UKRAINE

NATIONAL REPORT

ON COMPLIANCE OF UKRAINE WITH THE OBLIGATIONS UNDER THE CONVENTION ON NUCLEAR SAFETY

KYIV 2013

FOREWORD

On 20 September 1994, Ukraine signed the Convention on Nuclear Safety and put it into effect by the Law of Ukraine "On Ratification of the Convention on Nuclear Safety" on 17 December 1997.

Ukraine took an active part in review of the National Reports of the Contracting Parties, exchange of written questions and comments, as well as discussions during five Review Meetings.

This Sixth National Report has been developed in full compliance with the Convention on Nuclear Safety, "Guidelines Regarding National Reports under the Convention on Nuclear Safety" (International Atomic Energy Agency, Information Circular INFCIRC/572/Rev.4, 16 April 2013).

By submitting this National Report, Ukraine completely fulfils its obligations set forth in Article 20 of the Convention on Nuclear Safety.

This Report, as the previous ones, is the result of joint efforts of Ukrainian state authorities responsible for implementation of state nuclear energy policy and state enterprises (operating organisations):

- National Nuclear Energy Generating Company *Energoatom* (NAEK *Energoatom*);
- State Specialised Enterprise *Chornobyl NPP* (SSE *Chornobyl NPP*).

This Report is based on the legislative and regulatory documents applicable in Ukraine and official reports of the central executive bodies implementing the national nuclear energy policy.

The goal of this Report is to provide objective and unbiased information on the safety of nuclear installations and on measures undertaken to enhance its level and to protect the public and the environment of Ukraine, as well as to highlight changes and progress in the development of legislative and regulatory framework and in the nuclear energy sector of Ukraine over the last three years.

Based on the material presented in this National Report and according to the authorities entrusted by the Cabinet of Ministers of Ukraine, the Chairperson of the State Nuclear Regulatory Inspectorate of Ukraine declares:

The priority of human safety and environmental protection is maintained in the use of nuclear energy in Ukraine.

In this context, *Ukraine completely fulfils its obligations under the Convention on Nuclear Safety* as confirmed by:

- development of the legislative and regulatory framework to ensure the safe use of nuclear energy;
- establishment of the duly authorised state nuclear regulatory body, which sets safety criteria and requirements, develops and approves regulations and standards on nuclear and radiation safety and conducts licensing and state supervision independently of licensees and other state authorities;

- independence of the state nuclear regulatory body from any governmental bodies, institutions and officials dealing with nuclear energy and independence from the local authorities, self-administrations and associations of citizens;
- comprehensive safety assessments of existing nuclear installations and safety improvement measures;
- development of the emergency preparedness and response system;
- full responsibility of the licensee for ensuring safety and taking measures to protect the human and the environment;
- development of safety culture and implementation of safety self-evaluation practices.

The data in this Report, except as otherwise stated, are provided as of August 2013. The changes that may take place till March 2014 will be additionally reported by the delegation of Ukraine at the Sixth Review Meeting.

Conclusions on implementation of the obligations under appropriate articles of the Convention are italicised hereinafter in the text.

