REPORT
ON NUCLEAR AND RADIATION SAFETY IN UKRAINE
2013

The State Nuclear Regulatory Inspectorate
of Ukraine

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1. State Nuclear Regulatory Inspectorate of Ukraine

In order to improve state regulation of nuclear and radiation safety in connection with Ukraine's commitments under the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the State Nuclear Regulatory Committee of Ukraine was established on 5 December 2000 as a central executive body with special status. Under the optimization of central authorities in 2010, the State Nuclear Regulatory Committee of Ukraine was renamed the State Nuclear Regulatory Inspectorate of Ukraine.

Basis functions of the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) relating to safety regulation of nuclear energy are to:

- identify safety criteria, requirements and conditions for the use of nuclear energy (**standardization**);
- issue authorizations and licenses for activities in this area after review of the licensee’s submittals to confirm compliance with safety requirements **(licensing)**;
- conduct state supervision over compliance with legislation and regulations and standards on nuclear and radiation safety and apply sanctions established by law in case of violation (**supervision**).

The SNRIU regulates safety of:

- 15 nuclear power units in operation on the territory of Ukraine:

6 units of Zaporizhzhya NPP,

4 units of Rivne NPP,

3 units of South Ukraine NPP,

2 units of Khmelnitsky NPP;

3 units of Chornobyl NPP under decommissioning;

2 operating spent fuel storage facilities at Zaporizhzhya and Chornobyl NPPs and 2 storage facilities under construction in the Exclusion Zone;

2 research reactors;

neutron source based on a subcritical assembly driven by a linear electron accelerator being constructed on premises of the Kharkiv Institute of Physics and Technology;

nuclear fuel fabrication plant to be constructed in the Kirovograd region;

radioactive waste storage facilities and radioactive waste management facilities:

6 specialized plants of the Ukrainian State Association *Radon*,

radioactive waste disposal sites and temporary confinement sites of the State Specialized Enterprise *Complex*,

storage and disposal facilities for radioactive waste from territories contaminated in the Chornobyl accident being constructed and operated by the State Specialized Enterprise *Technocenter*;

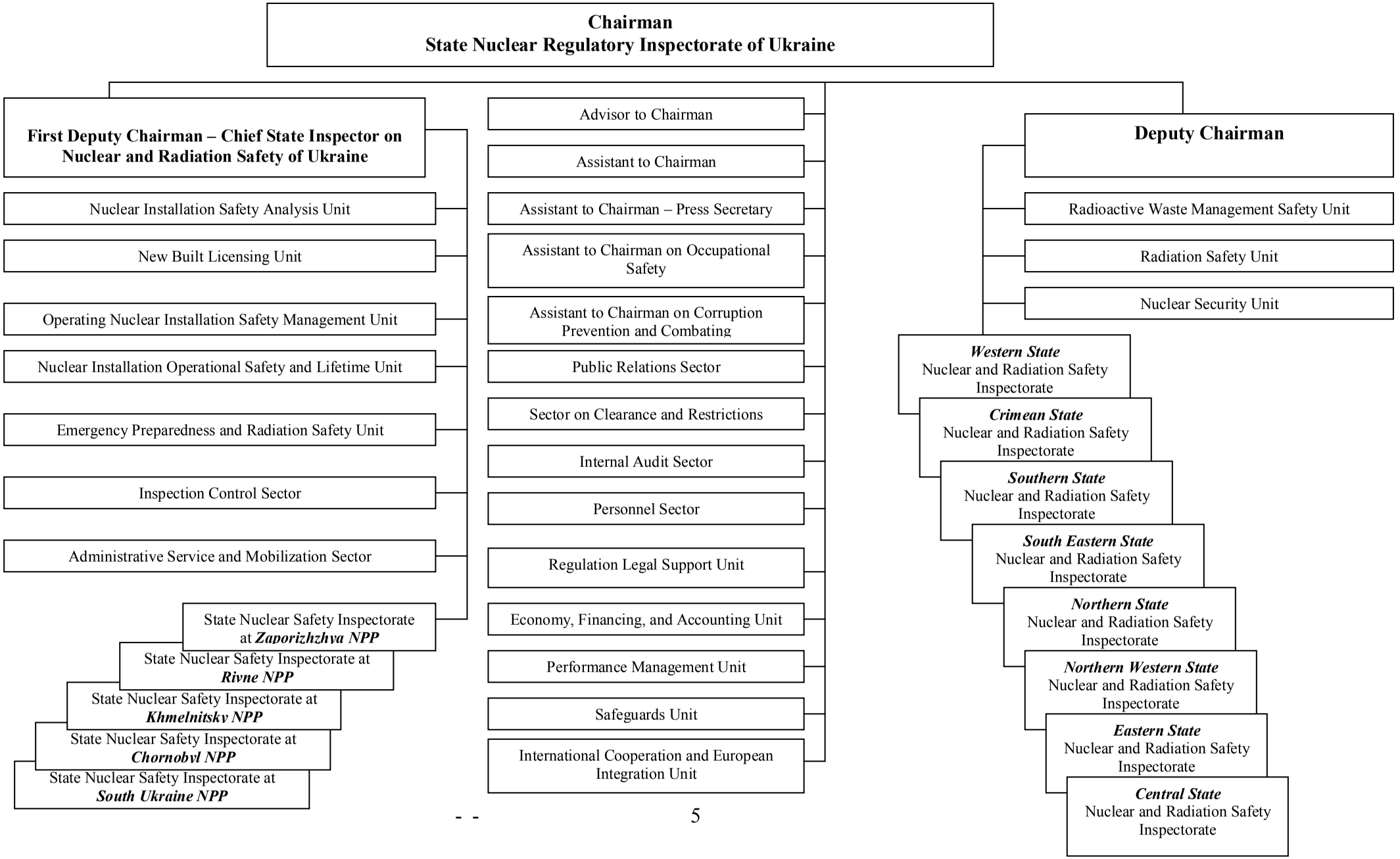
Shelter facility;

uranium mining and milling plants;

shipments of radioactive material through the territory of Ukraine;

use and fabrication of radiation sources and radiation technologies.

In 2013, the SNRIU staff amount to 292 positions: 161 at the headquarters, 35 at 5 on-site state nuclear safety inspectorates, and 96 at 8 state nuclear and radiation safety territorial inspectorates.


Chairman
State Nuclear Regulatory Inspectorate of Ukraine
First Deputy Chairman – Chief State Inspector on Nuclear and Radiation Safety of Ukraine
Nuclear Installation Safety Analysis Unit
New Built Licensing Unit
Operating Nuclear Installation Safety Management Unit
Nuclear Installation Operational Safety and Lifetime Unit
Emergency Preparedness and Radiation Safety Unit
Inspection Control Sector
Administrative Service and Mobilization Sector
State Nuclear Safety Inspectorate at Zaporizhzhya NPP
State Nuclear Safety Inspectorate at Rivne NPP
State Nuclear Safety Inspectorate at Khmelnitsky NPP
State Nuclear Safety Inspectorate at Chornobyl NPP
State Nuclear Safety Inspectorate at South Ukraine NPP
Advisor to Chairman
Assistant to Chairman
Assistant to Chairman – Press Secretary
Assistant to Chairman on Occupational Safety
Assistant to Chairman on Corruption Prevention and Combating
Public Relations Sector
Sector on Clearance and Restrictions
Internal Audit Sector
Personnel Sector
Regulation Legal Support Unit
Economy, Financing, and Accounting Unit
Performance Management Unit
Safeguards Unit
International Cooperation and European Integration Unit
Deputy Chairman
Radioactive Waste Management Safety Unit
Radiation Safety Unit
Nuclear Security Unit
Western State Nuclear and Radiation Safety Inspectorate
Crimean State Nuclear and Radiation Safety Inspectorate
Southern State Nuclear and Radiation Safety Inspectorate
South Eastern State Nuclear and Radiation Safety Inspectorate
Northern State Nuclear and Radiation Safety Inspectorate
Northern Western State Nuclear and Radiation Safety Inspectorate
Eastern State Nuclear and Radiation Safety Inspectorate
Central State Nuclear and Radiation Safety Inspectorate

To develop recommendations on significant issues and the most important areas of state regulation of nuclear and radiation safety, the following advisory and consultative bodies work on a permanent basis: SNRIU Board, Public Council, Reactor Safety Advisory Council and Radiation Protection Advisory Council.

The SNRIU has also collegial advisory bodies such as the Working Commission on Regulatory Control, Licensing Commission for Personnel, and general Licensing Commission, which coordinate the work and make collective and open decisions in relevant areas.

The SNRIU has two state enterprises that render scientific and technical support: State Scientific and Technical Centre for Nuclear and Radiation Safety and State Quality Control Center for Supplies and Services.

