installation (interim spent fuel storage facility (ISF-2)) of 20 February 2013.

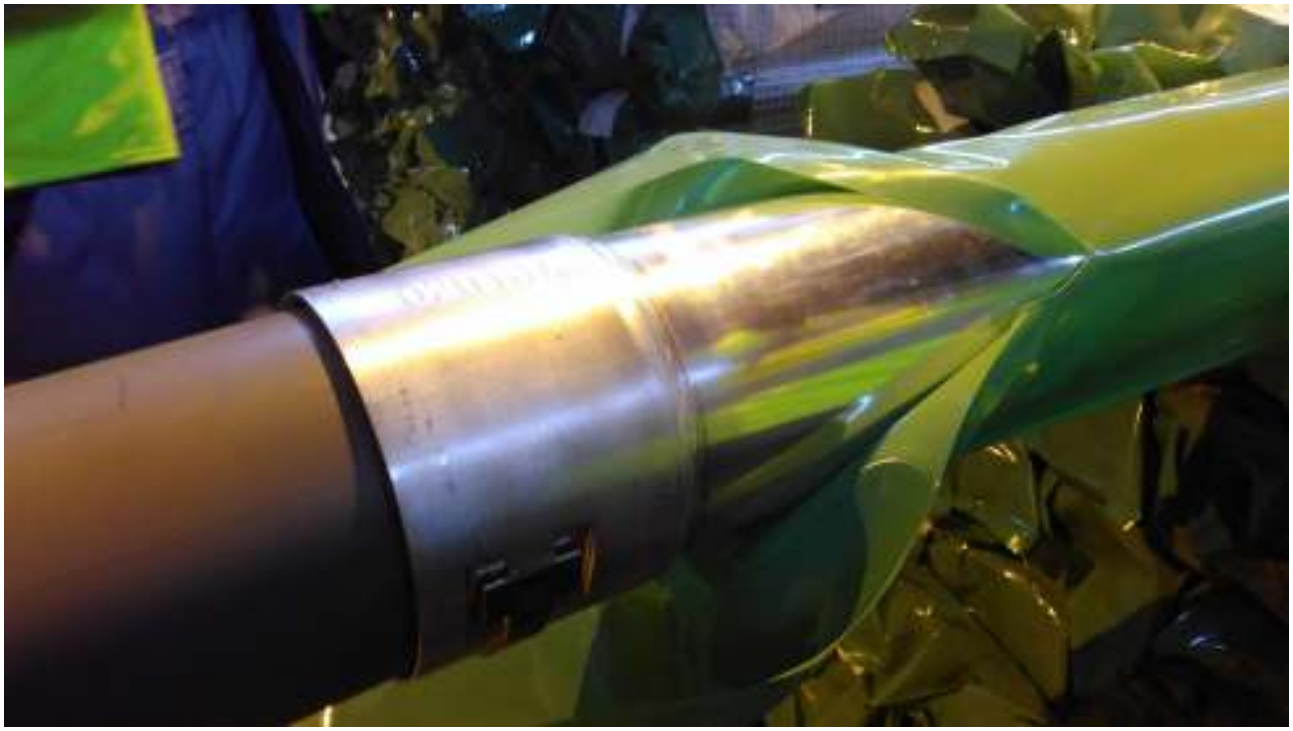
ISF-2 construction site

SNF management algorithm envisaged in ISF-2 design was presented in detail in the Report on Nuclear and Radiation Safety State in Ukraine in 2014.

During 2015, Chornobyl NPP continued development and agreement of packages of technical specifications (TS) and design documentation for the systems and equipment important to safety according to the established procedure. According to ISF-2 design, the following should be developed:

- 41 packages of TSs for equipment important to safety, 41 of which were preliminarily agreed by the SNRIU as of 01 January 2016 (14 were agreed in 2015);
- 7 TSs for the systems important to safety, all of which were preliminarily agreed by the SNRIU as of 01 January;
- 36 programs of acceptance testing of equipment important to safety, 22 of which were agreed by the SNRIU as of 01 January 2016 (20 of them were agreed in 2015); participation of SNRIU representatives in 12 acceptance tests was envisaged.

The first five double-walled shielded canisters at ISF-2 site



Fuel cartridges for spent fuel assemblies in double-walled shielded canisters

Besides, in 2015 the SNRIU experts developed and agreed according to the established procedure an Agreement on Amendment No. 1 to Agreement on Grant (ChNPP nuclear safety project) between the European Bank for Reconstruction and Development (as the Administrator of Grant funds of the Nuclear Safety Account), the Cabinet of Ministers of Ukraine and the State Nuclear Regulatory Committee of Ukraine (as a Receiver) of 8 July 2009" approved by the Resolution of the Cabinet of Ministers of Ukraine No. 1072-r of 13 October, 2015.

ISF-commissioning is planned in the 4th quarter of 2016.

6.3. Transport of Nuclear Fuel and Radioactive Materials

An important sphere of nuclear energy use is transport of radioactive materials to be used in nuclear energy, industry, medicine during radwaste management.

Radioactive materials are transported through public roads, thus, it is necessary to ensure conditions during transport that exclude impact of hazardous factors typical for radioactive materials on personnel, the public and the environment. In order to achieve this objective, administrative and technical measures should be taken such as licensing of radioactive material transport, issuing permits for international transport of radioactive materials, inspections, approval of package design and special conditions for radioactive material transport.

Radioactive material transfer is licensed according to the Law of Ukraine "On Authorizing Activity in Nuclear Energy Use". In 2015, the SNRIU issued, amended and revised 17 licenses. 47 enterprises have licenses for radioactive material transport.

The SNRIU issues permits for international transport in accordance with the procedure approved by the Resolution of the Cabinet of Ministers of Ukraine No. 1196 of 3 October 2007 in order to monitor transport of radionuclide sources and fresh and spent fuel through the borders during their import, export and transit. 17 permits were issued and amended in 2015.

An important segment in the structure of radioactive material transport is transfer of fresh and spent nuclear fuel of Ukrainian NPPs and fuel transit traffic between the Russian Federation and Eastern European countries such as Slovakia, Hungary and Bulgaria in accordance with intergovernmental agreements on cooperation in the field of nuclear material transport.

Railway wagon for nuclear fuel transport

The agreements specify basic legislative and administrative principles of cooperation in nuclear material transport: competent authorities involved in the implementation of agreements, international documents applicable to nuclear material transport, procedure for shipment tracking, physical security and protection, reloading points, guard changing points, responsibility for loss of shipment, civil responsibility for nuclear damage, elimination of accident consequences, the procedure of notification on transport.

The legislation of Ukraine also specifies the cases when transport of nuclear material and radioactive waste may not be implemented: in case of potential threats related to military actions, armed conflicts, civil war, insurrection, political or civil unrest, strikes, acts of terrorism; force majeure including natural events of exceptional, inevitable, unpredictable character; during the events of national importance in Ukraine (national holidays, international cultural and sport events, etc.).

In 2015, the SNRIU issued 28 licenses for transport of fresh and spent nuclear fuel of Ukrainian NPPs and transit traffic to foreign NPPs.

Safety during radioactive material transport is ensured through the use of transportation packages the design of which meets nuclear and radiation safety rules.

The international and national rules envisage approval of package design by competent authorities of producing countries, and multilateral approval of package design by competent authorities of transit and destination countries in case of international transport.

Package design compliance with the rules is approved by testing or calculations. Testing programs for different types of packages are specified in the IAEA rules and national regulations (Nuclear and Radiation Safety Rules in Radioactive Material Transport (PBPRM-2006)), and approved by the SNRIU in each individual case. As a rule, SNRIU representatives perform testing oversight. Testing results shall be fixed in minutes to be submitted with other technical documentation by Applicants to the SNRIU for package design approval.

Testing of transport packages

During radioactive material transport that does not comply with nuclear and radiation safety standards, rules and regulations, according to Article 58 of the Law of Ukraine “On Nuclear Energy Use and Radiation Safety”, the SNRIU shall approve special conditions for transport under which general safety level during transport is at least equivalent to a level that would be ensured if all applicable requirements of the rules are met.

The SNRIU issued 25 certificates for special conditions and 11 certificates for package design, at that, 7 certificates were issued in 2015.

In 2015, a range of administrative and technical measures specified by the legislation for safety regulation ensured high level of reliability and fail safety during radioactive material transport.

7. SAFE MANAGEMENT OF RADIATION SOURCES

7.1 International Standards, Approaches and Practice of Safety Regulation of Radiation Sources, Conceptual Changes and Prospects

Ukraine is one of the first countries in the world that considered the provisions of the Code of Conduct on the Safety and Security of Radioactive Sources (IAEA, 2003), which formed a basis of the state policy of radiation source safety and security.

This Code and the Guidelines on Export and Import of Radioactive Sources attached are an important tool to provide international safety and security mode of radionuclide sources.

The principles of this Code are to achieve and maintain high safety of sources during their lifecycle; prevent unauthorized access to radioactive sources, minimize radiological consequences of any accident or acts of crime related to radioactive sources; and increase safety level.

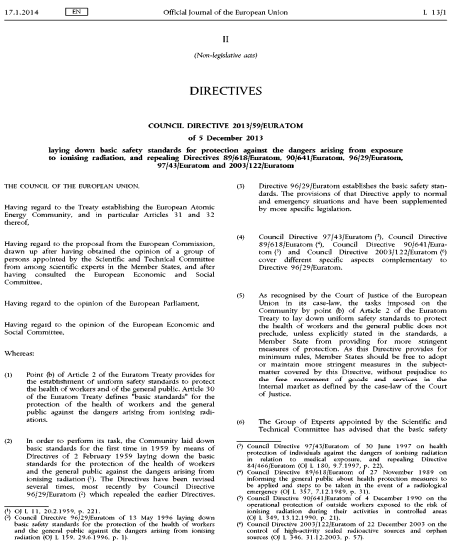
Taking into account the fact that radiation sources in Ukraine are in different sectors of economy (industry, medicine, scientific research, education, etc.), it is critical that their use be safe and consistent with the national and international requirements. The objective of this Code is achieved by establishing an appropriate regulatory control system of radioactive sources.

The State Nuclear Regulatory Inspectorate of Ukraine is responsible for coordination of measures aimed at development, functioning and progress of this system in Ukraine.

In 2015, SNRIU representatives took active part in IAEA development of harmonized *Guidelines to the Code on Management of Spent Radiation Sources.* It is necessary to note that the provisions of the draft Guides consider Ukrainian experience and practice in the regulation of safe management of spent radiation sources in expiration of their lifecycle, and legislative requirements in this sphere. The main ways of spent radiation source management are return to the Supplier, reuse and recycling, temporary storage in facilities and long-term storage followed by disposal at specialized radwaste treatment plants, etc.

One of SNRIU priority tasks in 2015 was to implement Council Directive 2013/59/Euratom, which establishes basic safety standards for protection against radiation and repeals Directives 89/816/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43Euratom and 2003/122Euratom.

This Directive is aimed at establishing the uniform basic safety standards to protect health of the public and people subjected to professional and medical exposure; improving the efficiency of radiation safety and radiation protection in using radiation sources in different spheres of economy and vital activity security; it shall be applied in case of planned, current and emergency exposure.