Kyiv, August 2013

Olena Mykolaichuk

Chairperson
State Nuclear Regulatory Inspectorate of Ukraine

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ABBREVIATIONS

C(I)SIP	Comprehensive (Integrated) Safety Improvement Program for Ukrainian Nuclear Power Plants
ChNPP	Chornobyl Nuclear Power Plant
CSFSF	Centralised Storage Facility for Spent Nuclear Fuel
DG	Diesel Generator
DSF	Dry Spent Fuel Storage Facility
DSS	Decision Support System
ECCS	Emergency Core Cooling System
ECR	Emergency Control Room
ENSREG	European Nuclear Safety Regulators Group
ÈOP	Emergency Operating Procedure
EU	European Union
FS	Feasibility Study
FSS	Full-Scale Simulator
IAEA	International Atomic Energy Agency
IMS	Integrated Management System
ISF	Interim Spent Fuel Storage Facility
KhNPP	Khmelnitsky Nuclear Power Plant
MCR	Main Control Room
NAEK *Energoatom*	National Nuclear Energy Generating Company *Energoatom*
NDE	Non-Destructive Examination
NPP	Nuclear Power Plant
OSART	Operational Safety Review Team
PGA	Peak Ground Acceleration
RNPP	Rivne Nuclear Power Plant
RPV	Reactor Pressure Vessel
SAM	Severe Accident Management
SAMG	Severe Accident Management Guideline
SAR	Safety Analysis Report
SAR	Safety Analysis Report
SBO	Station Blackout
SFP	Spent Fuel Pool
SG	Steam Generator
SNRIU	State Nuclear Regulatory Inspectorate of Ukraine
SSE	State Specialized Enterprise
SUNPP	South Ukraine Nuclear Power Plant
TC	Training Centre
UHS	Ultimate Heat Sink
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators' Association
WWER	Water-Cooled Water-Moderated Power Reactor
ZNPP	Zaporizhzhya Nuclear Power Plant

INTRODUCTION

The Fukushima Daiichi accident that occurred on 11 March 2011 posed the following challenges before the nuclear community: analyse in detail causes of the accident and learn its lessons, develop and implement measures to prevent severe accidents or, if they happen, mitigate their detrimental effects on the public and environment.

The improvement of operational safety at all Ukrainian nuclear power plants in the light of the Fukushima Daiichi accident was discussed at the meeting of the National Security and Defense Council of Ukraine (NSDC) on 8 April 2011. The NSDC resolutions, indicating a need for an extraordinary in-depth safety reassessment of Ukrainian NPPs including seismic analyses, were enacted by Presidential Decree No. 585/2011 of 12 May 2011.

On 19 May and 5 July 2011 the SNRIU Board approved

- Action Plan for a Targeted Safety Reassessment and Further Safety Improvement of Ukrainian NPPs in the Light of the Fukushima Daiichi Accident and
- Action Plan for a Targeted Safety Reassessment and Further Safety Improvement of Chornobyl NPP units 1-3 and Interim Spent Fuel Storage Facility (ISF-1) in the Light of the Fukushima Daiichi Accident, respectively.

A targeted safety reassessment of operating nuclear facilities at NPP sites (stress tests) was one of the activities defined in the Action Plans. The Action Plans also provide for the following:

- targeted review of emergency preparedness;
- review and amendment (based on stress-test results) of the Comprehensive (Integrated) Safety Improvement Programme for Ukrainian NPPs;
- update of the Plan for Safety Improvement of Chornobyl NPP Spent Nuclear Fuel Storage Facility (ISF-1);
- analysis and improvement of the regulatory framework for nuclear and radiation safety, strengthening of safety requirements for operating and new nuclear power units.

Ukraine joined the EC and ENSREG initiative to conduct stress tests in the EU member states and neighbouring countries followed by peer review of their results (Declaration on Stress Tests of 24 June 2011).

Based on the ENSREG Stress Test Specifications, the SNRIU developed and implemented “Recommendations on the Structure and Contents of the Report on Targeted Safety Reassessment of On-Site Nuclear Facilities to Learn Lessons from the Fukushima Daiichi Accident” (SNRIU Order No. 91 dated 23 June 2011).

The stress-test results and findings of the regulatory review of stress tests were discussed at the open sessions of the SNRIU Board:

- on 3 November 2011 for Chornobyl NPP units 1-3 and ISF-1;
- on 24-25 November 2011 for operating Ukrainian NPPs.

On 30 December 2011, the State Nuclear Regulatory Inspectorate of Ukraine submitted the

National Report on stress-test results for Ukrainian NPPs developed in line with ENSREG recommendations to the Secretariat on stress tests for peer review.

According to the peer review procedure, the results of stress tests for Ukrainian NPPs were thoroughly studied by European experts during topical review (in January-February 2012) and during expert visits to the SNRIU and SUNPP site in March 2013.