2. 2013 Year in Details

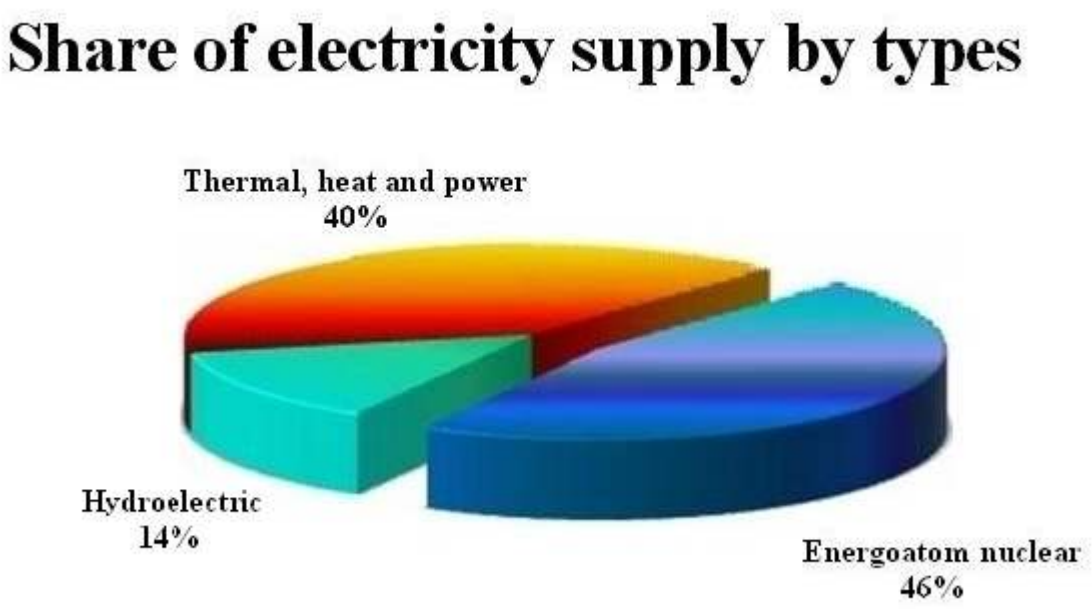
Date	Month/Event
	February
18	Working design for dismantling of ChNPP stage II agreed and approved
20	SNRIU issued license series EO No. 001002 for construction and commissioning of the Dry Spent Fuel Storage Facility (ISF-2) to the Chornobyl NPP
	March
5	Order No. 8 of the SNRIU Board agreed the draft "National Action Plan upon Stress-Test Results"
29	Order No. 9 of the SNRIU Board agreed the conclusion of state nuclear and radiation safety review for the ChNPP design "New Safe Confinement. Startup System-1. Licensing Package-6. Protective Structure with Process Life-Supporting Systems and Infrastructure"
	April
22	ChNPP obtained an individual authorization for construction and installation of the first startup system of the Shelter new safe confinement within licensing package LP-6
22-26	SNRIU experts participated in the peer review of the national plans of stress-test countries (EC countries, Switzerland, Ukraine)
	May
22	Individual authorization issued to ChNPP for dismantling of the ChNPP stage II ventilation stack
27	Cabinet Resolution No. 370-r approved the construction project for the neutron source based on a subcritical assembly driven by a linear electron accelerator
	June
14	SNRIU Order No. 64-or approved the Procedure for Establishing and Keeping the Unified Register of Licenses for Nuclear Energy Activities (NP 306.1.190-2013), registered at the Ministry of Justice of Ukraine, No. 1141/23673 dated 9 July 2013
14	SNRIU Board Order No. 10 approved the conclusion of state nuclear and radiation safety review on the "Basic Conceptual Decisions on New Khmelnitsky NPP Units No. 3 and 4 Based on AES-92 Design" and indicated that, among other things, these conceptual technical decisions: – in general complied with national standards, rules and regulations on nuclear and radiation safety; – took into account recommendations of international recommendations on new NPP designs; – allowed design of power units in compliance with the decisions identified

	in SNRIU Board Resolution No. 15 of 20 November 2012 "On Safety Criteria and Requirements for Construction of New NPP Units in the Light of the Fukushima Accident".
15	Chornobyl NPP successfully completed the second lifting of the metal structures of the New Safe Confinement to a level of 85 m
	July
25	SNRIU Order No. 76 approved the "Procedure for Establishment and Development of Security Culture at Nuclear Installations and Facilities for Management of Radioactive Waste and Other Radiation Sources" (NP 306.8.191-2013) and "Procedure for Assessment of Security Culture of Nuclear Installations and Facilities for Management of Radioactive Waste and Other Radiation Sources," registered in the Ministry of Justice by No. 1543/24075 and No. 1544/24076 on 6 September 2013
25	SNRIU Order No. 11 agreed the Sixth National Report of Ukraine's Compliance with Obligations under the Nuclear Safety Convention
12	The working documentation on "Compensatory Measures on Improving the Reliability of New ChNPP Ventilation Stack II and Eliminating Defects of the New Ventilation Stack Metal Structures" reviewed and agreed
	August
1	The technical decision "On Introduction of the Arch Working Platform into Commercial Operation in Free Access Mode" reviewed and agreed
2	Chornobyl NPP obtained an individual authorization for commissioning of the new ventilation stack of ChNPP stage II
5	SNRIU Order No. 83 approved the "Rules for Radiation Safety of Electron Accelerators" (NP 306.5.192-2013), registered in the Ministry of Justice, No. 1442/23974 dated 21 August 2013
9	SNRIU Order No. 83 agreed the "Provisions on Departmental Incentive Awards of the State Nuclear Regulatory Inspectorate of Ukraine" (NP 306.1.193-2013), registered in the Ministry of Justice, No. 1484/24016, 29 August 2013
29	The ChNPP working design on recovery (repair) of the enclosing structure of the ChNPP unit 4 turbine hall after the abnormal event on 12 February 2013 with partial collapse of the roof and wall panels in the turbine hall reviewed and agreed
	September
13	The work design for the third jacking of the eastern part of the new safe confinement arch reviewed and agreed
26	SNRIU Board Order No. 14 considered it possible to issue a license to the Kharkiv Institute of Physics and Technology for construction and commissioning of the neutron source based on a subcritical assembly driven by a linear electron accelerator
	October
10	The SNRIU issued license series EO No. 001018 to the Kharkiv Institute of

	Physics and Technology for construction and commissioning of the neutron source based on a subcritical assembly driven by a linear electron accelerator
11	The Chornobyl NPP successfully completed the third lifting of metal structures of the eastern part of the new safe confinement arch to a level of 109 m
25	SNRIU issued an individual authorization to the Chornobyl NPP for operation of the new ventilation stage of ChNPP stage II
	November
13	Cabinet Resolution No. 824 approved the "Procedure for State Supervision over Compliance with Nuclear and Radiation Safety Requirements"
18	Public hearings on the SNRIU draft decision on long-term operation of South Ukraine Unit 1
28	SNRIU Board Resolution No. 17 validated the possibility of South Ukraine Unit 2 operation at design-basis power up to 2 December 2023
	December
4	According to SNRIU Order No. 18, First Deputy Chairman, Chief State Nuclear and Radiation Safety Inspector, M. Gashev, approved the conclusions of state review for the Preliminary Safety Analysis Report on the Nuclear Fuel Fabrication Plant
26	According to SNRIU Order No. 25, it was decided to limit operation of the nuclear research reactor VVR-M only to maintenance and repair in shutdown state with nuclear fuel removed from the core, and conditions were identified to reconsider its further operation

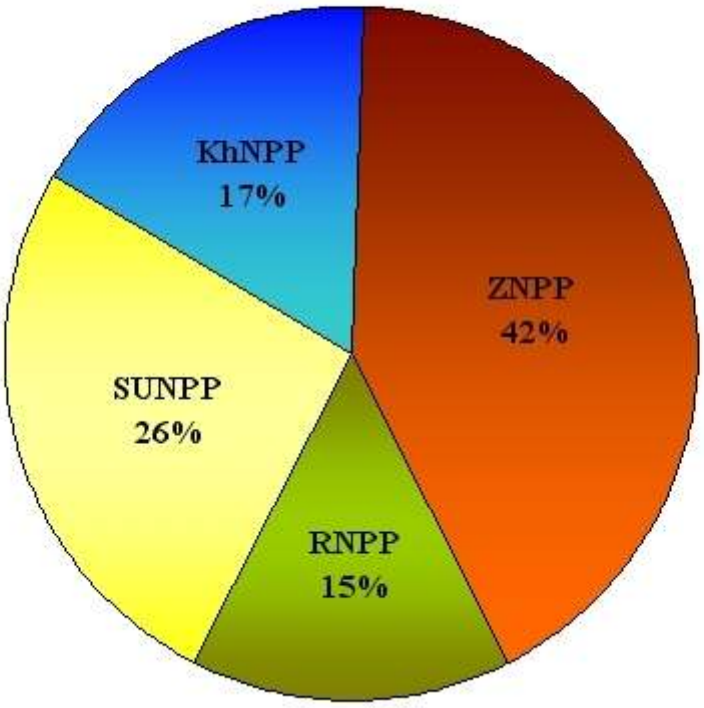
3. Safety Enhancement of Ukrainian NPPs

Ukraine operates 15 power units, ranks 10th in the world for this indicator and takes the 7th place in the installed capacity. The only operator of all operating nuclear power plants in Ukraine is the State Enterprise "National Nuclear Energy Generating Company Energoatom (hereinafter – National Nuclear Utility *Energoatom*). The National Utility *Energoatom* includes four nuclear power plants.