17.1.2014 EN Official Journal of the European Union L 13/1

II

(Non-legislative acts)

DIRECTIVES

COUNCIL DIRECTIVE 2013/59/EURATOM

of 5 December 2013

laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Articles 31 and 32 thereof,

Having regard to the proposal from the European Commission, drawn up after having obtained the opinion of a group of persons appointed by the Scientific and Technical Committee from among scientific experts in the Member States, and after having consulted the European Economic and Social Committee,

Having regard to the opinion of the European Parliament,

Having regard to the opinion of the European Economic and Social Committee,

Whereas:

(1) Point (b) of Article 2 of the Euratom Treaty provides for the establishment of uniform safety standards to protect the health of workers and of the general public. Article 30 of the Euratom Treaty defines "basic standards" for the protection of the health of workers and the general public against the dangers arising from ionising radiations.

(2) In order to perform its task, the Community laid down basic standards for the first time in 1959 by means of Directives of 2 February 1959 laying down the basic standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation (1). The Directives have been revised several times, most recently by Council Directive 96/29/Euratom (2) which repealed the earlier Directives.

(3) Directive 96/29/Euratom establishes the basic safety standards. The provisions of that Directive apply to normal and emergency situations and have been supplemented by more specific legislation.

(4) Council Directive 97/43/Euratom (3), Council Directive 89/618/Euratom (4), Council Directive 90/641/Euratom (5) and Council Directive 2003/122/Euratom (6) cover different specific aspects complementary to Directive 96/29/Euratom.

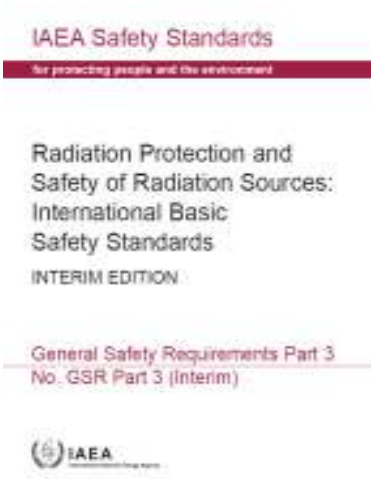
(5) As recognised by the Court of Justice of the European Union in its case-law, the tasks imposed on the Community by point (b) of Article 2 of the Euratom Treaty to lay down uniform safety standards to protect the health of workers and the general public does not preclude, unless explicitly stated in the standards, a Member State from providing for more stringent measures of protection. As that Directive provides for minimum rules, Member States should be free to adopt or maintain more stringent measures in the subject-matter covered by this Directive, without prejudice to the free movement of goods and services in the internal market as defined by the case-law of the Court of Justice.

(6) The Group of Experts appointed by the Scientific and Technical Committee has advised that the basic safety

(1) OJ L 11, 20.2.1959, p. 221.
(2) Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation (OJ L 159, 29.6.1996, p. 1).
(3) Council Directive 97/43/Euratom of 30 June 1997 on health protection of individuals against the dangers of ionising radiation in relation to medical exposure, and repealing Directive 84/466/Euratom (OJ L 180, 9.7.1997, p. 22).
(4) Council Directive 89/618/Euratom of 27 November 1989 on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency (OJ L 357, 7.12.1989, p. 31).
(5) Council Directive 90/641/Euratom of 4 December 1990 on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas (OJ L 349, 13.12.1990, p. 21).
(6) Council Directive 2003/122/Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources (OJ L 346, 31.12.2003, p. 57).

Chapter VII: Council Directives 2013/59/Euratom of 05 December 2013 are devoted to radiation safety regulation in medicine using radiation sources, particularly, the requirements for licensing of medical institutions, justification of medical exposure, monitoring of radiation parameters of equipment with radioactive sources, establishment and application of reference diagnostic levels for diagnostic procedures, and other safety requirements.

According to the international standards (GSR Part 3 International Basic Safety Standards, IAEA; Radiation Protection and Safety in Medical Uses of Ionizing Radiation, IAEA SAFETY STANDARDS DS399 of 22 September 2014), the functions of the nuclear regulatory body in the field of the use of radiation sources in medicine are to:



identify the type of authorizing procedure (notification, registration, licensing) applied for a medical institution;

establish requirements for the scope of radiation safety functions performed by personnel of a medical institution who perform activities using radiation sources (independently of authorizing procedure used – licensing or registration);

perform NRS review of projects of placement of radiation sources used in medicine or their reconstruction;

It is important that in compliance with the international standards:

conditions for release from licensing such as *safety and protection envisaged in radiation source structure, absence of accidents with such radiation sources, simple operating procedures, etc.* are not used for release from licensing of radiation sources used in medicine for three reasons (patient's safety depends on human factor, equipment design does not provide radiation safety and security, personnel training is important);

license for medical practice (in using radiation sources for diagnostics or therapy) is not issued by the Ministry of Health Protection without an authorizing document of the nuclear regulatory body.

Thus, coordination and interaction with the health protection authority and state regulatory authority are necessary for radiation protection and comprehensive safety in a medical institution**.**

The SNRIU applies considerable efforts to preserve and develop the system of state regulation (licensing, registration, oversight) for safe use of radiation sources in compliance with EU legislation and IAEA standards.

7.2 State Safety Regulation of Radiation Sources in Ukraine

The state regulation of nuclear energy use (Article 27 of the Law of Ukraine "On the Use of Nuclear Energy and Radiation Safety") is extended to the use of radiation sources in industry, agriculture, medicine, education and research considering differentiated approach to safety requirements depending on potential nuclear and radiation hazard of a particular type of activities related to specific facilities (sources).

The principle of individual approach is also used in the authorizing activity: the system procedure, levels and criteria of radiation source release from regulatory control, state registration and licensing were established.

That is, since 2000 the SNRIU uses during its activity the optimization principle of state regulation (not just deregulation, but also finding an optimum state regulation level considering the potential hazard of facilities and types of activity related to them).

4 167 entities in Ukraine use radiation sources, only **59% (2481)** of them are subjected to licensing; the others are released from licensing according to the procedure established by the legislation **(41%).**

According to the criteria established by the Cabinet of Ministers of Ukraine (Resolution No. 1174 of 16 November 2011), the following is released from licensing: educational and medical institutions (x-ray rooms, stomatology, fluoroscopy, mammography etc.); enterprises using radioactive sources for calibration (metrological centers, enterprises with smoke detectors, aviation enterprises, etc.); scientific and industrial enterprises using electron microscopes and X-ray analysis devices; customs authorities using radiation sources to check luggage etc.

At the same time, the state regulation (oversight and authorizing activity) is performed by institutions dealing with high potential hazard: oncologic centers; scientific institutions with linear accelerators; enterprises using intensive radiation sources (e.g., flaw detectors at NPP, in construction and science) etc.

The activity dealing with the use of radiation sources is licensed exceptionally to ensure nuclear and radiation safety; it is not a permit for economic activity, and provided that the enterprises, organizations and institutions ensure the required level of nuclear and radiation safety in the licensing process, safe conditions are formed for business development in different sectors of the economy.

In 2015, the SNRIU proposed the following in form of a respective draft law in order to optimize the state regulation and decrease regulatory pressure on radiation source users with low level of potential hazard:

release from licensing the transport of radioactive materials by rail, water and air transport; reloading (loading, unloading and shipment) of packages and their transit storage in sea and river ports, airports, railway stations provided that carriers and organizations

performing such operations have a license for transport of hazardous shipment in order to avoid duplication in licensing;

exclude receiving (purchase) and transfer (sale) of such sources including also their supply from the list of activities related to the use of radiation sources subjected to licensing.

24 582 radiation sources are used in Ukraine, **9 654** of them are radionuclide sources and **14 928** are radiation generators.

Flaw detector **Protection with uranium (biological protection)** **Transport cask**

In 2015, **519** radiation sources were deregistered, **265** of them were spent radionuclide sources transferred for storage to specialized radwaste treatment plants, **14** radiation sources were returned to the suppliers abroad, **254** generators were put out of operation.

In 2015, **187** radionuclide sources to be used in medicine and industry were transported to the territory of Ukraine. As compared to 2013 and 2014, the number of radiation sources imported was decreased only by 15-20%.

Radioisotope process monitoring devices (moisture and density meters, etc.)

The main producers and suppliers of radionuclide radiations sources to the territory of Ukraine are enterprises in Poland, Belarus, Germany, Netherlands, the USA, Czech Republic, Finland, in particular, the following: the National Center for Nuclear Research (successor to the Institute of Atomic Energy POLATOM) joint Belarusian-Russian CJSC *Isotopic Technologies*, Eckert&Zeigler Nuclitec GmbH, Berthold Technologies GmbH&Co.KG, Mallinckrodt Medical BV, Environics Oy, etc.

Radionuclide sources in Ukraine are supplied by Ukrainian State Production Enterprise Isotop, Ltd. "Foreign Trade Company *Impuls"*, Ltd. Tutkov Borehole Service, Ltd. STAR TECHNOLOGY, and the intergovernmental organization *Ukrainian Science and Technology Center*.

The number of radionuclide sources imported in 2015 and their application area are stated in Table 7.1

Table 7.1

No.	Radionuclide	Application area	Number of radiation sources	
			Units	% (of imported)

1	Am-241	Radioisotope monitoring devices	92	49.7
2	Ir-192	Gamma-therapy, Gamma-radiography	34	18.34
3	Cs-137	Radioisotope process monitoring devices	24	13.0
4	Co-60	Gamma-therapy, Radioisotope process monitoring devices, exposure installations, radiography	20	10.8
5	Cf-252	Radioisotope monitoring devices	5	2.7
6	Others		10	5.4

The main users of radionuclide radiation sources in 2015 are the State Border Service of Ukraine - 41.62%; industrial enterprises (in nuclear energy sector, mining and processing, metallurgy, ship-repair and shipbuilding, oil and gas, paper, pulp and cardboard branches, etc.) - 43.78%; medical oncological institutions- 14.60 %.

14 spent radiation sources were exported from the territory of Ukraine in 2015, 12 of them to be used in medicine were returned to the producer to the Netherlands and two radiation sources to be used in industry were returned to the producer to Poland.

2 083 radiation sources with lifetime over 35 years are used in Ukraine, including: 25 sourced produced in the fifties of the previous century and 170 sources produced in the sixties. Over 100 entities did not make a decision on further management of spent radionuclide sources.