On 26 April 2012, ENSREG presented the peer review results for the EU member states and neighbouring countries (Ukraine, Switzerland) in the ENSREG summary report and in respective country-specific reports.

Based on the stress-test results, a National Action Plan was developed and approved. The Plan specifies the need to consider:

- ENSREG recommendations and proposals provided in the "Compilation of Recommendations and Suggestions. Peer Review of Stress Tests Performed on European Nuclear Power Plants" in the areas: Natural Hazards, Loss of Safety Systems and Severe Accident Management;
- key topics of the 2nd Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety in the areas: National Organisations, Emergency Preparedness and Response and International Cooperation.

The Plan also provides Ukraine-specific information on planned safety improvement activities at Ukrainian NPPs in the context of Fukushima Daiichi events upon results of:

- stress tests at operating NPPs (ZNPP, RNPP, SUNPP, KhNPP) and dry spent fuel storage facility (ZNPP);
- stress tests at ChNPP units and ISF-1;
- regulatory review of stress-test results;
- peer review, as set forth in respective ENSREG and EC reports.

In addition, the Plan includes information on improvement of Ukraine's regulatory and legal framework on nuclear and radiation safety to address lessons learnt from the Fukushima Daiichi accident and to ensure harmonisation with the WENRA reference levels.

Taking account of Ukraine's active participation in NPP stress tests and their peer review, Ukraine was invited to participate in the next stage whereat the respective national action plans had to be developed and further peer-reviewed.

As of 2013, there are 15 operating power units with water-cooled water-moderated reactors (WWER) at four nuclear power plants in Ukraine. Three power units of the Chornobyl NPP are under decommissioning. The Chornobyl NPP Shelter is being transformed into an environmentally safe system. The power units and their main features are listed in Annex 1.

Ukraine currently makes considerable efforts to resolve the following important issues:

- safety upgrading of operating NPPs;
- lifetime extension of operating NPPs based on safety reassessment, determination of

residual lifetime, implementation of safety upgrades and aging management of systems and equipment important to safety;

- spent fuel management;
- Chornobyl NPP decommissioning and Shelter transformation into an environmentally safe system.

Implementation of safety improvement measures during the period under review was based on the Comprehensive (Integrated) Safety Improvement Programme (C(I)SIP) approved by the Cabinet of Ministers of Ukraine (Resolution No. 1270 dated 7 December 2011) and aimed at:

- improving NPP operational safety;
- minimising risks of NPP accidents in case of natural events or other hazards;
- improving the management of design basis accidents and beyond design basis accidents at NPPs and mitigating their consequences.

The C(I)SIP includes the safety improvement measures determined in the "Concept for Safety Improvement of Operating NPPs" (approved by Cabinet Resolution No. 515-r dated 13 December 2005) that had not been implemented by the operating organisation before the Concept expiry date, as well as safety upgrades for Khmelnitsky NPP unit 2 and Rivne NPP unit 4.

The results and recommendations of the IAEA design safety missions held at all NPPs within the "Memorandum of Understanding on Cooperation in the Field of Energy between the European Union and Ukraine" in the area of nuclear safety are also considered in C(I)SIP.

It is envisaged that all C(I)SIP measures would be implemented in 2012–2017. Their implementation will allow improving NPP safety in line with international standards and promoting conditions for making decisions on possible lifetime extension of NPP units.

In addition, in 2011-2013 Ukraine implemented a series of measures aimed at construction of new nuclear installations, in particular:

- 4 July 2012: the Feasibility Study for Construction of Khmelnitsky NPP units 3 and 4 was approved by Cabinet Resolution No. 498-r;
- 6 September 2012: the Verkhovna Rada of Ukraine passed Law No. 5217-VI “On Siting, Design and Construction of Khmelnitsky Nuclear Power Plant Units 3 and 4”;
- 9 February 2012: the Verkhovna Rada of Ukraine took a decision concerning siting, design and construction of the centralised spent fuel storage facility by passing Law No. 4383-VI “On Spent Fuel Management Pertaining to Siting, Design and Construction of the Centralised Storage Facility for Spent Nuclear Fuel of Ukrainian WWER NPPs”;
- 7 December 2012: SSE *Chornobyl NPP* passed Order No. 946 to approve the “ISF-2 Completion Design”; on 20 February 2013, SNRIU issued Licence No. EO 001002 to SSE *Chornobyl NPP* for construction and commissioning of ISF-2.