Installed capacity of Ukrainian nuclear power units in 2013 is 13,835 MW.

Share of each NPP in total nuclear electricity production



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 international best practices.

Peer reviews of WANO[1] and IAEA confirmed operational safety of Ukrainian NPPs and validity of safety upgrades implemented under operating safety improvement and long-term operation programs.

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 Cabinet Resolution No. 1270 of 7 December 2011. The C(I)SIP) objective is 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.

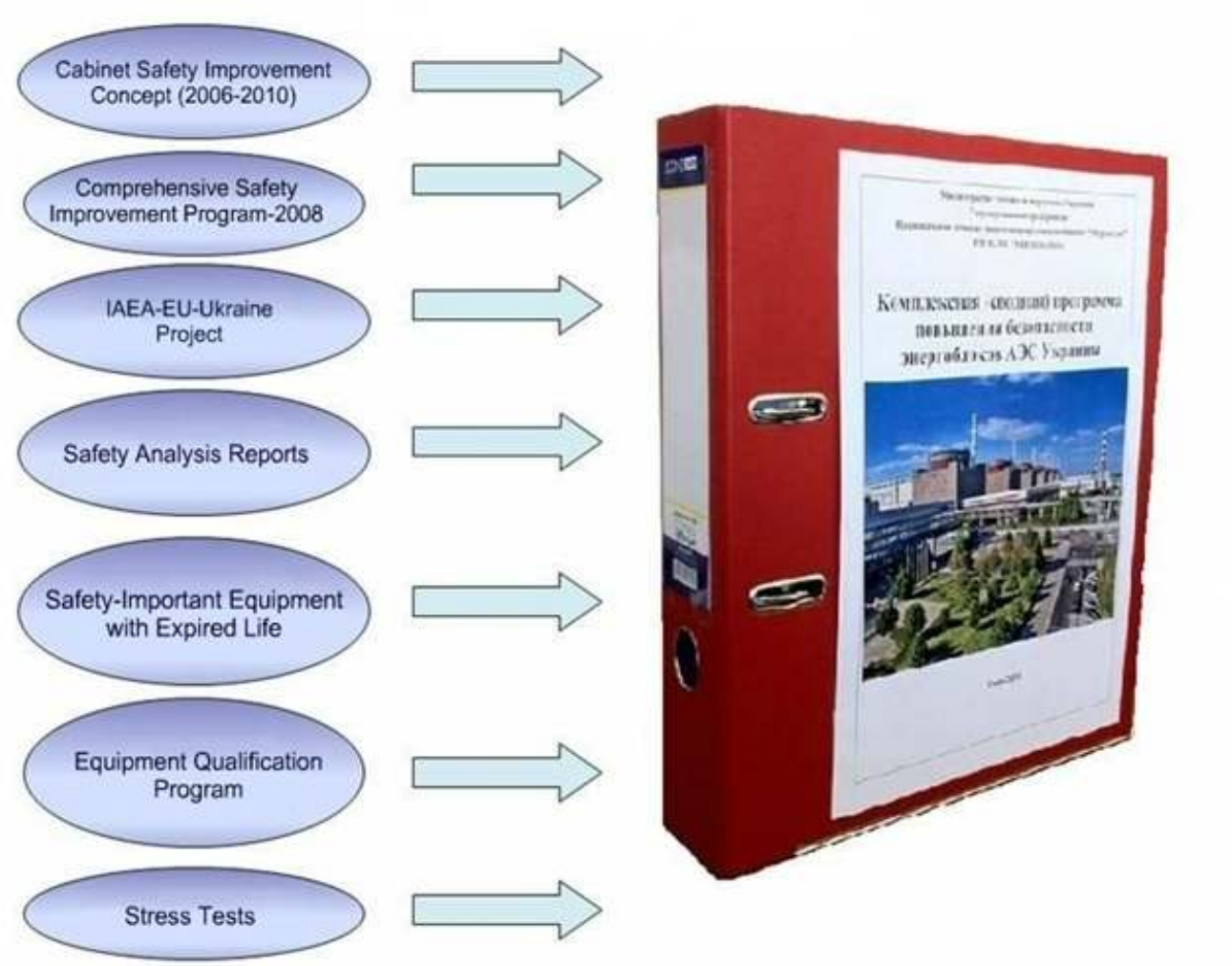
The C(I)SIP is based on safety improvement measures of the previous program: “Concept for Safety Improvement of Operating Nuclear Power Units” (agreed by Cabinet Resolution No. 515-r of 13 December 2005), which were not implemented by the operating organization till the end of

[1] WANO is the World Association of Nuclear Operators

the Concept, and safety improvement measures for Khmelnitsky-2 and Rivne-4, which 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 implemented at all NPPs under the Memorandum of Understanding in the Field of Nuclear Energy between Ukraine and EC.

Comprehensive (Integrated) Safety Improvement Program for Ukrainian NPPs



After the Fukushima accident, the program included additional measures for 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 10 Ukrainian NPP units expires from 2013 to 2019 (see Table 1); moreover, it may be required to make decisions on long-term operation of two power units at the same time in 2015, 2016, 2017 and 2019.

Table 1 – Data on Power Units of Ukrainian NPPs

NPP, unit No.	Electrical power, MW	Reactor type	Completion date of design operation
ZNPP			
1	1000	V-320	23.12. 2015
2	1000	V-320	19.02. 2016
3	1000	V-320	14.07.2017
4	1000	V-320	04.04.2018
5	1000	V-320	27.05.2020
6	1000	V-320	21.10.2026
SUNPP			
1	1000	V-302	02.12.2023
2	1000	V-338	12.05.2015
3	1000	V-320	10.02.2020
RNPP			
1	420	V-213	22.12.2030
2	415	V-213	22.12.2031
3	1000	V-320	11.12.2017
4	1000	V-320	07.06. 2035
KhNPP			
1	1000	V-320	13.12.2018
2	1000	V-320	07.09.2035

During 2013, a number of important C(I)SIP measures were implemented for the first time at operating units of Ukrainian NPPs. According to C(I)SIP plans, the operator focused its main efforts in 2013 on the development and implementation of long-term operation measures for South Ukraine NPP units 1 and 2 and Zaporizhzhya NPP units 1 and. The experience in measures at the so-called pilot power units is further used at other operating units. Examples of the most important measures in 2013 include the following:

- implementation of severe accident management guidelines and symptom-oriented emergency operating procedure for shutdown states;
- commissioning of the information storage system in design-basis and beyond design-basis accidents (black box). Implementation of this system will allow identification and analysis of emergency and accident causes and development of mitigation measures;

Black Box System

- replacement of BRU-A electrical drives by those qualified for harsh environments that may occur during secondary steam line break;

- implementation of the leak-before-break concept for the primary pressure coolant piping;

- monitoring and mitigation of hydrogen in the containment (introduction of hydrogen emergency concentration measurement system and hydrogen emergency removal system);
- implementation of measures to prevent severe accidents, in particular, heat removal from nuclear fuel in severe accidents and emergency power supply in station blackout conditions (steam generator makeup, additional power supply sources, operability of group A service water supply systems, containment emergency venting).