The information on import of unsealed radiation sources to Ukraine in 2015 for medical exposure is given in Table 7.2:

Table 7.2

	2015	**For comparison**	
		2014	**2013**
I-131	3 687,774 Gbq	1 192,138 Gbq	2 049,08 Gbq
I-125	23 815,179 MBq	966,75668 MBq	16 452,246 MBq
P-32	13 290,07 MBq	8 391,97 MBq	7 816,879 MBq
Sr-89	2 430,3 MBq	4 500 MBq	1 050 MBq
Sm-153	104 292,0 MBq	198 MBq	24 036 MBq

The information on production of radiation generators in Ukraine in 2015 is presented in Table 7.3:

Table 7.3

Producer enterprise	**Type of manufactured generator**	**Produced (units)**	**including**	
			for Ukrainian needs	**exported abroad**
CJSC Kyiv Production Enterprise *Medaparatura*	X-ray diagnostic complex with digital image processing RDK-VSM	8	5	3
	X-ray with digital image processing FTsOZ	22	16	6
LTS. X-ray Equipment Plant *Kvant*	X-ray diagnostic complex KRD-50 INDIagraf	11	11	-
	X-ray diagnostic complex INDIascop	2	2	-

Producer enterprise	Type of manufactured generator	Produced (units)	including	
			for Ukrainian needs	exported abroad
	X-ray diagnostic complex INDIascan	7	7	-
Radmir firm	X-ray mammographic digital complexes MADIS	8	4	4
	X-ray mammographic digital complexes SIMA	5	-	5
Ltd. Scientific and Production Enterprise *KRAS*	X-ray digital device Aspect	1	1	-
	X-ray device 12F9 Ukraina	10	10	-
	X-ray device KRAS 30/50	4	4	-
Ltd. Teleoptik	X-ray diagnostic digital complex KRDTs	4	4	-
Ltd. Elvatekh	Spectrometer of the X-ray radiation energy SER-01 and SER-02	108	5	103
Ltd. Institute of Analytical Monitoring Methodologies	X-ray fluorescent elemental analyzers of alloys Expert 3L	6	5	1
	X-ray fluorescent elemental analyzers of alloys Expert Mobile	1	1	-
TOTAL		197	75	122

The number of radiation generators produced abroad and imported to Ukraine in 2015 is 46 units to be used in medicine.

Placement of radiation sources and their owners in administrative - territorial units of Ukraine is demonstrated in Table 7.4:

Table 7.4

Administrative - territorial unit (region)	Total number of owners	Radionuclide radiation sources	Generators
Vinnytsia	123	66	465
Zhytomyr	103	70	374
Kyiv	129	1 909	556
Cherkasy	113	50	327
Chernihiv	75	44	308
The city of Kyiv	286	421	1 419
Dnipropetrovs'k	329	1 221	1 130
Kirovohrad	80	70	320
Donets'k	447	692	1287
Zaporizhzhya	174	573	618
Luhan'sk	200	337	621
Kharkiv	316	1 005	1 350

Administrative - territorial unit (region)	Total number of owners	Radionuclide radiation sources	Generators
Poltava	141	373	516
Sumy	151	137	466
Rivne	95	266	323
Volyn’	78	46	266
Khmelnytsky	132	157	398
Ternopil	87	8	251
Ivano-Frankivs’k	101	54	374
Lviv	163	219	747
Zakarpattya	69	88	298
Chernivtsi	56	23	311
Odesa	212	1 019	684
Mykolaiv	82	540	341
Kherson	87	12	279
The Autonomous Republic of Crimea	310	139	804
The city of Sevastopol	28	138	66
Total in Ukraine	**4 167**	**9 654**	**14 928**

8. ACTIVITY IN THE EXCLUSION ZONE

8.1. Chornobyl NPP Decommissioning

Chornobyl NPP is being decommissioned and the respective projects are implemented within this activity according to SNRIU License EO 000040 of 22 March 2002.

According to Chornobyl NPP Decommissioning Program and conditions of the license, decommissioning is implemented in the following stages: termination of operation, final closure and preservation, safe storage, and dismantling.

In March 2015, the SNRIU completed the review of ChNPP application and a package of documents and issued individual license OD 000040/8 for activity at the stage of final closure and preservation at Chornobyl NPP units 1, 2 and 3.

This license resulted in termination of operation and beginning of Chornobyl NPP decommissioning stage.

A package of the following main documents was analyzed during the licensing process for the stage of final closure and preservation: project of final closure and preservation of units 1, 2 and 3, Chornobyl NPP safety analysis report at the stage of final closure and preservation, stage implementation program, radiation protection program and radwaste management program, operating procedures of units 1, 2 and 3 at the stage of final closure and preservation, as well as other documentation.

The documents submitted describe the activity to be performed at ChNPP including spent nuclear fuel and radwaste management, operation of ChNPP industrial site and infrastructure on it, etc.

The implementation of final closure and preservation project is envisaged within six commissioning stages (CS):

- CS-1 – reconstruction of fire water system at Chornobyl NPP;
- CS-2 – dismounting and upgrade of ChNPP process channels and CPS channels;
- CS-3 and CS-5 –of reactor preservation and confinement of unit preservation areas of Chornobyl NPP units 1, 2, and 3;
- CS-4 and CS-6 – reconstruction of central hall covers and dismounting of hoisting devices at Chornobyl NPP units 1, 2 and 3.

Completion of the final closure and preservation stage is envisaged in 2028.

Radwaste management facilities at Chornobyl NPP

Radioactive waste accumulated during Chornobyl NPP operation, accident elimination in 1986, those generated during decommissioning of units 1, 2 and 3 and the Shelter transformation into an environmentally safe system are stored in radwaste storage facilities at Chornobyl NPP site such as solid radwaste storage facility, liquid radwaste storage facility, and solid and liquid radwaste storage facility[1], and are transferred for disposal to facilities at Buryakivka radwaste disposal site.

[1] ChNPP liquid radwaste storage system consists of interrelated special piping for liquid radwaste pumping in the following storage facilities:

- liquid radwaste storage facility (LRSF) designed for 26 000 m^3 including 5 intake tanks with volume of 5000 m^3 and two intake tanks with volume of 500 m^3 made of corrosion resistant steel;
- liquid and solid radwaste storage facility (LSRSF) that operates only for liquid radwaste storage is designed for 12 000 m^3 and includes 12 intake tanks with volume of 1 000 m^3 made of corrosion resistant steel;
- radioactive oil storage facility consisting of two tanks with volume of 72 m^3 each.

During 2015, 18.35 m^3 of liquid radwaste was generated at Chornobyl NPP and sent for storage, including 15 m^3 of vat residue and 3.35 m^3 of perlite pulp. In total, the following was accumulated at the end of 2015 in liquid radwaste storage facilities: 13 523.40 m^3 of vat residue; 4 082.36 m^3 of spent ion-exchange resin; 2 293.38 m^3 of perlite pulp; 145.314 m^3 of radioactive contaminated oil-fuel mixture.

Low – and intermediate-level solid radwaste generated during decommissioning and the Shelter transformation into the environmentally safe system are transferred for disposal to facilities at Buryakivka radwaste disposal site. 4923.80 m^3 (7669.06 t) of low-level radwaste and 87.60 m^3 (121.20 t) of intermediate level solid waste were transported to Buryakivka radwaste disposal site in 2015.

High-level radwaste is collected into special casks (KTZV-0.2) and placed in temporary solid radwaste storage facility in a building of former fresh fuel storage facility. During 2015, 0.01 m^3 (0.007 t) of solid high-level radwaste and 0.33 m^3 (2.07 t) of low-level and intermediate level long-lived radwaste was generated and transferred for storage.

A number of radioactive waste management facilities was constructed and is being currently put into operation at Chornobyl NPP site in the framework of international technical assistance projects. The commissioning of these facilities will provide processing of accumulated and generated radwaste to bring them to a condition suitable for safe disposal.

Liquid radwaste treatment plant (LRTP) is designed to process liquid radwaste accumulated in tanks of LRSF, LSRSF and SRSF that will be generated resulting from decommissioning.

On 11 December 2014, the SNRIU issued individual license OD 000040/7 for LRTP operation.

However, the plant operation may be started in presence of a Certificate for Facility Completion according to the Procedure for Completed Facility Commissioning approved by the Resolution of the Cabinet of Ministers of Ukraine No. 461 of 13 April 2011.

This Certificate is absent in Chornobyl NPP and fire and lighting protection systems should be reconstructed in accordance with new regulations in order to obtain it. This requires additional time and funding from the State Budget of Ukraine.

For such reasons, processing of liquid radwaste at LRTP in 2015 has not been performed, and support of equipment and systems in an operable state has been provided.

During the reporting period, the SNRIU considered and approved the following documents on LRTP:

- Decision on Subsequent Processing of ChNPP Liquid Radwaste Considering the Results of Activities at the Stage of LRTP Commissioning;
- Radiation Monitoring Procedure during Operation of ChNPP Liquid Radwaste Treatment Plant.

Industrial complex for solid radwaste management (ICSRM) at ChNPP site includes a number of radwaste management facilities[2]. ICSRM facilities were completed, their commissioning is underway.

[2]**Temporary storage facility for low-level and intermediate level long-lived high-level radwaste** is designed for interim storage (during 30 years) of long-lived and high-level radwaste that will be generated during sorting at SRTP, and activities aimed at preparation to construction of the Shelter New Safe Confinement. This storage facility was constructed by means of reconstruction and re-equipment of a room, which was located on the upper level of ChNPP LSRSF that has not been operated until present;

SRRF is solid radwaste retrieval facility designed to retrieve solid radwaste from current solid radwaste storage facility at ChNPP and transfer radwaste for processing to SRTP;

Three stages of **SRRF** and **LRTP** commissioning are envisaged to test and maintain functioning of all systems including equipment for radwaste characterization and sorting:

Stage 1 – testing of radwaste in sealed packages with characteristics known in advance (completed),

Stage 2 – testing of unsealed radwaste with known characteristics (completed),

Stage 3 – testing of radwaste retrieved from solid radwaste storage facility sections.

In 2015, ChNPP performed preparation to ICSRM commissioning and developed a "Decision on Stage 3 of Hot Testing and Initial Stage of ICSRM Commercial Operation agreed with the SNRIU at the beginning of 2016.

Radwaste will be received and placed for storage in sections of temporary storage facility for low-level and intermediate-level long-lived and high-level radwaste after completion of SRTP commissioning.

The SNRIU also considered and approved in 2015 Technical Decision "On Construction of Decontamination Section in Building BNS-1,2" to meet the needs for decontamination of a significant amount of dismantled structures and equipment, which is released in the framework of ChNPP decommissioning.

ChNPP started operation of the said decontamination section.

8.2. Construction of the Shelter New Safe Confinement (NSC)

The task related to the Shelter transformation into an environmentally safe system was solved through a subsequent development and implementation of individual plans, projects and programs.

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

NSC project implementation is envisaged in the framework of two commissioning stages (NSC CS):

- NSC CS-1– protective building with process life support systems and required infrastructure;
- NCS CS-2 – an infrastructure for dismounting of non-stable structures of the Shelter.

NSC design lifetime makes up 100 years.

NSC CS-1 is currently implemented by the contractor for design, construction and commissioning of which is French Company Novarka.

According to the predicted design schedule, NSC CS-1 will be completed in November 2017.

NSC arch structures are mounted at a specially equipped site to the West from the Shelter at the distance of about 200 meters to decrease the Shelter negative effect on personnel during the work.

After mounting completion, NSC arch will be transferred and established into a design position over the Shelter[3].

SRTP is solid radwaste treatment plant designed for sorting of solid radwaste of all categories and processing (fragmentation, incineration, compaction, concreting) of low-and intermediate-level short-lived solid radwaste retrieved from solid radwaste storage facility and waste generated resulting from ChNPP decommissioning and the Shelter transformation into an environmentally safe system. SRTP also envisages packaging of long-lived high-level radwaste that will be generated during sorting, and transport of these packages for storage to temporary storage facility.

[3] Important stages of NSC CS-1 construction during 2012-2014:

For the Eastern part of the arch:

-the first lifting of the arch at the height of about 53 m was in November 2012.