Chornobyl NPP units 1-3 are under decommissioning. After the accident in April 1986,

Chornobyl NPP unit 4 received the status of Shelter facility.

In ratifying the Convention on Nuclear Safety in 1997, the Verkhovna Rada of Ukraine declared that Article 3 of the Convention would not apply to the Shelter. Nevertheless, general information on activities at Chornobyl NPP units 1-3 and the Shelter is given in Annexes 7 and 8.

SECTION I. BASIC CONCLUSIONS ON RESULTS OF THE FIFTH REVIEW MEETING

This Report covers the following main aspects that require further consideration and were identified in the previous National Report of Ukraine:

- improving the system of regulations and standards on nuclear and radiation safety (Section III, para. 3.1.1);
- implementing measures for training and professional development of the state nuclear regulatory body's staff (Section IV, para. 4.1.1);
- proceeding with NPP safety improvement measures (Section II, para.2.1);
- updating Safety Analysis Reports to take into account completed activities (Section 2, para. 2.1; Section 5, para. 5.5.1);
- constructing a centralised interim storage facility for WWER spent nuclear fuel (Section 6, para. 6.1.4) ;
- proceeding with in-depth safety analysis of NPPs (Section 5, para. 5.5.1).

This Report also takes into account the recommendations of the Fifth Review Meeting of the Contracting Parties with regard to the further provision of information on issues that are of interest for all Parties to the Convention on Nuclear Safety, considering the Report of the IAEA Secretariat to the Contracting Parties, "Synopsis of the Relevant IAEA Requirement Statements Reflecting the Issues Addressed by Articles 6 to 19 of the Convention on Nuclear Safety" (Synopsis).

This Report does not provide any information on the Synopsis-related matters, which was included in the previous Reports that Ukraine submitted to the attention of the Parties.

SECTION II. GENERAL PROVISIONS

2.1. Existing Nuclear Installations (Convention Article 6)

Each Contracting Party should take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible.

When necessary in the context of this Convention, the Contracting Party should ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental, and economic impact.

After shutdown of the Chornobyl NPP, Ukraine operates only WWER-type nuclear power plants.

Ukrainian NPPs operate WWER-type reactors, including 11 WWER-1000/V-320 power units, one WWER-1000/V-302, one WWER-1000/V-338 and two WWER-440/V-213 (the nuclear installations are listed in Annex 1).

The operating organisation (hereinafter referred to as the operator) NAEK *Energoatom* continuously takes measures to upgrade safety of operating nuclear installations. With the aim of safety improvement, starting from 2000 the operator assures implementation of relative measures in the scope of safety improvement programmes. Major safety improvement programmes currently in effect are listed in Annex 3.

Safety improvement measures are implemented on the basis of IAEA recommendations, operating experience, safety analyses and operator's commitments on safety upgrading to international organisations.

The operator is finalising implementation of the IAEA recommendations related to resolution of safety issues determined in the IAEA reports, namely: "Safety Issues and Their Ranking for WWER-1000 Model 320 Nuclear Power Plants" (IAEA-EBP-WWER-05), "Safety Issues and Their Ranking for Small Series WWER-1000 Nuclear Power Plants" (IAEA-EBP-WWER-14) and "Safety Issues and Their Ranking for WWER-440 Model 213" (IAEA-EBP-WWER-03). To resolve safety issues identified in the above reports, the operator has implemented a significant number of safety upgrades. They have included measures on improvement of control rod insertion reliability (RC2), RPV embrittlement and its monitoring (CI1), application of non-destructive testing (visual, ultrasonic, eddy current) (CI2), elimination of ECCS sump screen blocking and replacement of primary equipment insulation at all reactors (S5), replacement of SG pilot-operated relief valves at all V-320 power units (S9), replacement of storage batteries and UPS with expired lifetime at all power units (El5), backup of the reactor protection system

(I&C5), fire prevention (IH2), etc. Detailed information on elimination of safety issues and implementation of the IAEA recommendations set forth in the above mentioned reports is provided in Annex 3.