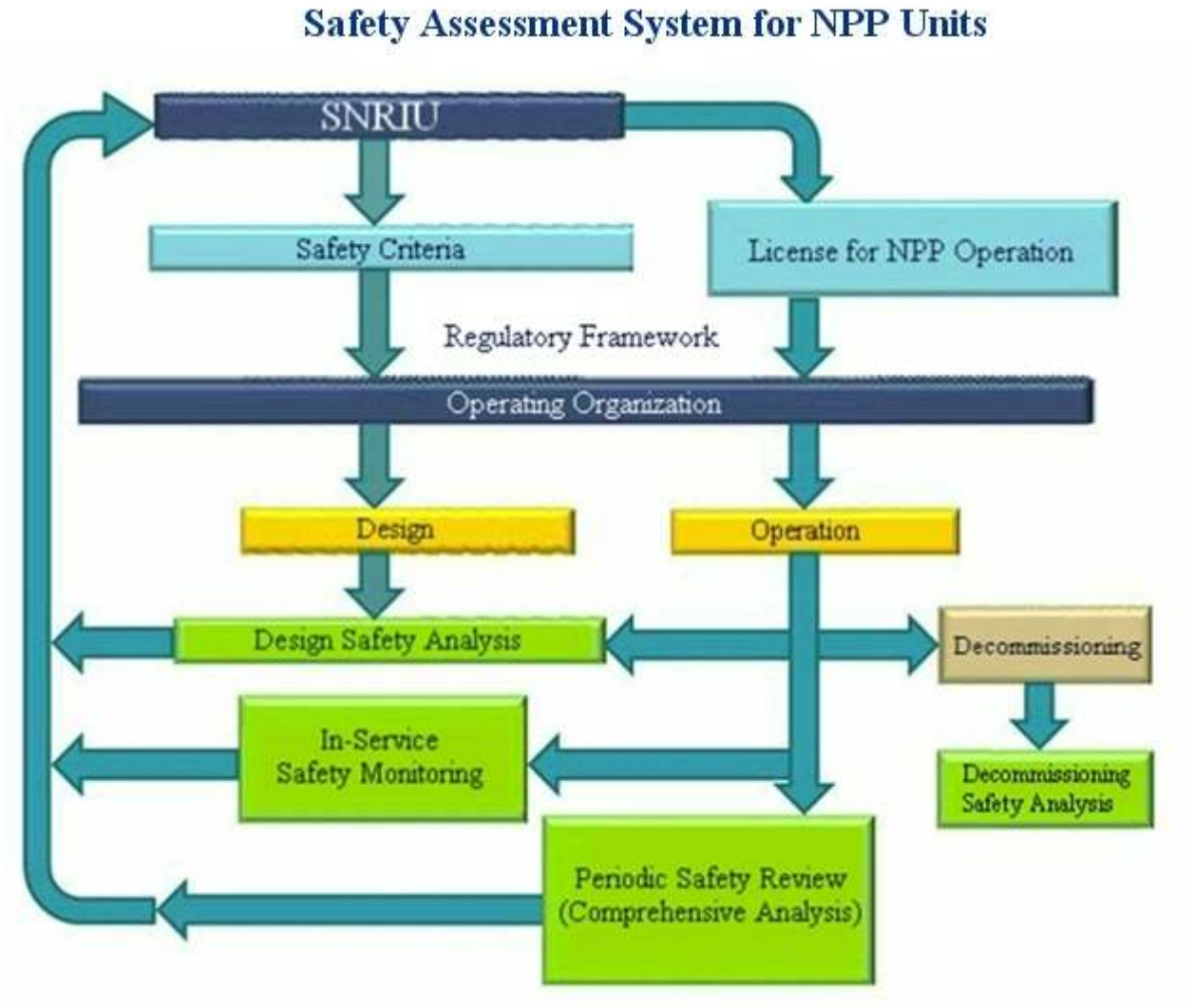
The current industry-wide issue is to implement an automated control system for the primary-to-secondary accident for VVER-1000. The system provides for automation of necessary personnel actions to increase the reliability of compliance with acceptance criteria for managing the accidents caused by primary-to-secondary coolant leakage. In 2013, the primary-to-secondary-leakage management system was introduced into trial operation at Rivne-4 and South Ukraine-1. The system is under implementation at all other power units.

Equipment qualification, technical state assessment and emergency response system improvement measures are underway at all operating units. The reports are gradually submitted to the SNRIU for state review. It should be separately noted that instrumented seismic analyses are in their final stage for ZNPP. The results of these seismic analyses and safety margins will be used to establish the seismic level of ZNPP site (similar efforts were completed for SUNPP, introduction of seismic monitoring system is underway for KhNPP and RNPP).

Any modifications important to safety of nuclear installations (change in nuclear installation configuration, bringing of nuclear installation level into compliance with current regulations and standards, changes in operational documents, modification of the organizational structure of the operating organization) are implemented upon agreement with the SNRIU.

The State Nuclear Regulatory Inspectorate of Ukraine constantly monitors all stages of modifications (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 of this monitoring are discussed at open meetings of the SNRIU Board involving all stakeholders, including the public and mass media.

Hence, the Board meeting on 14 February 2013 analyzed the status of safety improvement measures implemented at nuclear power plants in compliance with the "Schedule of C(I)SIP Measures for 2012 for V-320, V-338, V-302 and V-213 Reactors", agreed by SNRIU.



During the year, 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.

This document was developed in compliance with the National Action Plan (NAcP) Guidance as directed within the ENSREG Stress test Action Plan.

The National Action Plan upon Stress-Test Results takes into account:

- ENSREG recommendations and proposals set forth in the "Compilation of recommendations and suggestions. Peer review of stress tests performed on European nuclear power plants" in areas such as external extreme hazards, loss of safety functions and management of severe accidents;

- basic issues of the Extraordinary Meeting of the contracting parties to the Convention on Nuclear Safety (August 2012, Vienna, Austria) in areas such as national organizations, emergency preparedness and response and international cooperation.

The draft National Action Plan was presented at the open meeting of the SNRIU Board on 5 March 2013 with involvement of interested ministries/departments/organizations and the pubic. The National Plan revised to incorporate stakeholder's proposals was submitted by the SNRIU to ENSREG for further joint discussion by all stress-test countries in April 2013 in Brussels.

The National Plan of Ukraine was positively evaluated by the 'stress-test' countries, recognized as transparent and complying with the structure proposed by ENSREG, and covering all the aspects mentioned in the ENSREG action plan. The National Plan was discussed and approved at an ENSREG public meeting with stakeholders, including non-governmental organizations and mass media.

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.

4. South Ukraine NPP Unit 1

At the end of 2011, resulting from analysis of the targeted extraordinary safety assessment at operating NPPs and considering lessons learnt from the Fukushima accident (stress tests), SNRIU Board Order No. 13 dated 24-25 November established obligatory conditions for NPP long-term operation over 30 years, such as safety improvement measures identified upon stress-test results to be implemented by the operator. South Ukraine NPP unit 1 was the first to comply with these SNRIU requirements.

It was noted at the SNRIU Board meeting on 20 December 2012 regarding further possible operation of South Ukraine-1 based on periodic safety review that the measures taken by the operator to prepare the power unit for further operation gave no grounds for making a positive decision, and the following conditions for reconsideration of this issue were established:

− complete activities related to justification of resistance to earthquakes at a level of 0.12 g (ground acceleration) for piping, buildings and structures that perform critical safety functions;

− complete activities related to equipment qualification for harsh environments and seismic impacts;

− complete activities related to technical state assessment of components such as the reactor pressure vessel, piping and group B and C equipment providing safe shutdown and reactor cooldown;

− confirm the possibility of safe long-term operation of the containment (considering current technical state);

− take measures of the Comprehensive (Integrated) Safety Improvement Program at NPPs in the scope established by the SNRIU.

http://www.snrc.gov.ua/nuclear/uk/publish/article/205102

During 2013, the operator focused its activities, human and financial resources on safety improvement of the NPP unit and substantiation of its further operation considering the lessons learnt from the Fukushima accident and appropriate SNRIU decisions.

After taking significant administrative and technical measures to prepare South Ukraine-1 for further operation and revise the Periodic Safety Review Report (PSRR) to incorporate comments of the state nuclear and radiation safety review and address the results of activities performed in autumn 2013, the operator repeatedly applied to the SNRIU to reissue License Series EO No. 000064 for nuclear facility operation at South Ukraine NPP.

The operator substantiated safe operation within ten years in the PSRR for South Ukraine-1, which is an obligatory annex to the application according to legislation.

The SNRIU together with representatives of the Ministry for Internal Affairs, State Service for Mining Supervision and Industrial Safety, State Health and Epidemiological Service, State Ecological Inspectorate, State Emergency Service and SSTC NRS experts performed comprehensive inspection according to the Law of Ukraine "On Authorizing Activity in Nuclear Energy Use" to check completeness and reliability of the information submitted by *Energoatom* and identify the applicant's capability to comply with conditions established for the specified activity within a period from 7 to 10 October 2013 at the South Ukraine NPP site.

The State Nuclear Regulatory Inspectorate of Ukraine conducted public discussion of long-term operation of South Ukraine-1 and renewal of License Series EO No. 000 064 for

Energoatom activities on nuclear facility operation at South Ukraine NPP to involve the public in state affairs, discuss decisions that might affect the environment, and allow free access to information on activities performed by executive bodies in October and November 2013.

http://www.snrc.gov.ua/nuclear/uk/publish/article/229466

The key stage of this dialog with the public was public hearings conducted by the SNRIU jointly with its Public Council and with involvement of *Energoatom* on 18 November 2013 in the city of Yuzhnoukrainsk.

http://www.snrc.gov.ua/nuclear/uk/publish/article/232977

Further possible operation of South Ukraine-1 resulting from periodic safety review was considered at the open meeting of the SNRIU Board on 28 November 2013.