- completion of the second lifting of the arch to the level of 85 meters was in June 2013;
- the third jacking to the level of 109 meters was performed in several stages and completed in October 2013;

ChNPP and Novarka performed practical work envisaged in the design decisions approved by the SNRIU.

The Structures of the Western and Eastern parts of the arch were mounted at the site for NSC arch mounting and in the local area of the Shelter, particularly, end walls, ventilation center and air ducts of the ventilation system; the activity on covering the inner and outer walls of the arch was continued; the components of NSC main crane system were installed; the process building and other auxiliary buildings were constructed: buildings of electrical and technical devices, firefighting pump station; NSC external and internal space was equipped (electricity, water, sewage), etc.

An important stage of NSC design implantation was joining together of the Western and the Eastern part of the arch that was successfully completed on 24 July 2015.

Safety assessment of the following main documentation was performed within the reporting year by the SNRIU within the regulatory support of NSC CS-1 construction:

- the state NRS review was performed and four work projects were agreed related to reinforcement and confinement of ChNPP Stage II building structures performing functions of NSC fencing system;

- from 31 March to 02 April 2014, the Eastern part of the arch was transferred to the waiting area; the structure with the weight of 12.6 thousand ton was transferred by 112 meters within 72 hours;

For the Western part of the arch:

- the first lifting was completed in May 2014;
- the second lifting was completed in August 2014;
- the third lifting of the arch with total weight of over 12 560 ton to the height of 109 meters was completed on 12 November 2014;
- the first stage of back skidding of the arch was completed on 26 November 2014: the Eastern part of the arch was transferred by 25 meters to the Western part; the distance between the end parts of the metal structures of two halves of the arch was 1.35 m.

- a review was performed and three technical decisions were agreed on management of radioactive materials and radwaste generated during NSC fencing structure reinforcement and confinement;
- a review was performed and document "NSC Main Crane System. Specification for Purchase" was agreed as a preliminary technical specification for the main crane system; compliance with the requirements of this system should be approved by acceptance testing results;
- review was performed and amendments to NSC CS -1 design related to the optimization of the power supply system and NCS electrical equipment;
- technical assessment was conducted and regulatory decisions were developed in the packages of operational documentation on safety justification of NCS fire water system, the ventilation system and the system for installation of sealing anchors, and standard shielding at the upper levels of the NCS, etc.

Joining together of the Eastern and Western parts of NSC arch

As regards NSC CS -2, that is, the infrastructure for dismounting unstable structures of the Shelter, its designing is envisaged in two Stages:

Stage 1 – studying of an option of "integrated dismounting/management" and option of "dismounting with postponed management" related to dismounted structures and radwaste and justification of option selection (completed);

Stage 2 – development of NSC CS-2 working design for the selected option of dismantling.

At the beginning of 2015, the SNRIU agreed ChNPP technical decision "On Selection of an Option for Early Dismantling to Develop NSC CS-2 Working Design *Infrastructure for Dismantling of the Shelter Unstable Structures*",

According to this decision, the implementation of an option for integrated dismantling/management is envisaged within NSC CS-2 as the most advisable one in view of economy and technology.

Such option is also acceptable in view of safety since management of dismantled structures and radwaste that will be generated during the activities is more optimized in this option.

However, NSC CS-2 working design was not developed because of lack of funding and uncertainties in financing.

8.3. Radwaste Management Facilities in the Exclusion Zone

The Exclusion Zone of unconditional compulsory evacuation is the territory of Ukraine contaminated by radionuclides resulting from Chornobyl accident, from which the population was evacuated during the first years after the accident.

The State Specialized Enterprise *Centralized Radwaste Management Enterprise* (SSE CRME), which is assigned by the Operator at the stages of operation and closure of radwaste disposal facilities, performs the main activity related to radwaste management on the territory of the Exclusion Zone (except ChNPP site), as well as individual types of activity aimed at radwaste processing and transport.

SSE CRME performs the following on the territory of the Exclusion Zone:

- operation of two parallel modules of engineered near surface solid radwaste disposal facility (ENSDF) at the Vektor site for radwaste package disposal from LRTP and SRTP;
- operation of near-surface radwaste disposal facilities - Buryakivka radwaste disposal site;
- maintenance and safety enhancement of Pidlisnyy and ChNPP Stage III radwaste disposal site established during the first years of accident elimination at ChNPP;
- maintenance, survey monitoring and elimination of trenches and storage pits in radwaste interim confinement points (RICP);
- operation of decontamination point of overalls and individual protection means and decontamination point for special vehicles and equipment.

The State specialized enterprise for Exclusion Zone capital construction management assigned by the Operator at the stage of siting, design, and construction of radwaste storage-disposal facilities of the Vektor complex performs designing, construction and repair of radwaste management facilities on the territory of the Exclusion Zone (except ChNPP site).

Chornobyl Specialized Plant performs radiation and dosimetric monitoring and environmental control in the Exclusion Zone.

The Vektor complex

The site of the Vektor complex is placed on the territory of the Exclusion Zone at the distance of 11 km in the South-West direction from the Chornobyl NPP.

The Vektor complex is a complex of enterprises for radwaste decontamination, transport, processing and disposal. The construction of this complex was started in March 1998 in two stages.

The Vektor complex Stage 1 is designed for disposal of radwaste generated resulting from Chornobyl accident. The commissioning stage 1 includes a facility for radwaste disposal in reinforced concrete containers (SRW-1) and module disposal facility for non-packed large-sized radioactive waste in bulk (SRW-2) with total capacity of 19.2 thousand m^3 and required infrastructure facilities.

Unfortunately, completion of SRW-1 and SRW-2 radwaste disposal facilities and other Vektor complex facilities was stopped in 2010 and has not been renewed until present. The buildings and equipment are degraded through constant delays of completion, some infrastructure facilities constructed at the beginning of 2000 are to be already subjected to repair, the design cost increases, reliability of safe radwaste storage in new facilities requires additional measures aimed at inspection and assessment.

The Vektor site – the main facilities of Stage 1 and ENSDF

The engineered near surface disposal facility designed for disposal of ChNPP conditioned radwaste was constructed and commissioned at the Vektor site. The design capacity of the disposal facility is 50 210 m^3 for radwaste packages. ENSDF consists of two parallel sections; each has 11 reinforced concrete compartments (modules). The facility is equipped by central drainage gallery, two portable frame structures with bridge cranes for filling of modules, the radiation and environmental monitoring system. In the framework of the disposal facility operation, the functioning of the central drainage gallery under the disposal facility and monitoring of the state of building structures in disposal facility modules is provided, up-to-date methodologies of safety assessment are studied and implemented for ENSDF safety review in order to extend the number of radwaste suppliers and actualize radwaste acceptance criteria to this disposal facility.

The SNRIU submitted to SSE CRME the regulatory decisions on approval of acceptance of radwaste packages produced in other radwaste treatment plants (except Chornobyl NPP) for disposal to ENSDF. In 2015, 74 packages of conditioned radwaste with total mass of 123588 kg was accepted from Kharkiv SISP for disposal to ENSDF. In total, 66.78 m3 of radwaste with activity of 1.7E+11 Bq were disposed in ENSDF.

Radwaste disposal in ENSDF Section A-1

According to the feasibility study of the Vektor complex Stage 2 approved by the Resolution of the Cabinet of Ministers of Ukraine No. 1605-r of 23 December 2009, **the Vektor complex Stage 2**, envisages construction of a complex of radwaste management facilities:

– centralized near surface disposal facilities for radwaste generated during operation of current Ukrainian NPPs and accumulated at the sites of the specialized radwaste treatment plants of the Ukrainian State Association *Radon*;

– treatment plants of Chornobyl radwaste and the one from the sites of the specialized radwaste treatment plants of the Ukrainian State Association *Radon*;

– long-term storage facilities for high-level long-lived radwaste including long-term storage facilities for vitrified waste that will be returned from the Russian Federation after treatment of spent nuclear fuel from Ukrainian NPPs;

– centralized long-term storage facility for spent radiation sources.

During 2015, construction of the centralized long-term storage facility for spent radiation sources and mantling of the systems and equipment in this storage facility related to technological process of management of spent radiation sources including their acceptance, treatment and long-term storage as well as radiation monitoring and ventilation systems was completed. The project implementation is supported by the Department of Energy and Climate Change of the Great Britain.

SSE CRME was appointed as the operator at the stages of operation and closure.

SSE CRME performed testing of the systems important to safety of the centralized long-term storage facility for spent radiation sources (CLTSF) including comprehensive tests (cold startup) of CLTSF according to appropriate programs agreed with the SNRIU.

The SNRIU accepted SSE CRME licensing documents for consideration regarding CLTSF operation together with the documents justifying safety of comprehensive (hot) tests of CLTSF using spent radiation sources at the beginning of operation.

CLTSF is a facility that does not have any analogs in the world at present and is the main component for improvement of the whole management system of spent radiation sources in Ukraine. CLTSF should provide centralized placement of the whole amount of spent radiation sources (about 500000 spent radiation sources of different type and structures) accumulated currently at the sites of specialized radwaste treatment plants of the Ukrainian State Association *Radon* and used in medicine and industry.

CLTSF

CLTSF storage site for spent radiation sources

Existing radwaste management facilities on the territory of the Exclusion Zone

Facilities for disposal and confinement of a large amount of emergency radwaste were constructed on the territory of the Exclusion Zone in 1986-1987 in taking urgent measures for Chornobyl accident elimination. These radwaste disposal facilities include facilities at

Buryakivka and Pidlisnyy radwaste disposal site, ChNPP Stage III radwaste disposal site and radwaste interim confinement points (RICP).

Buryakivka radwaste disposal site is operated since 1987. Buryakivka radwaste disposal site consists of 30 near-surface radwaste disposal facilities (trenches). The main engineering barrier providing radionuclide confinement is a specially constructed clay screen with thickness of one meter. In total, about 687 thousand m^3 of Chornobyl radwaste with total activity of $2.54x10^{15}$ Bq were placed since the beginning of operation in storage facilities (trenches) of Buryakivka radwaste disposal site.

Buryakivka radwaste disposal site is one of the main components of the management system of large amount of emergency radwaste generated resulting from Chornobyl accident that was constructed when urgent measures were taken to eliminate accident consequences. Operation of the storage facilities at this radwaste disposal site provides until present disposal of a large amount of low-level radwaste generated during the activities at ChNPP site and on contaminated territories in the Exclusion Zone. The capacity of Buryakivka radwaste disposal site is almost exhausted. Considering safety review of Buryakivka radwaste disposal site supported by the European Commission, a decision is under consideration for its reconstruction and extending its capacity for disposal of low-level radwaste.

Pidlisnyy and ChNPP Stage III radwaste disposal site were constructed during the first years of Chornobyl accident elimination. The most hazardous high-level long-lived emergency radwaste was stored in these facilities. Radwaste should be further retrieved from these facilities and disposed in geological disposal facility. Safety of these facilities should be envisaged before construction of the geological disposal facility in Ukraine. Activities were performed at the Pidlisnyy radwaste disposal site during the previous years according to the approved temporary shutdown project. These activities were aimed at protection against degradation and maintenance of required confining functions of engineering barriers in these storage facilities, construction of additional barriers and improvement of the monitoring systems. Project "Disposal Facility Closure at ChNPP Stage III Radwaste Disposal Site" was approved. The project envisages construction of additional engineering barriers (new multi-layer upper protective shield over the existing modules with radwaste), modernized drainage system and monitoring system, facility infrastructure improvement (driveways, physical protection system, etc.) for stabilization and safety improvement of this facility.