The operator complied with the SNRIU conditions to review this issue and consider the lessons learnt from the Fukushima accident, namely:

- after seismic qualification and after upgrading or replacement, 100 % of equipment performing critical safety functions was qualified for peak ground acceleration (PGA) of 0.12g. Seismic resistance for PGA=0.12g of power unit piping, buildings and structures contributing to critical safety functions was confirmed (it should be noted that significant safety margins exist for most equipment, piping, buildings and structures at South Ukraine-1);
- equipment subjected to qualification for harsh environments was qualified by 100 %;
- current technical state of the reactor pressure vessel, containment, piping and group B and C equipment performing safe shutdown and reactor cooldown meets the requirements of current standards, rules and regulations, their potential further safe operation was confirmed;

- measures of the Comprehensive (Integrated) Safety Improvement Program for NPPs established in SNRIU Board Ordinance No. 18 of 20 December 2012 were implemented, including safety improvement measures identified upon stress-test results.

The possibility of safe operation of the power unit at design power was justified up to 2 December 2023 based on results of state nuclear and radiation safety review of South Ukraine-1 PSRR and comprehensive inspection.

http://www.snrc.gov.ua/nuclear/uk/publish/article/234340

The SNRIU reissued License Series EO No. 001019 for South Ukraine-1 operation; conditions for further operation of the power unit were determined and the period and scope of the next safety review were established.

5. Construction of Shelter New Safe Confinement (NSC)

The New Safe Confinement is the main project for Shelter transformation into an environmentally safe system. NOVARKA Consortium is the contractor responsible for design, construction and commissioning of the NSC first startup complex (NSC SC-1).

At the end of March 2013, the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) completed the state review on nuclear and radiation safety of NSC SC-1: "New Safe Confinement. Startup Complex 1. Licensing Package 6. Protective Structure with Vital Process Systems and Corresponding Infrastructure". It was acknowledged that the project complied with the requirements for nuclear and radiation safety. The state review conclusions for the project were approved by SNRIU Board Decision No. 9 of 29 March 2013.

On 22 April 2013, the SNRIU issued an authorization to implement activities envisaged by the abovementioned project.

In 2013, in the framework of authorizations issued earlier and agreed design decisions, Chornobyl NPP and NOVARKA Consortium carried out physical activities, in particular, the northern part of NSC foundation was constructed in the service area, NSC arch external and internal cladding panels and NSC supports and ventilation system air ducts were mounted. Preparatory work in the Shelter local area involved territory planning and cleaning, construction of a temporary protective wall, erection of supporting walls, soil cementation and preparation of the NSC processing building foundation.

The first lifting of NSC arch eastern part took place in November 2012. This part was lifted up to a height of approximately 53 m.

The second and the third lifting of this part of the arch took place in 2013:

- second lifting to a height of 85 m was completed on 15 June 2013;
- third lifting (final) to a height of 109 m was carried out in several stages and completed on 11 October 2013.

The arch metalwork weight together with mounted crane beams and air ducts made approximately 11,639 tons.

In the first part of 2014, in compliance with Chornobyl NPP plans, this part of the NSC arch has to be transferred to the so-called assembly area (holding zone) towards the Shelter to clear the place on the erection platform to mount the western part of the arch. After completion of the mounting and lifting of the western part of the arch, this part is to be connected to the eastern part. Then the "connected" NSC arch should be transferred and set in position above the Shelter envisaged by the design. The transfer of the eastern part of NSC arch to the "holding zone" was agreed upon by the SNRIU.

The erected eastern part of the arch should be held in this area for some time. It is planned to create conditions in this area similar to those on the arch erection platform (qualified as a free-access area), to create the so-called "strict-access area with special conditions of personnel access". A corresponding technical decision of the Chornobyl NPP was considered and agreed upon by the SNRIU.

The NSC side walls (eastern and western) will include newly built structures and existing ChNPP Stage II structures. In the framework of NSC project, it is necessary to reinforce and seal the existing civil structures. At the end of 2013, the SNRIU started the state review on nuclear and radiation safety of the working design "Reconstruction of ChNPP Stage II Main Building (Units 3, 4) with reinforcement and sealing of NSC enclosing structures".

First lifting

Second lifting

Third lifting

Commissioning of ChNPP Stage II new ventilation stack (NVS)

The mounting of ChNPP Stage II new ventilation stack (NVS) was completed in March 2012.

In view of NVS metalwork defects (hairline cracks) revealed in July 2012, the Licensee, together with participants of KCK Consortium, *Ukratomenergo*, Paton Electric Welding Institute, Bechtel and V. Shimanovsky Ukrainian Research and Design Institute of Steel Structures inspected NVS and developed measures on elimination of these defects.

In compliance with the request of the State Enterprise *Ukrderzhbudekspertyza*, the SNRIU carried out the state review on nuclear and radiation safety and agreed the working design "Compensatory measures on NVS reliability enhancement and elimination of NVS metalwork defects".

In parallel, the SNRIU reviewed a set of documents submitted by Chornobyl NPP to obtain an authorization for commissioning of ChNPP Stage II NVS.

On 2 August 2013, based on the review of the submitted documents, the SNRIU issued Authorization Series OD No. 000033/7 for NVS commissioning to be performed in two stages: NVS trial operation and acceptance tests.

On 25 October 2013, after elimination of NVS metalwork defects and after completion of trial operation and acceptance tests, the SNRIU issued Authorization Series OD No. 000033/8 for NVS commissioning based on the application package submitted by Chornobyl NPP.

Dismantling of ChNPP Stage II ventilation stack (VS-2)

The ChNPP Stage II ventilation stack (VS-2) hindered sliding of the New Safe Confinement to its design position and thus had to be dismantled. Basic dismantling work could be carried out after elimination of defects in the new ventilation stack (NVS) and after its commissioning.

The SNRIU, based on the request of the State Enterprise *Ukrderzhbudekspertyza*, carried out the state review on nuclear and radiation safety of the working design "ChNPP Stage II ventilation stack (VS-2) dismantling" and agreed the abovementioned design in February 2013.

On 22 May 2013, based on review of the Chornobyl NPP application package, the SNRIU issued Authorization Series OD No. 000033/6 for VS-2 dismantling.

In the framework of the dismantling design, the SNRIU considered and agreed additional documentation on basic construction (dismantling) and fragmentation of the dismantled ventilation stack and temporary storage of the VS-2 fragments.

The basic dismantling work started at the end of October 2013 after NVS commissioning. The last 7th assembly of VS-2 was dismantled on 24 November 2013 and the VS-2 opening was closed at the end of 2013. The fragmentation and dust suppression of the dismantled structures and their storage arrangement are to be completed in the first part of 2014.

6. Physical Protection (20 Years in Ukraine)

After gaining independence in 1991, Ukraine became the owner of a powerful arsenal of nuclear weapons and five nuclear power plants. The Soviet legacy includes a great number of institutions, industrial enterprises and organizations that dealt with radiation sources, enterprises that used radioisotope instruments, and several uranium mining and milling plants. However, there was practically no regulatory and legal framework to govern the rights, duties and responsibilities of entities in the area of nuclear energy. Therefore, in the early years of independence, Ukraine started the active development of its national nuclear legislation.

In terms of physical protection, 2013 is an anniversary year for Ukraine. There was a series of events in the young Ukrainian state that initiated and formed the objectives and areas for development of physical protection, namely:

5 May 1993: the Government of Ukraine adopted the Resolution "On Participation of Ukraine in the Convention on the Physical Protection of Nuclear Material of 1980".

25 October 1993: the Agreement between Ukraine and the United States of America concerning assistance to Ukraine in the elimination of strategic nuclear arms and the prevention of proliferation of weapons of mass destruction was signed. Among other US obligations, the Agreement provides for the development of state control and physical protection systems for nuclear materials.

18 December 1993: the Agreement between the State Nuclear Regulatory Committee of Ukraine and the Department of Defense of the United States of America concerning the development of state systems for control, accounting and physical protection of nuclear materials to promote the prevention of nuclear weapons proliferation from Ukraine was signed to implement the Agreement dated 25 October 1993.

28 December 1993: the President of Ukraine issued the Decree "On Measures for Physical Protection of Nuclear Material and Nuclear Installations in Ukraine". The Decree is a legal act establishing the powers of the then State Nuclear Regulatory Committee of Ukraine,

Security Service of Ukraine and Ministry for Internal Affairs of Ukraine and the obligations of legal entities dealing with construction or operation of nuclear installations and use, storage or transportation of nuclear material, for the first time in the area of physical protection.