Nine **RICP**s were placed on the Exclusion Zone territory: Stantsiya Yaniv, Naftobaza, Pischane Plato, Rudiy Lis, Stara Budbaza, Nova Budbaza, Prypyat, Kopachi, Chystohalivka with total area of about ten hectares having trenches and storage pits with radwaste on their territory. Estimated number of trenches and storage pits on the territories of RICP is about 1000 pieces. RICP territory survey, maintenance of trenches and storage pits in a safe state is being regularly performed. The objective of this survey is to find and specify the layout of trenches and storage pits with radwaste, and identify the composition and activity of radwaste placed. First, the decisions to eliminate RICP storage pits and trenches were taken for territories with seasonal flooding where the activities were performed in the framework of ChNPP decommissioning projects and at the Shelter. Storage pits and trenches of Nova Budbaza and Naftobaza RICP were retrieved and disposed according to the technical decisions approved by the SNRIU. In total, 4800 m^3 of radwaste from RICP storage pits and trenches were retrieved and disposed at Buryakivka radwaste disposal facility site during 2015.

In 2015, the Central Analytical Laboratory (CAL) of the Measuring Center of Radiation and Environmental Monitoring and Dosimetric Control *Ecocenter* of Chornobyl Specialized

Plant was established, which was funded by the European Community in the framework of cooperation in the sphere of nuclear safety.

The implementation of this project was aimed at improving the radioactive waste management infrastructure in the Exclusion Zone, in particular: characterization of radwaste samples according to physical, chemical and radiation indicators; checking compliance with specification for conditioned radwaste packages; development of methodologies for monitoring and standardization.

The SNRIU arranged consideration of "Measurement Methodology for Full Radwaste Characterization in the CAL and Survey of Radioactively Contaminated Territories by the Mobile Laboratory" submitted by Chornobyl Specialized Plant.

9. EMERGENCY PREPAREDNESS AND RESPONSE

9.1. Emergency Preparedness and Response

Emergency preparedness and response is one of the fundamental safety principles and a constituent of the defense-in-depth concept in order to:

- develop response measures at local, regional, national and international level to any nuclear or radiation emergency;
- minimize radiation risks in case of anticipated events;
- take measures to mitigate consequences for human life, health and the environment in any incidents even those of very low probability.

These measures include timely establishing criteria for protective actions and personnel informing under emergency.

The IAEA considers that the objective of the emergency preparedness and response to incidents and emergencies is to support and improve the national and international mechanisms and potential for early notification and timely response to incidents and emergencies *independently on whether they result from man-made accident, disaster, negligence or criminal activity*.

Considering the experience of training and response to actual emergencies, in particular the Fukushima accident, the IAEA involving the majority of its member states reviewed safety requirements "Preparedness and Response for a Nuclear or Radiological Emergency" (Safety Series GS-R-2). New publication of the document of GRS Series Part 7 containing general criteria for protective measures was approved by the IAEA Board of Governors and published in 2015.

In this regard, the SNRIU in cooperation with other state bodies, licensees, scientific and public organizations reviews the national regulatory requirements for emergency preparedness and response to bring them into compliance with IAEA safety standards, provisions of Council Directive EU/Euratom 2013/59 establishing fundamental safety standards for protection against radiation sources.

The SNRIU monitors trends and participates in implementing modern European approaches on planning and preparedness to take protective measures at the early stage of a nuclear accident (HERCA-WENRA approach). The HERCA-WENRA approach is aimed at enhancing international coordination of response to nuclear accidents by establishing planning zones for preventive, emergency and long-term actions of radiation protection. First, it concerns protective measures in NPP near area at the early stages of a nuclear accident and making prompt decisions for preventive measures in the area of emergency impact based on predictive assessments, even at a time when there is very little information on the situation, but there is a severe accident threat.

The HERCA-WENRA approach shall be implemented at the national level in each European country including Ukraine, which became a member of the WENRA Association in 2015.

In order to harmonize with the HERCA-WENRA approaches, it is planned to review the national legislation and regulatory framework that is a basis for emergency planning and radiation protection measures for the public. Recommendations on general and procedural issues will be considered in the review of the national response plan for radiation accidents and other regulatory documents in force in Ukraine in the system of emergency preparedness and response.

The SNRIU as a national competent authority and single national point of communication within the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency provided jointly with the State Emergency Service, participation in the IAEA exercises of ConvEx format to test mechanisms in the event of transnational radiological emergency, check the communication with the IAEA Incident and Emergency Center, test mechanisms for request and assistance, etc.

On-line information exchange between the SNRIU, the IAEA and competent authorities of the countries in compliance with the intergovernmental agreement is implemented through secure web site within the unified system for information exchange in incidents and emergencies (USIE).

The analysis of possibilities and preparatory measures on registration of national potential in IAEA network on response and assistance was performed (RANET) was performed jointly with the State Emergency Service in 2015.

By SNRIU Ordinance No.163 of 06 February 2015, functional subsystem of the unified civil protection system (hereinafter – FS UCPS) "Safety of Nuclear Facilities" was transferred to the high alert mode in compliance with FS UCPS mode.

Subsystem activity at facility level is ensured by State Inspections on Nuclear Safety, at regional level it is ensured by the State Regional Inspections on Nuclear and Radiation Safety.

At the national level, the key subsystem component is SNRIU Information and Emergency Center (IEC), which under its activation involves the most experienced experts of SNRIU subdivisions and subordinated organizations.

Twenty-four hours duty, operational communication with NPPs of Ukraine, analysis and registration of the information of NPP events and its inclusion to computerized database is provided in the SNRIU IEC. Information summaries on the state of NPP units in Ukraine and messages on NPP operational events shall be prepared for distribution and be available at SNRIU web site www.snrcu.gov.ua.

The FS UCPS ensured the following in the high alert mode:

- observe and control nuclear and radiation safety and security of potentially hazardous facilities of licensees and adjacent territories;
- improve oversight of implementing measures to prevent accidents during production, use of radiation sources, transport of radioactive materials and at radioactive waste management facilities, uranium facilities, to ensure preparedness of enterprises, institutions and organizations for eliminating consequences of such accidents;
- additional checking of the licensee's emergency plans, in particular, information update, checking communication systems and procedure of participant interaction, etc.

In 2015, the SNRIU IEC was fully activated during joint plant emergency training, namely:

on 22-23 April at SUNPP, simulated emergency "Loss of Power Supply at SUNPP with Failure of all Diesel-Generators at Unit 1 with Subsequent Severe Core Damage";

on 2–3 November at ZNPP, simulated emergency "General Emergency at ZNPP Resulted from Extraordinary Geological Situation in ZNPP Location Area and Caused Failure of Main and Backup Energy Saving Systems, as well as Unit 1 Depressurization".

A system to support decision-making (RODOS) as a tool for comprehensive analysis of possible consequences of various emergency scenarios and operational verification for prediction calculation of the operating organization was used by IEC experts in trial operation

during joint plant emergency training to assess, predict progression and management of emergencies outside nuclear sites.

Based on training analysis, appropriate corrective measures to improve response to emergencies at NPPs were developed and implemented.

To monitor radiation situation in the observation area of the Ukrainian NPPs, as well as to predict and support decision making on protective measures for the public outside nuclear sites, the SNRIU uses the data of the automatic radiation monitoring systems (ARMS) obtained in the IEC in on-line mode from all operating NPPs after connection to the SUNPP ARMS Data Transfer System since September 2015.

On 26 January 2015, a “round table” on emergency preparedness and response in the field of nuclear energy was held by the SNRIU jointly with the All-Ukrainian Environmental NGO "MAMA-86" under the auspices of the European social network Nuclear Transparency Watch supported by the Swedish International Cooperation and Development Agency.

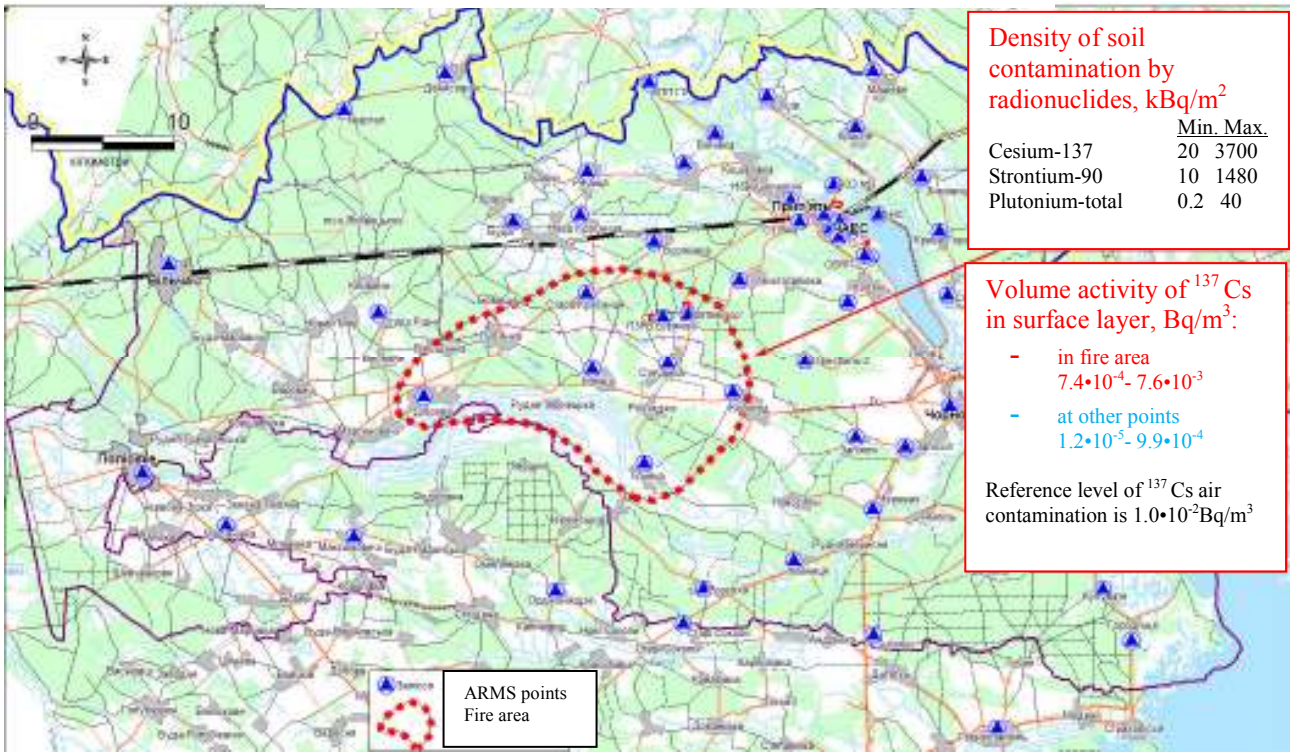
9.2. Fire Suppression in the Exclusion Zone

Fires in the exclusion zone in spring and summer 2015 caused public concern and media attention due to possible spread of radionuclide contamination with combustion products outside the Exclusion Zone.

The SNRIU in cooperation with the Hydrometeorological Center of Ukraine, Central Geophysical Laboratory, Chornobyl NPP, Measuring Center of Radiation and Environmental Monitoring and Dosimetric Control *Ecocenter* of Chernobyl Specialized Plant and SSTC mobile laboratory analyzed the data on radiation state monitoring, assessed radiation impact, provided information by request of the IAEA, some member states in compliance with the intergovernmental agreements and disclosure of on-line information on the official website www.snrc.gov.ua.

Continuous monitoring of radiation background in the Exclusion Area is provided by the automatic radiation monitoring system (ARMS) of *Ecocenter* at 39 points. Data are obtained in the control center each hour and in emergency each 2 minutes within twenty-four hours.

Sketch-map of ARMS points in the Exclusion Zone



Location of fire area as of 30 April 2015.

Due to forest fires on **28-30 April 2015**, control over radiation situation in the Zone was strengthened. The data on background radiation and radionuclide content in the air near fire according to nine ARMS stationary points and mobile response groups equipped with dosimeters and aspiration devices were analyzed online.

Increase of radionuclide content in the near-surface air to the values not exceeding the reference levels established for this area was observed during fires according to measurements.

Analysis of air sample in Stara Krasnytsya **on 28 April 2015** showed the volume activity of ^{137}Cs in the air 7.6×10^{-3} Bq/m^3 that was approximate to the reference level of ^{137}Cs air contamination (reference level for ^{137}Cs volume activity in the air was established at the level of 1.0×10^{-2} Bq/m^3 for the 10 km zone around Chernobyl NPP).

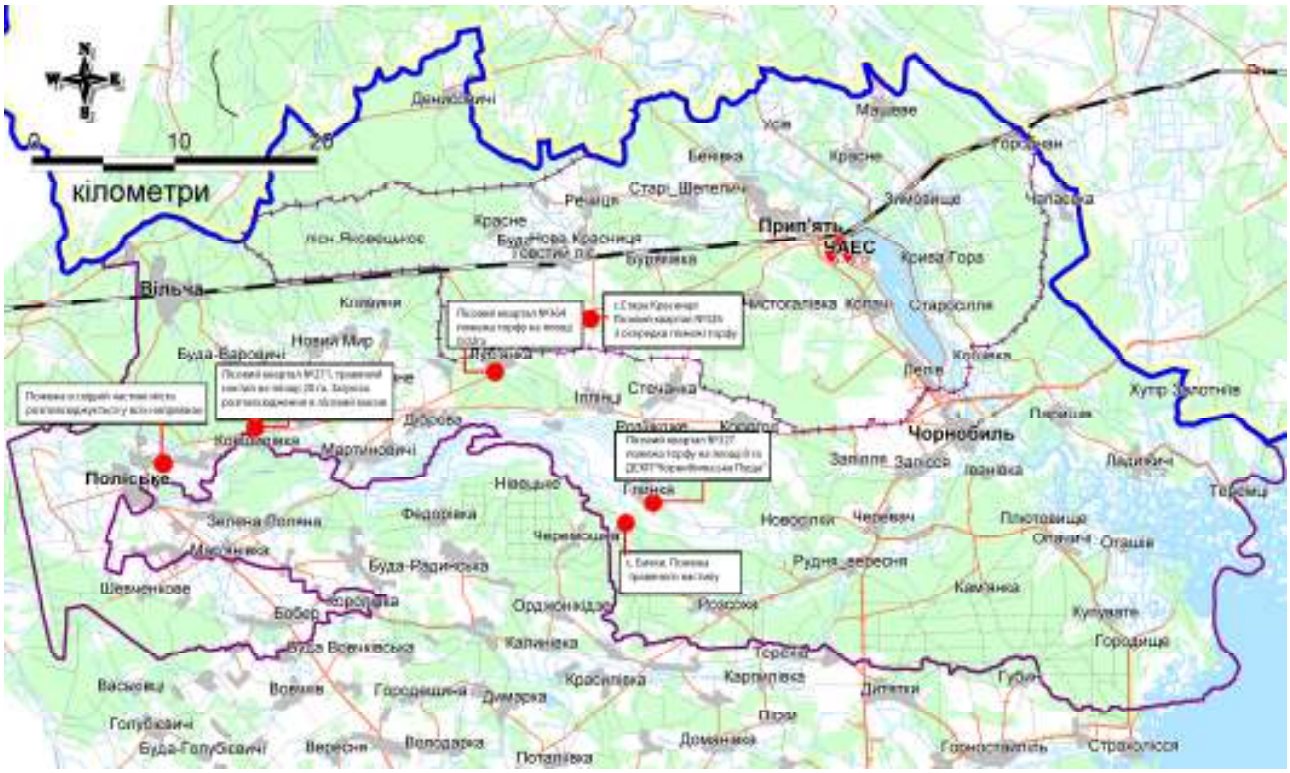
On 3 April 2015, the experts from the SSTC NRS Radiation Protection Department, SNRIU performed radiation survey of Kyiv using mobile radiological laboratory "RanidSONNI" by the following route: Vasylya Stusa Street – Peremoga Avenue – Shevchenko Boulevard – Khreshchatyk Street – Volodymyr Descent – Poshtova Square – Naberezhno-Rybalska Street – Heroiiv Stalingradu Avenue – Obolonskiy Avenue – Bohatyrska Street – Lugova Street – Pravdy Avenue – Velyka Kiltseva Road.

No radiation anomalies were found in Kyiv streets during continuous monitoring by stationary and portable equipment of "RanidSONNI" laboratory. Gama-radiation doses are within 0.04 - 0.10 μSv/h that complies with natural background conditions. The levels of radionuclide content in the air are significantly below the permissible levels established by the Radiation Safety Standards of Ukraine.

Reference: the mobile laboratory is Mercedes-Benz based laboratory equipped with stationary radiometric complex with highly effective gamma radiation detectors, portable spectrometer with a detector of high-purity germanium, portable radiometer with gamma radiation and neutron detectors. Radiation monitoring equipment of the laboratory has state metrological certificates. The car is equipped with GPS, video monitoring, sampling devices.

Operating experience of the mobile laboratory: activities to improve security against the threats of nuclear and radiation terrorism during preparing to and holding the final part of the European Football Championship EURO 2012 in Ukraine; surveys of facilities and territories of the Kirovograd region by request of local authorities; scheduled inspection of the Kyiv State Interregional Specialized Plant by the SNRIU; scheduled survey of medical institutions where radiation and nuclear technologies are applied: Feofania Clinical Hospital of the State Administration and Municipal Institution of the Kyiv Regional Council, Kyiv Regional Oncology Center.

On 29 June 2015, several fire sites of different type occurred in the south-western part of the Exclusion Zone. The distance from fires to Chernobyl was about 20 km, to ChNPP was 23 km, to Buryakivka radwaste disposal site and Vektor site was 10 km, to and to the southern boundary of the Exclusion Zone 5-10 was km.



Location of fire sites as of 30 June 2015

On 30 June 2015, a mobile group of the Measuring Center of Radiation and Environmental Monitoring and Dosimetric Control *Ecocenter* performed radiological survey of fire areas by the following route: Korogod – Dibrova – Kovshylivka – Poliske – Lubianka – Stara Krasnytsia. No significant increase in the gamma exposure dose rate and beta-particle flux density has been found.

However, an air sample taken in the fire area near the evacuated urban village of Polis'ke contained 2.5×10^{-3} Bq/m^3 of ^{137}Cs, which is one order of magnitude higher than the reference level established in the health and safety standard "Basic Reference Levels, Exemption Levels and Action Levels for Radioactive Contamination of Objects in the Exclusion and Resettlement Zone" for the former populated centers, where specific categories of personnel are staying. In ash sample (remaining forest cover), radionuclide content was: ^{137}Cs – 3.4 kBq/kg, ^{90}Sr – 2.7 kBq/kg that is below the criteria for referring ash to solid radioactive waste.

Thus, the data from current radiation monitoring systems in the Exclusion Zone and adjacent territories showed that changes in key indexes of air radiation state, except fire sites did not exceed the reference levels established for certain areas and in Kiev they were within natural background fluctuations.

Realtime Online Decision Support System (RODOS) for nuclear emergency management implemented in Ukraine under assistance of the EC was used in test mode to assess dispersion and to develop models for atmosphere transfer of combustion products.

10. NUCLEAR SECURITY ISSUES

10.1. Design-Basis Threat

Problems of ensuring security of radioactive materials have recently attracted much attention from the community and a wide range of experts. This is caused not only by increase of nuclear terroristic threats, but also recognition of these threats on the highest political level of the state. This was mainly fostered by the Washington Summit 2010, Nuclear Security Summit Seoul 2012 and Hague Summit 2014. The main issues of these events were prevention of nuclear terrorism, measures on neutralization of internal and external threats related to malicious use of radioactive materials.

Taking this into account, priority tasks of the state nuclear policy related to security are aimed at Ukraine meeting international obligations to reach main purposes of physical protection: minimize risks of nuclear terrorism, theft of nuclear material, radioactive waste and other radiation sources, and strengthening of the non-proliferation regime.

In 2015, new revision of the **Design-Basis Threat for Nuclear Facilities, Nuclear Material, Radioactive Waste and Other Radiation Sources in Ukraine** was approved by the President's Decree No. 520/14t/2015 dated 27 August 2015. Provisions of this document have criteria to:

- improve the regulatory framework for physical protection and illicit trafficking of radioactive waste;
- perform state review of documents related to physical protection systems of nuclear facilities, nuclear materials, radioactive waste, other radiation sources and designs of engineering and technical means of physical protection systems that are under reconstruction or technically upgraded;
- perform state checking the ability of physical protection systems of nuclear facilities, nuclear materials, radioactive waste, other radiation sources to withstand design-basis threat.

According to the mentioned Decree, facility design-basis threats have been developed at all Ukrainian NPPs; the documents of the Interdepartmental Commission on Protection of the Most Important NPP Facilities have been revised.

Taking into account current threats to national security of Ukraine and functioning of the state physical protection system in the high alert mode, NPP security staff kept enhanced guard. New Facility Interaction Plans have been developed and implemented at all NPPs for all cases of a sabotage at a nuclear power plant. Besides, the Procedure for Facility Interaction Plan Participants Staying at NPP Site in Case of Emergency has been also developed and implemented. During 2015, a set of emergency trainings were held at all NPPs. The training objective was to exercise actions of the Facility Interaction Plan participants in case of a sabotage in different situations, and to eliminate consequences revealed in earlier trainings. Vulnerability assessment of Ukrainian NPPs has been completed. It was followed by reports on assessing vulnerability of nuclear facilities and nuclear materials and recommendations of putting the physical protection system in compliance with requirements of the current legislation.

Within implementation of the program "Global Threat Reduction Initiative and Improving the Security of Radiation Sources" in 2015, surveys were held in Ukraine and the decision was made on the modernization of engineering and technical means of the physical protection system of the following medical institutions: Vinnytsia Regional Cancer Center, Zhytomyr Regional Cancer Center, Kyiv Regional Cancer Center, Chernihiv Regional Cancer

Center. Besides, the decision on the modernization of physical protection system of UkrDo Radon state interregional plants has been made.