The concept for state regulation and control of nuclear industry in Ukraine, adopted by Governmental Resolution No. 3871-XII dated 25 January 1994, became the first step in creating the nuclear legislation in Ukraine.

The next step was governmental adoption of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" on 8 February 1995, which is a fundamental act for dealing with the issues of safe use of nuclear energy and radiation safety. This Law also defined the competence of nuclear regulatory authorities, governed state regulation of safety in the use of nuclear energy etc. The Law was the first to legally establish requirements for physical protection. The Law of Ukraine "On Physical Protection of Nuclear Installations, Nuclear Material, Radioactive Waste and Other Radiation Sources" was adopted on 19 October 2000 in development of the regulatory framework on physical protection.

1 – nuclear installation
2 – industrial site
3 – controlled area (within 3 km)
4 – observation area (within 30 km).

According to the Law of Ukraine "On Physical Protection of Nuclear Installations, Nuclear Material, Radioactive Waste and Other Radiation Sources", the physical protection system for nuclear installations, nuclear material, radioactive waste and other radiation sources is a series of administrative and technical measures taken to foster conditions to minimize the potential for sabotage, theft or any other improper removal of radioactive materials and strengthening of the nuclear non-proliferation regime.

Physical protection involves activities in the field of nuclear energy to ensure the security of nuclear installations, nuclear material, radioactive waste and other radiation sources and to strengthen the nuclear non-proliferation regime.


The State Nuclear Regulatory Committee of Ukraine, as a central executive body with a special status, was established by the Presidential Decree of 5 December 2000. This Decree entitled the State Nuclear Regulatory Committee of Ukraine with establishing safety criteria, conditions and requirements for the use of nuclear energy, issuing licenses and authorizations for activities in this area, exercising state oversight for compliance with legislation, regulations and standards for nuclear and radiation safety and performing other functions assigned to the national nuclear regulatory authority identified by the Convention on Nuclear Safety and Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

In connection with the administrative reform, the State Nuclear Regulatory Committee of Ukraine was renamed the State Nuclear Regulatory Inspectorate of Ukraine, and the Presidential Decree of 6 April 2011 approved the Statute of the State Nuclear Regulatory Inspectorate.

The main priority in the regulation of physical protection in recent years was implemented by amendment of the Laws of Ukraine “On Nuclear Energy Use and Radiation Safety” and “On Physical Protection of Nuclear Installations, Nuclear Material, Radioactive Waste and Other Radiation Sources” to consider current requirements for the physical protection system.

Under the Global Threat Reduction Initiative, surveys regarding the upgrading of engineered features of physical protection systems for a number of facilities were conducted all over the country. Hence, with assistance of the US Department of Energy and supervision of the State Nuclear Regulatory Inspectorate of Ukraine, the physical protection systems at medical facilities using radiation sources of category 1 were thoroughly upgraded from 2009 to 2013; 45 facilities were upgraded as a total. Efforts in this area are underway at other 25 facilities. Moreover, the SNRIU takes part in the international program to detect radioactive material in illicit trafficking, including measures for interaction of all involved central executive bodies of Ukraine and neighboring countries.

7. Operational Events at Ukrainian NPPs in 2013

Accounting and analysis of NPP operational events are an integral part of the operating experience feedback system, which in turn is a separate element of NPP safe operation.

Eleven operational events occurred at operating Ukrainian NPPs in 2013. They include:

- 5 events at ZNPP
- 2 events at RNPP
- 2 events at KhNPP
- 2 events at SUNPP.

Figure 1 presents the distribution of operational events at Ukrainian NPPs from 2008 to 2013 and shows that the number of events in 2013 slightly decreased as compared to the last year.

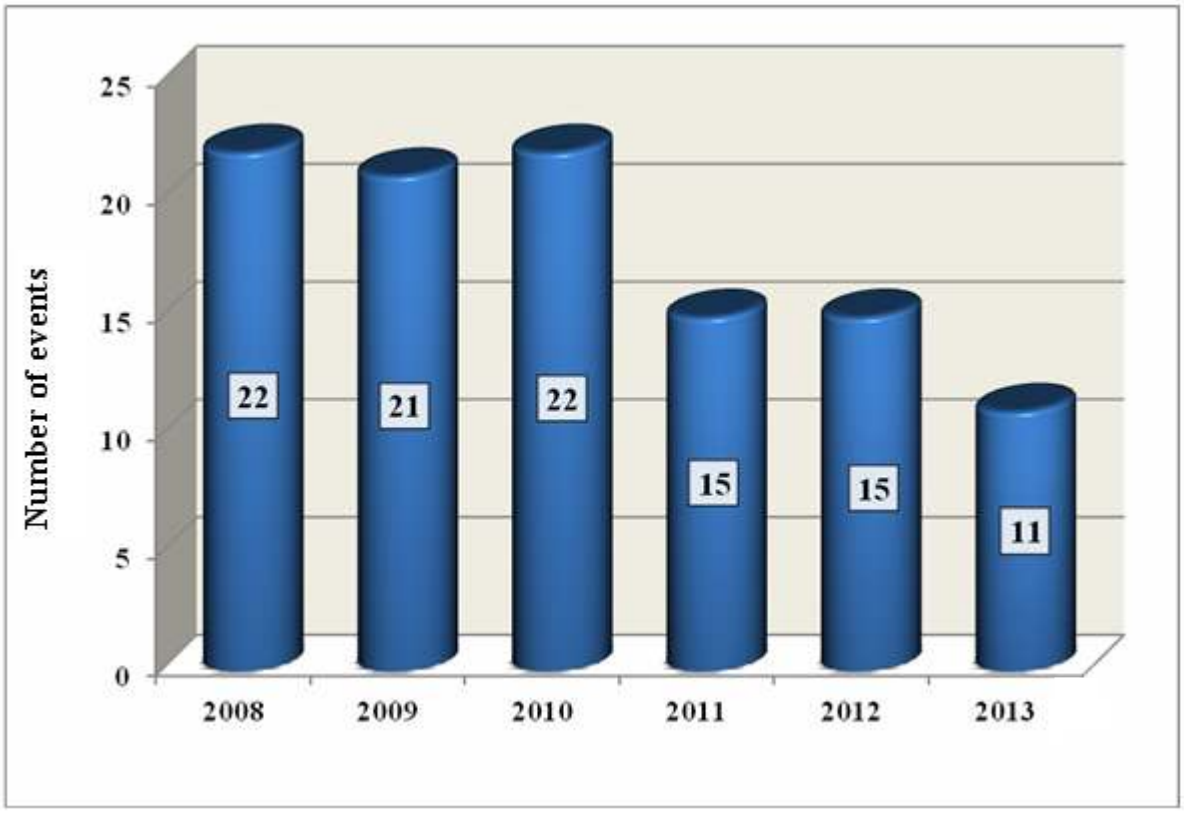


Figure 1 – Number of operational events at Ukrainian NPPs in 2008-2013

Figure 2 presents distribution of events by NPP sites in 2008-2013.

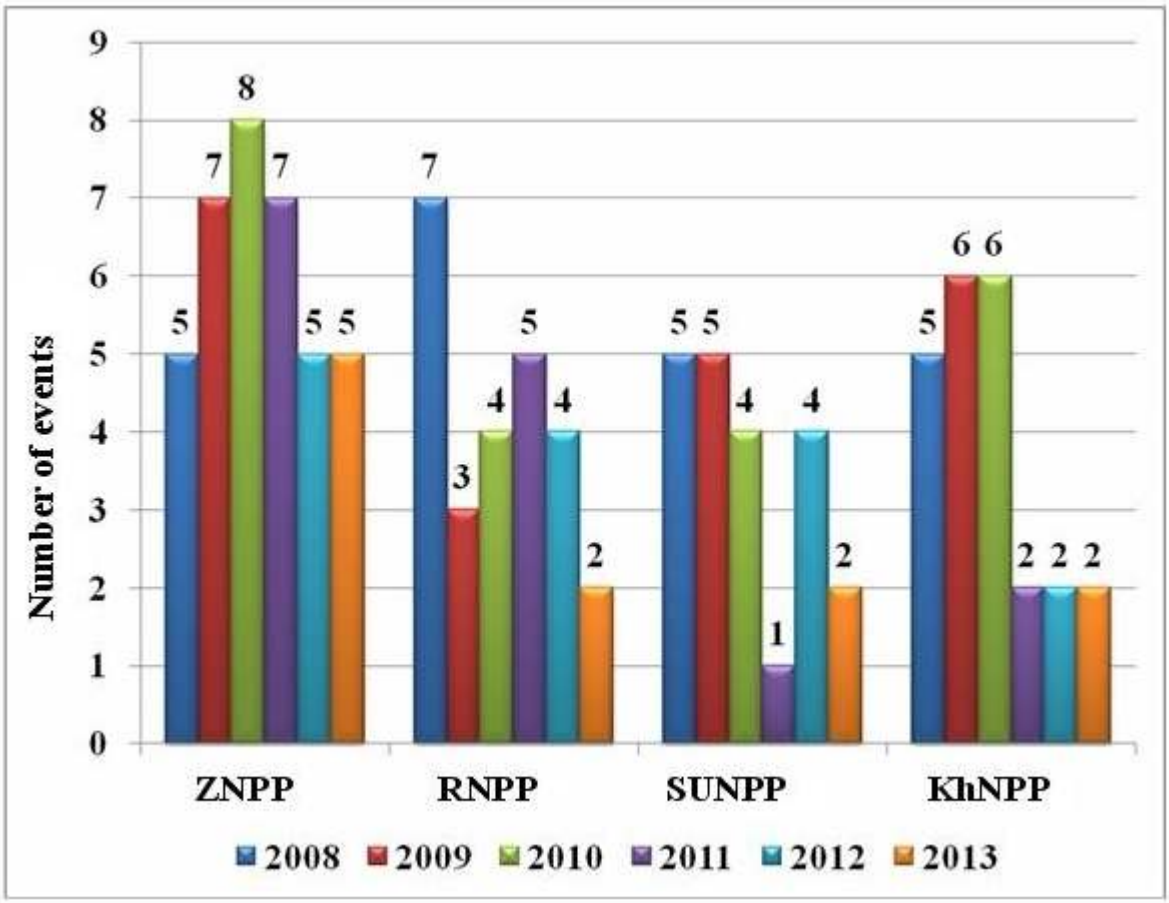


Figure 2 – Distribution of events by NPP sites in 2008-2013

RNPP and SUNPP were noted by the decrease of operational events. Performance indicators for KhNPP and ZNPP remained unchanged compared to the previous year.

All power units under commercial operation are divided into two groups according to reactor types: WWER-1000 (13 units) and WWER-440 (2 units).

Figure 3 presents distribution of the average number of events per unit according to reactor types of operating power units.

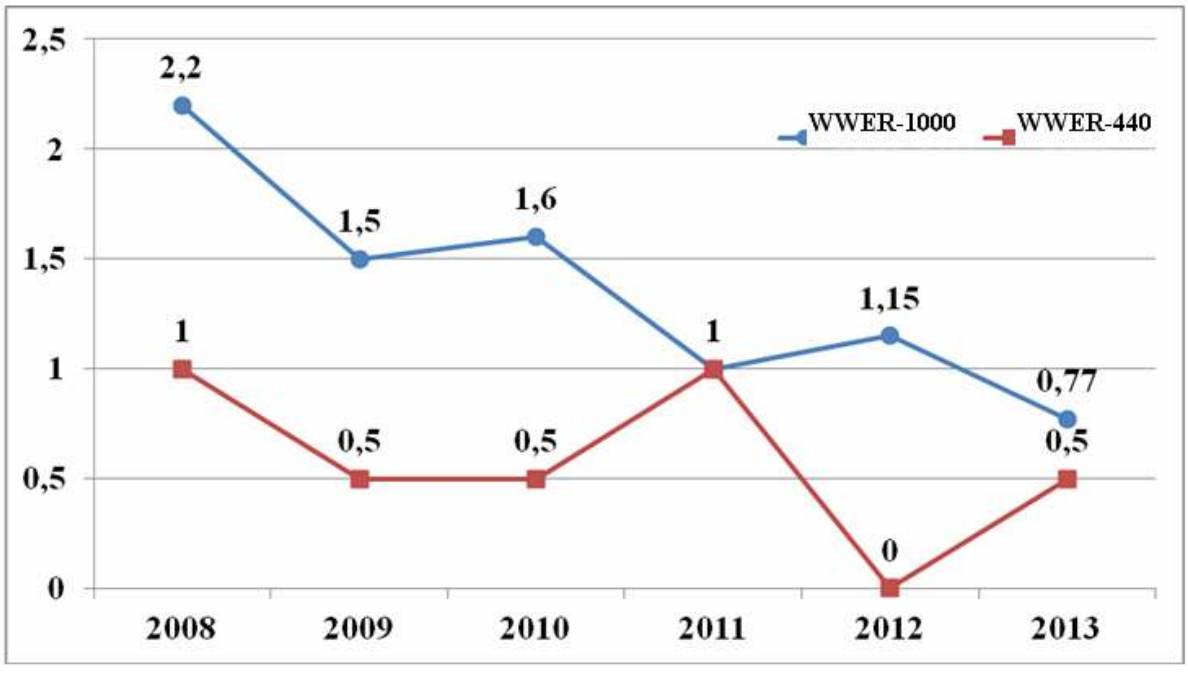


Figure 3 – Distribution of the average number of events per unit according to reactor types

According to 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 2013.

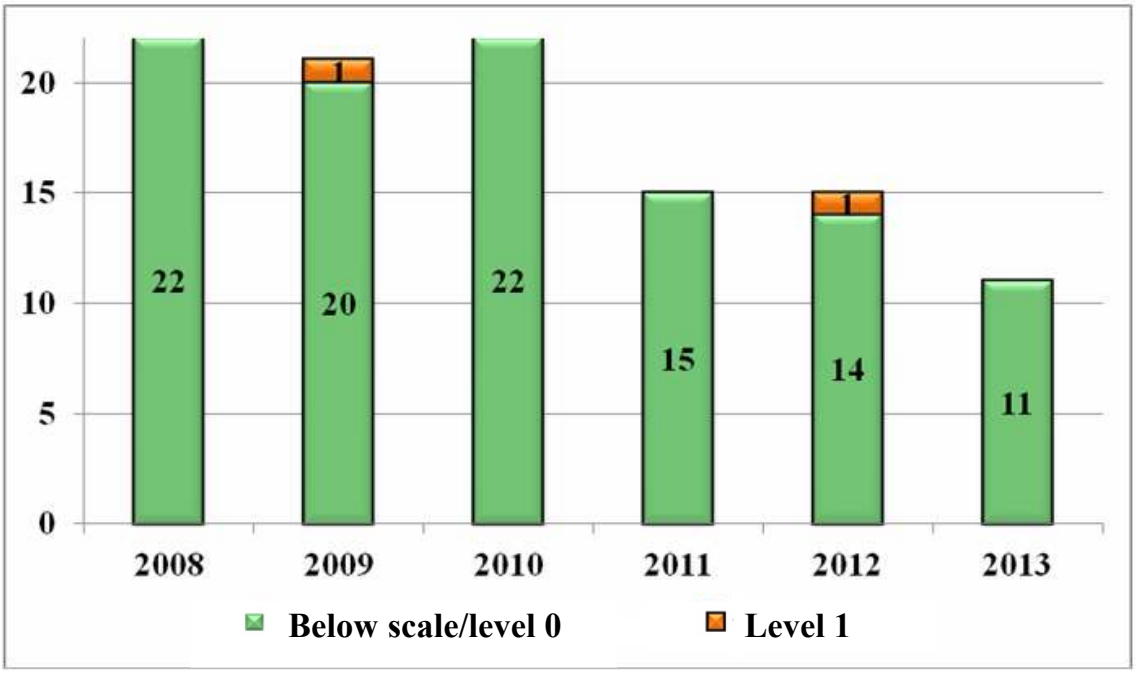


Figure 4 – Distribution of operational events at Ukrainian NPPs according to INES in 2008-2013

Depending on features and consequences, NPP operational events in 2013 included the following:

- reactor shutdown or power unit disconnection from the grid – 19% (2 events);
- power decrease by 25% and more from the preceding level – 36% (4 events);
- inoperability of a safety system train (trains) during the period not exceeding the one allowed by Technical Specifications for Safe Operation – 9% (1 event);
- failure of safety class 1 and 2 equipment and piping important to safety – 36% (4 events).

During an NPP operational event, there is deviation from normal operation (abnormal event) that can be caused by equipment failure, external impact, human error or procedure drawbacks. Figure 5 presents the distribution according to systems that failed or were affected during abnormal events.