10.2. Zaporizhzhya NPP Security

Reinforced security duty has been implemented at Zaporizhzhya NPP since 2014 to ensure stable and reliable functioning of the nuclear power plant, prevent unauthorized access to NPP facilities, and counter possible sabotage and terroristic acts.

According to the current legislation of Ukraine, NPP physical protection subdivisions and military departments of the National Guard of Ukraine shall ensure uninterrupted operation of Zaporizhzhya NPP physical protection systems, unconditional compliance with the mode requirements at its facilities, enhanced protection of nuclear facilities and nuclear materials, preventive measures for emergencies.

Considering the current revision of the design-basis threat, Zaporizhzhya NPP together with other Ukrainian NPPs is put in compliance with regard to issues of its protection, equipping the fighters of the National Guard of Ukraine, their interaction with other departments, including air defense staff of the Ministry of Defense of Ukraine. The measures have been developed on prevention of insider actions, special measures on elimination of potential threats from the outside of NPP perimeter. Due to ZNPP design, additional measures on monitoring of the water area around the facility were taken, physical protection department and NPP air defense subdivision armored groups were enhanced.

In 2015, emergency training “Facility-2015” on checking preparedness of forces and means of the participants of ZNPP Facility Interaction Plan in Case of a Sabotage was held.

The following exercises were performed:

– interaction of anti-terrorist groups on revealing, prevention and termination of possible terroristic acts and sabotage at facilities with large amount of people staying there;

– practical skills of ZNPP anti-terrorist staff, advance and coordinating group of the Anti-Terrorist Center of the Security Service of Ukraine in Zaporizhzhya region during taking anti-terrorist measures at the facility related to rally point, data analysis and draft decisions on termination of possible terrorist actions and sabotage.

Tactics and interaction procedure of anti-terrorist subdivisions, local authorities, ZNPP management during anti-terrorist operations on revealing and mitigation of terrorist acts have been improved.

Due to certain publications in western mass media on the reliability of ZNPP nuclear security, including Zaporizhzhya ISF, scheduled International Insurance Inspection of World Insurance Pool System was performed on ZNPP site in May 2015. The inspection was held by technical inspectors of Ukrainian and foreign nuclear insurance pools within the agreement on general liability insurance of NAEK Energoatom for nuclear damage. The issue related to safe storage of spent nuclear fuel at Zaporizhzhya NPP was included into NPP report and program for NPP inspection by the experts of the International Insurance Inspection.

According to results of Zaporizhzhya ISF inspection, the inspectors confirmed that such a method for spent nuclear fuel storage complies with all international standards and best practices.

11. INTERNATIONAL COOPERATION IN NUCLEAR AND RADIATION SAFETY

WENRA

Currently, international non-governmental organizations and associations acquire special significance in the international cooperation on nuclear and radiation safety. WENRA (Western European Nuclear Regulators Association) goes ahead among the leading European non-governmental organizations.

WENRA was established in 1999 on a voluntary basis by the regulatory bodies of EU Member States and Switzerland as an association of senior management of the Western European regulatory authorities having at least one nuclear facility under construction, operation or decommissioning.

The priority feature of WENRA activity is to develop common standards of nuclear and radiation safety in EU member states and establish assessment criteria of the regulatory sphere in the countries planning to join EU. Since 2009, Ukraine is an associate member of WENRA.

In 2003, the list of WENRA member states was extended due to membership of new countries in the European Union.

Today, WENRA Association includes: Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Lithuania, Netherlands, Romania, Slovenia, Slovakia, Spain, Sweden, Switzerland, the United Kingdom and Ukraine. Austria, Armenia, Norway, Poland, Belarus, Denmark, Ireland, Canada, Luxemburg and Russia are included to WENRA Association as observer countries.

The main WENRA tasks are to:

- develop and improve methods of independent safety assessment of nuclear facilities;
- develop general approaches related to nuclear safety and its regulation as well as support to harmonization of requirements in practices.

To implement the above tasks, two WENRA work groups were established in 2002; one of them is the work group on radioactive waste management and decommissioning (WGWD).

The objective of this work group is to develop the so-called safety reference levels (SRLs) and subsequent analysis of national legislation and development of National Action Plans to harmonize regulations of WENRA member states with the SRLs. The main documents for the development of SRLs are IAEA safety standards and experience in activities in the field of radwaste management and decommissioning. WGWD develops reports and safety reference levels related to:

- radioactive waste storage;
- decommissioning;
- radioactive waste disposal;
- radioactive waste processing.

Ukraine recognizes the importance of international cooperation between regulatory authorities for harmonization of regulatory requirements on NPP safety, safety in management of spent nuclear fuel and radioactive waste and NPP decommissioning, exchange of experience and development of common approaches to nuclear and radiation safety regulation. In 2015, Ukraine took an active part in WENRA plenary sessions and work groups. In particular, after the official application of SNRIU Chairman during regular plenary session, WENRA Secretariat considered the application for Ukraine to acquire full membership in the Association, which was later announced during the Association plenary session in March 2015 in Geneva (Switzerland). On 26 March 2015, Ukraine and WENRA member states signed

relevant guide document of the Association, namely "Terms of Reference of the Western European Nuclear Regulatory Association". Ukraine became a full member of WENRA Association.

The new status of Ukraine within the Association confirms foreign policy course of the state with the European integration as one of the main priorities. Active participation of Ukraine in new initiatives of the Association according to current challenges and further steps in the harmonization of national requirements for nuclear and radiation safety with WENRA reference levels will contribute to improved cooperation of the SNRIU with WENRA member states regulators, which will respectively give an opportunity to get closer to nuclear and radiation safety standards of the EU and continue developing common approaches to the major issues related to improving the safety of nuclear power plants under operation.

To fulfil Ukraine's obligations as a full member of the Association and in order to arrange efficient WENRA-SNRIU interaction, Order No. 115 dated 17 June 2015 approved SNRIU Board on harmonization of national regulations and rules of nuclear and radiation safety of Ukraine with WENRA reference levels.

Currently, the SNRIU completed self-assessment of Ukrainian regulations on decommissioning to check their compliance with WENRA safety reference levels and submitted them for WGWD consideration. The report with safety reference levels related to radwaste processing is under development.

Swedish-Norwegian-Ukrainian Initiative on Nuclear Safety and Security Cooperation

During the Nuclear Security Summit held in the Hague on 24-25 March 2014 in the Hague, Erna Solberg, the Prime Minister of Norway, and the Government of Sweden made statements regarding cooperation with Ukraine and noted that Norway and Sweden propose to initiate cooperation with Ukraine in issues related to improving nuclear safety and security of nuclear power plants in the country. Such statements were made in connection with the temporary occupation of Crimea, Donets'k and Luhans'k regions by the Russian Federation.

On 18 November 2014, Ole Harbitz, Director General of the Norwegian Radiation Protection Authority, Fredrik Hassel, Deputy Director General of the Swedish Radiation Safety Authority, and Serhii Bozhko, SNRIU Chairman, signed the Common Statement on Cooperation in the Sphere of Nuclear Safety and Security between Ukraine, Norway and Sweden.

According to the Statement, the Parties have pledged to report on cooperation results and achieved progress during the Washington Security Summit (USA, 2016).

Creation of this trilateral Initiative became a framework for a number of joint projects related to nuclear security of Ukrainian NPPs. It is important to state that nuclear safety and security are of a strategical importance for national safety in general under emergency conditions during armed conflict.

In 2015, eight projects have been implemented within the Initiative arranged according to the results of the Hague Nuclear Security Summit of March 2014. The meeting objective was to discuss results of the following projects:

1. Technical support of the SNRIU in the development of requirements for licensing of new and modified fuel.
2. Improvement of SNRIU capabilities in periodical safety assessment using state-of-the-art computer codes.
3. Modernization of applied software of the State Register of Radiation Sources (Register).
4. Damaged fuel management.

5. Instruments for probabilistic safety analysis.
6. Modernization of systems important to safety of RNPP, as a part of C(I)SIP implementation.
7. Modernization of Khmelnitsky NPP physical protection system.
8. 13th Ukrainian Nuclear Security Conference.

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

Ukraine is a party of an important international IAEA tool, such as the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management.

On 11-22 May 2015, the **Fifth Meeting on Obligations under the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management** (Joint Convention) was held in the IAEA headquarters in Vienna. The meeting objective was to present the Fifth National Report on Compliance with Obligations under the Joint Convention. Ukraine presented comprehensive information on the current state of spent fuel and radioactive waste management infrastructure in Ukraine, legal aspects, progress reached during three years, policies and future plans in this sphere.

According to the established rules and procedures, review of national reports of countries is confidential, so that the authorized representatives of the Parties had the opportunity to consider openly and impartially safety challenges in the management of spent nuclear fuel and radioactive waste, assess progress in reaching the Convention objectives, express recommendations on needed measures to overcome challenges and threats. Presentation of national reports was performed in seven working groups of countries. Ukraine was included into the fifth group of countries together with Lithuania, Hungary, Luxemburg, Morocco, Croatia, Vietnam, Tajikistan, Russia and Gabon.

Ukrainian presentation was made by Tetiana Kilochytska, SNRIU Deputy Chairperson. The presentation paid much attention to the functioning of spent fuel and radioactive waste management infrastructure, legal aspects, progress reached during three years, policies and future plans in this area. Ukrainian presentation is placed on SNRIU web site.

Ukrainian delegation gave weighted, competent and extensive answers to the questions of meeting participants, which contributed to making a positive conclusion on the National Report of Ukraine.

The final report on review results of the National Report of Ukraine stated that Ukraine demonstrated significant progress from the Fourth Meeting of the Parties with regard to creating the infrastructure for safe management of spent nuclear fuel and radioactive waste and presented recommendations on a number of safety improvement measures during the next three years, namely:

- development of plans related to ChNPP Exclusion Zone future;
- development of conceptual plans related to Exclusion Zone use and status;
- under further development of conceptual plans for the Exclusion Zone one shall consider opinions of other countries (namely, countries suffered from Chornobyl accident), in particular Belarus;
- continued safety review of specialized plants for radioactive waste management of UkrDO Radon and implementation of improvement measures, if necessary.

The following challenges were defined for Ukraine:

- completion of ChNPP New Safe Confinement;

- construction of priority facilities for radioactive waste and spent nuclear fuel management in the Exclusion Zone, including design and construction of the centralized ISF, design and construction of long-term storage facility for vitrified high-level waste from WWER-440 spent fuel processing to be returned from Russia.

Therefore, Ukraine confirmed fulfillment of its obligations under the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management.

Annex 1. SPECIAL REGULATORY ASPECTS IN INDIVIDUAL TERRITORIES OF UKRAINE

In 2015, Ukraine fully met the requirements of non-proliferation, as set out in the Agreement on the Application of Safeguards in Connection with the Treaty on the Nonproliferation of Nuclear Weapons and the Additional Protocol to the Agreement. Reports on nuclear materials, other information on nuclear activities in Ukraine were timely sent to the IAEA, three additional accesses and 39 IAEA inspections were arranged and conducted at the Ukrainian enterprises, including six unannounced. Due to the official report of Ukraine to the IAEA on lost control over nuclear material and forced limitation of access for IAEA inspectors to certain locations of nuclear material in the temporarily occupied territory of Crimea, Donets'k and Luhans'k regions, the above agreements did not cover these areas in 2015.