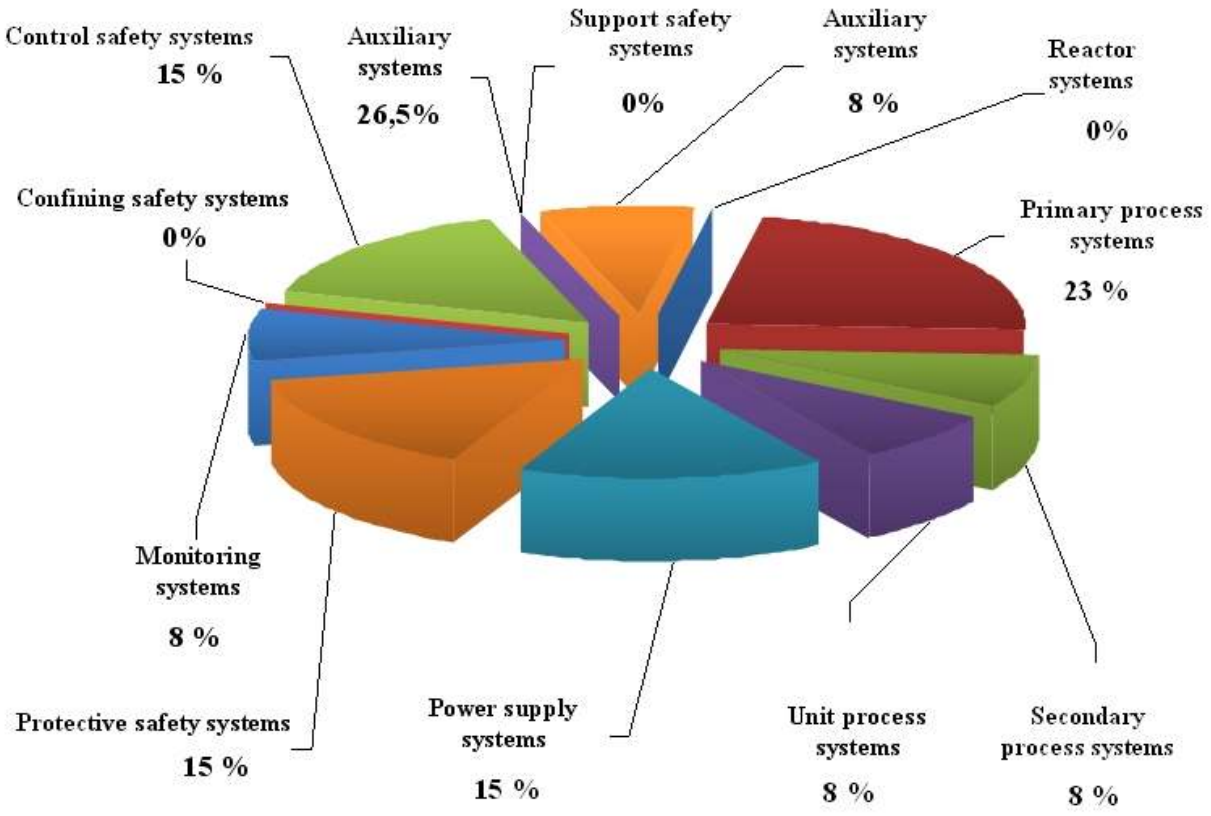


Figure 5 – Distribution according to systems that failed or were affected during abnormal events

The following systems failed the most in 2013:

- coolant system (primary process systems, reactor compartment systems);
- reactor control and protection system automation (control safety systems).

Analysis of components that failed or were damaged and categories of personnel who made a mistake showed that the highest number of events in 2013 occurred at:

- equipment of process systems (25%);
- equipment of systems for automated control of protection and alarm (25%);
- equipment of power supply systems (18.75%).

Figure 6 presents the distribution of root causes of abnormal events in 2008-2013.

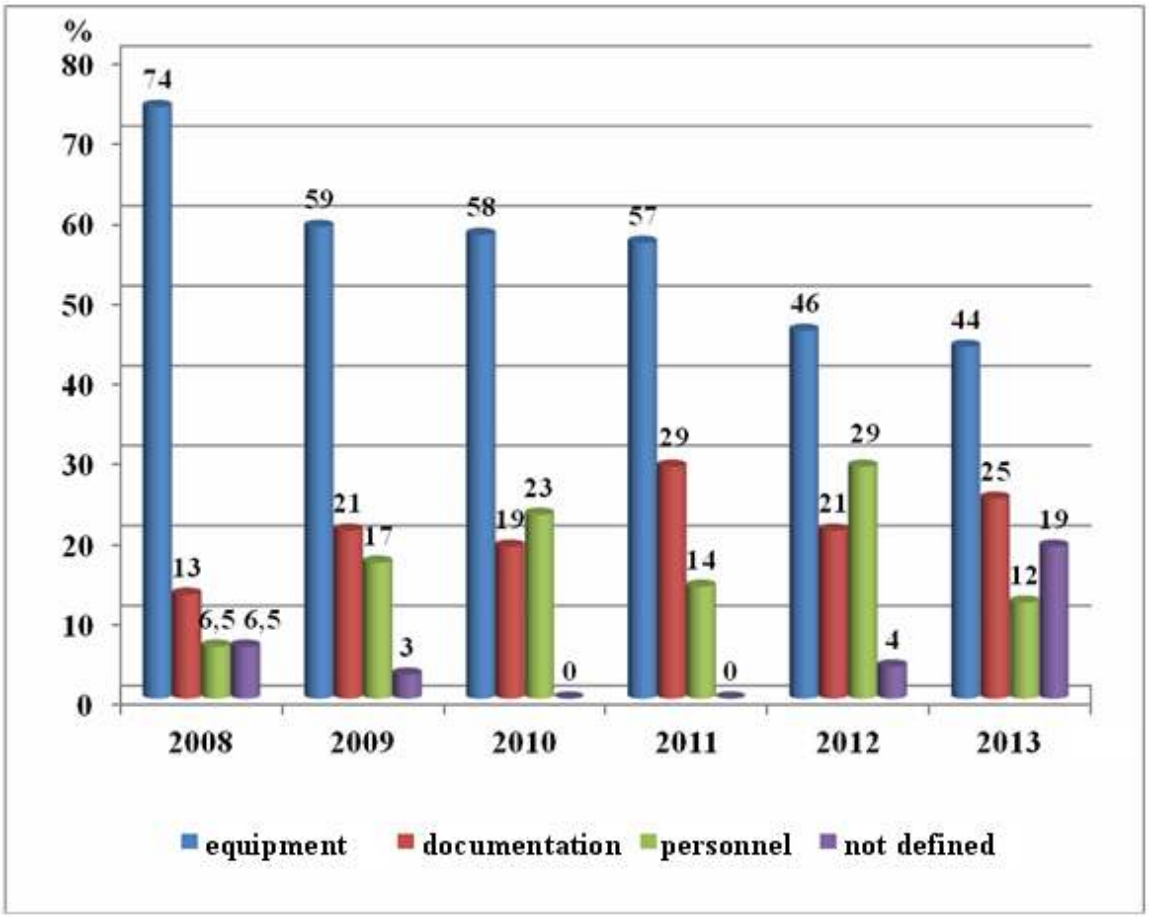


Figure 6 – Distribution of root causes of abnormal events

As a rule, causes related to equipment failures make the greatest contribution (44%). Over the last year, there was a sharp increase in the share of root causes not defined during the investigation that could cause further similar events. Comparing to the previous year, the share of root causes related to personnel decreased by 2.4 times.

The root causes related to equipment particularly occurred due to:

– design drawbacks;
– fabrication drawbacks.

Abnormal event with partial damage of wall panels and roof of the turbine hall at Chornobyl unit 4

On 12 February 2013, an abnormal event involving partial damage of the wall panels and roof above unattended rooms in the turbine hall occurred at ChNPP unit 4. The total area of destruction was about 600 m^2. There were no victims of this event.

According to conclusions of the investigation team and IAEA mission, roof collapse was caused by the ageing and damage of turbine hall roof structures and deaerator stack after the 1986 accident, uneven distribution of loads on structures, water leaking through the roof that contributed to corrosion of roof metal structures, absence of full-scale monitoring over the technical state of bearing structures because of hindered access to them, high doses on personnel, etc.

The SNRIU analyzed and classified the abnormal event with partial damage of the roof and wall panels of the turbine hall at ChNPP-4 as level 1 according to INES.

ChNPP took primary measures to avoid a possible negative impact of this incident and developed the “Action Plan on Reducing Consequences of Roof Collapse and Decrease of Potential Risks for Existing Structures and Personnel”, which was agreed by the SNRIU after revision.

ChNPP performed dust suppression inside the turbine hall to avoid spread of radioactive dust through the damaged roof, pumped additional volumes of water that flew into the turbine hall during precipitations, demounted and removed damaged structures in unstable state and implemented other activities.

ChNPP developed the project “Recovery of External Wall of the Turbine Hall at ChNPP-4 in Axes 46-52 of Rows A-B” and submitted it to the State Enterprise *Ukrderzhbudekspertyza* pursuant to the abovementioned “Action Plan …”. At the end of August 2013, the SNRIU completed state review of nuclear and radiation safety and agreed the project.

In November 2013, recovery of the external wall of the ChNPP-4 turbine hall started at ChNPP site.