Individual Territories of Donets'k and Luhans'k Regions

On 14 April 2014, Decree of the President of Ukraine "On the Decision of the National Security and Defense Council of Ukraine of 13 April 2014 "On Urgent Measures to Overcome the Terrorist Threat and to Preserve the Territorial Integrity of Ukraine"" No. 405/2014 came into force.

Since June 2014 and during 2015, almost continuous combat operations were ongoing in some areas of Donets'k and Luhans'k regions occupied by illegal armed groups. Large territories within the area of the South-Eastern Inspection responsibility were found under control of terrorists. The largest number of industrial coal, metallurgical, chemical and mining enterprises in Ukraine, which belong to the industries of high risk and use sealed radionuclide radiation sources are located in these territories.

Seventy three economic entities (including eight institutions with category 1 high-level radiation sources, activity over 1000 Ci), using over 1200 units of sealed radionuclide radiation sources lost state regulatory control of nuclear and radiation safety in Ukraine. Almost all enterprises of Donbass coal industry (including *Donets'k Coal Energy Company* and *Luganskvugillia*) and a half of all iron and steel companies of South-Eastern Ukraine were found under control of terrorists. In addition, two storage facilities remained in the territory of Donets'k (Special Center *Vugleisotop* and PJSC *Donets'kstal' – Metallurgical Plant*) where about 500 sealed radionuclide radiation sources are stored.

Cabinet Ordinance No. 1085-r of 07 November 2014 approved the list of populated centers where state authorities temporarily do not exercise their powers. This list included 24 reginal centers and 136 populated centers of Donets'k and Luhans'k regions including regional centers Donets'k and Luhans'k. Another 114 settlements are located on the confrontation line. Thus, control of nuclear and radiation safety in these settlements is almost impossible.

At the same time, a number of nuclear entities using radiation sources, in 2015 performed activities in compliance with the requirements of laws, regulations, rules and standards on nuclear and radiation safety of Ukraine. Appropriate reporting documents (annual reports on radiation safety, quarterly reports on amount of radioactive waste) were timely submitted to the South-Eastern State Inspection. The measures were taken on nuclear material accounting and control. During 2015, seven licensees applied to the South-Eastern State Inspection to amend the licenses due to change of legal entity location to the territory under control of Ukraine. They include an enterprise, which tests radiation sources and checks their tightness in the territory of Ukraine.

The South-Eastern State Inspection received official notification on radiation incidents from licensees in the territories beyond Ukrainian control. In particular, JSC *Yenakiyevo Steel Plant* reported the discovery of an abandoned container with radiation sources in its territory, which was in illegal trafficking and was previously used in small private enterprise *BIK* in Sverdlovsk district of Luhans'k region.

In addition, three licensees in nuclear energy officially informed the South-Eastern State Inspection on the impossibility to ensure physical protection of radiation sources due to acquisition by seizure of facilities using radiation sources by armed military units of the so called Donets'k People's Republic and Luhans'k People's Republic (Luhans'k Customs, LLC *Cargill Combine*, PJSC *Ilyich Iron and Steel Works of Mariupol*).

Unfortunately, there is no official information in the SNRIU on radiation safety at two large Donbass coal mining enterprises (*Donets'k Coal Energy Company* and *Luhans'kvugillia*) bringing together 14 coal mines located in the territory beyond the control of Ukraine. Total number of radiation sources used by these companies is 114 (maximum rated activity of single source reaches 2.35×10^{11} Bq). There is no information also on the state of temporary

shutdown radioactive waste storage facility located on the territory of Donets'k state factory of chemical products, which experienced strong explosion at the end of 2014.

The territory of Donets'k state factory of chemical products

Based on the analysis of the situation, it can be concluded that the main potential threat in the area of the Anti-Terrorist Operation is illicit trafficking of radiation sources and radioactive waste from the territory beyond Ukrainian control that could result in public exposure and radioactive contamination of the environment due to unsealing of radiation sources or their use as a "dirty" bomb.

In this regard, the SNRIU took measures to strengthen control over radiation sources and radioactive waste from the territories beyond Ukrainian control to reduce the threat of their illicit trafficking and assess risks of loss of regulatory control over them.

For interaction under emergency with radiation hazard for the public, mutual information feedback on similar cases among the South-Eastern State Inspection and regional state administrations of Donets'k, Luhans'k and Zaporizhzhya regions was provided. The lists of nuclear entities with high risk in these regions were also provided. In order to specify the plans of response to radiation accidents in Donets'k, Luhans'k and Zaporizhzhya regions, the information on enterprises and organizations whose activity may result in radiation accidents was submitted to the Main Department of the State Emergency Service of Ukraine in Zaporizhzhya region and the Department of Civil Protection, Mobilization and Defense Activity of the Donets'k Regional State Administration. To timely notify and submit the information on emergencies with radiation hazard for the public, licensees using radionuclide radiation sources were proposed to urgently review the emergency plans regarding update of the contact information for emergency communication.

Autonomous Republic of Crimea

Due to the occupation of the Autonomous Republic of Crimea in 2014 by the Russian Federation, Ukraine lost regulatory control over such nuclear facilities as research reactor IR-100 of the Sevastopol National University of Nuclear Energy and Industry and two subcritical assemblies with low-enriched and natural uranium. In addition, in Crimea there are several companies and medical institutions using devices and containers with radiation protection of depleted uranium and high-level radiation sources (7 institutions, mainly oncological centers).

Taking into account Resolution of the UN General Assembly of 27 March 2014 "The Territorial Integrity of Ukraine", the IAEA informed Ukraine on continuation of applying its safeguards in accordance with its Charter and the international law. Therefore, the IAEA applies the safeguards to nuclear materials and facilities in the territory of Crimea in accordance with the Safeguards Agreement between Ukraine and the Agency and its Additional Protocol.

However, in 2015 the licensees located in Crimea did not submit any report on the results of physical inventory for the current year. Communication between the SNRIU with the Crimean State Inspection for Nuclear and Radiation Safety was actually lost, and since September 2014, it was officially subordinated by the Federal Service for Environmental, Technological and Nuclear Supervision of the Russian Federation.

At the beginning of 2015, the State Nuclear Regulatory Inspectorate of Ukraine decided to terminate activity of the Crimean State Inspection on Nuclear and Radiation Safety (Simferopol, K. Marks St., 40) by its reorganization, namely joining as regards:

safety regulation of nuclear facilities, radioactive waste management facilities goes to the Northern State Inspection on Nuclear and Radiation Safety (Kyiv, Verkhovna Rada Blvd., 3);

safety regulation of other radiation sources goes to the Southern State Inspection on Nuclear and Radiation Safety (Odessa, Shevchenko Avenue, 1).

Annex 2. PUBLIC HEARINGS ON LONG-TERM OPERATION OF SUNPP UNIT 2

On 28 October 2015, the State Nuclear Regulatory Inspectorate of Ukraine initiated public discussion of SNRIU draft decision on possible long-term operation of the nuclear facility, namely SUNPP unit 2.

Public hearings held by the SNRIU in Yuzhnoukrainsk on 25 November 2015 with the participation of *Energoatom* Company were the key stage of active dialogue with the public.

The event attracted much attention of the public. Nearly 600 people participated in the event: residents of SUNPP region, representatives of public organizations, journalists of central and regional mass media.

The following documents were provisionally published on official web sites of the regulatory body and the operating organization and distributed to participants of the public hearings on long-term operation of SUNPP unit 2:

- SNRIU draft decision;
- periodical safety review report. Safety factor 14 “Environmental impact of operation”;
- periodical safety review report. Comprehensive safety analysis of SUNPP unit 2;
- conclusions of the state review of nuclear and radiation safety of the Report on periodical safety review of SUNPP unit 2;
- certificate of comprehensive inspection of Energoatom Company preparedness to perform activities at a lifecycle stage “nuclear facility operation” on SUNPP unit 2 long-term operation;
- environmental information presented to the public during public discussion of March-June 2015 of safety justification of SUNPP unit 2 long-term operation arranged by state authorities and local bodies of SUNPP observation area;
- possible transboundary impact from SUNPP regular operation and in case of emergencies within requirements of Espoo Convention.

Serhii Bozhko, SNRIU Chairman, opened public hearings and stressed that interaction with the public is one of regulator's priorities and making the decision on further SUNPP unit 2 operation is open and transparent despite existing global nuclear safety challenges and nuclear non-proliferation safeguards. S. Bozhko stated that the SNRIU is guided by national legislation that is in full compliance with international IAEA and WENRA standards. NPP safety improvement is the decisive criterion.

Yurii Nedashkivsky, Energoatom Company President, and Volodymyr Lisnichenko, SUNPP Director General, presented the operating organization.

All interested parties, supporters and fierce opponents of nuclear energy, had the opportunity to express their opinion. The following presentations were made: Volodymyr Korovkin, Ukrainian Nuclear Community, Tetiana Verbytska, National Ecological Center of Ukraine, Olha Kosharna, Ukrainian Nuclear Forum, Serhii Koliesnikov, Zeleny Svit (Voznesensk), and Mykhailo Yatsenko, Youth Energy Community. Many representatives of other Ukrainian public organizations, local residents, local and regional council members joined the discussion on further fate of SUNPP unit 2. Viktor Parokonnyi, Yuzhnoukrainsk Mayor, also made a speech.

The documents based on public discussion results were published on SNRIU official web site. Public hearing results were analyzed on 7 December 2015 during the open session of SNRIU Board related to making the decision on ensuring SUNPP unit 2 long-term operation.

List of Abbreviations

C(I)SIP – Comprehensive (Integrated) Safety Improvement Program
centralized ISF – Centralized Spent Fuel Storage Facility
ChNPP – Chornobyl Nuclear Power Plant
CRME – Centralized Radioactive Waste Management Enterprise
CS – Commissioning Stage
FS UCPS – Functional Subsystem of the Unified Civil Protection System
IAEA – International Atomic Energy Agency
ICSRM – Industrial Complex for Solid Radioactive Waste Management
IEC – Information and Emergency Center
INES – International Nuclear and Radiological Event Scale
ISF – Interim Spent Fuel Storage Facility
KhNPP – Khmelnytsky Nuclear Power Plant
LRTP – Liquid Radioactive Waste Treatment Plant
NIP – Nuclear Insurance Pool
NPP – Nuclear Power Plant
NRBU – Radiation Safety Standards of Ukraine
NRS – Nuclear and Radiation Safety
NSC – New Safe Confinement
PSA – Probabilistic Safety Analysis
PSRR – Periodical Safety Review Report
Radwaste – Radioactive Waste
RNPP – Rivne NPP
SAR – Safety Analysis Report
SFA – Spent Fuel Assembly
SIP – Shelter Implementation Plan
SNF – Spent Nuclear Fuel
SSE – State Specialized Enterprise
SUNPP – South Ukraine Nuclear Power Plant
VSC – Ventilated Storage Cask
WWER – Water-Cooled Water-Moderated Power Reactor
Zaporizhzhya ISF – Dry-type Spent Fuel Storage Facility
ZNPP – Zaporizhzhya NPP