In 2012 adaptation of SARs for pilot power units to non-pilot units of Ukrainian NPPs was completed (see para. 5.5 for details).

SAR review and assessment by the SNRIU allow concluding that:

- power units are operated safely at an acceptable level of risk. The provided materials prove that the requirements for reactor safety imposed by the design, scientific and technical documentation and international practices are adequately fulfilled;
- the operator has analysed deviations from current regulatory requirements and has set up appropriate compensating activities that allow operation of power units within design limits and there is no need to shut down units for eliminating those deviations;
- implementation of safety improvements has already resulted in significant decrease in the core damage frequency (CDF) and large early release frequency (LERF) for all NPP units.

Most of the safety improvement recommendations determined in safety analysis have been implemented. The remaining measures were included in the current safety improvement programme.

Positive findings of SARs concerning the safety level of Ukrainian NPPs are consistent with the conclusions drawn by experts of international review missions on Ukrainian NPP safety assessment.

Currently, safety upgrades are implemented in line with the on-going safety improvement programme (C(I)SIP), whose status was upgraded after the Fukushima Daiichi accident.

To implement the C(I)SIP, the operator ensured planning and funding, continuously monitors its progress, organised reporting (annual, quarterly, monthly, for each measure), and developed and keeps a database on programme implementation status. Under the C(I)SIP, NAEK *Energoatom* shall implement 1311 measures altogether at all NPP units till 2017. 415 measures have already been implemented. 896 measures are under implementation. The number of C(I)SIP measures may change subject to periodic safety review results, operating experience and new research in the area of safety, recommendations of international experts, etc.

The C(I)SIP implementation progress is continuously supervised by the State Nuclear Regulatory Inspectorate, Ministry of Energy and Coal Industry and Cabinet of Ministers of Ukraine.

After the Fukushima Daiichi accident, NAEK *Energoatom* conducted extraordinary targeted safety assessment of Ukrainian NPPs (stress tests) in line with the decisions accepted by the National Security and Defence Council of Ukraine at the meeting of 8 April 2011, which were effected enacted by Presidential Decree No. 585/2011 dated 12 May 2011).

Detailed information on the stress tests is given in para. 5.5.

Based on results of the stress tests, a list of measures for prevention of severe accidents similar to that at the Fukushima Daiichi was complied. These measures are to be implemented for NPP lifetime extension and are intended to:

- ensure resistance to an earthquake of 7 points (MSK-64 scale) at minimum, but with PGA not less than 0.1g (PGA=0.12 g for the SUNPP site) for equipment, piping, buildings and structures required for critical safety functions: reactor safe shutdown and maintaining its safe condition, heat removal from the reactor core and spent fuel pool, prevention of radioactive releases to the environment;
- ensure performance of equipment important to safety in harsh environments;
- implement containment filtered venting systems at WWER-1000 NPPs for forced steam and gas release from the containment;
- implement measures to ensure emergency makeup of steam generators (reactor secondary system cooldown) and spent fuel pools under conditions of station blackout (SBO) and/or loss of ultimate heat sink (UHS), ensure emergency supply of essential service water;
- implement severe accident management guidelines (SAMG) addressing possible severe fuel damage both in the core and in the spent fuel pool, and symptom-oriented EOPs for low-power operation mode.

As recommended by the National Report of Ukraine on Stress-Test Results and its peer review, NAEK *Energoatom* developed additional safety improvement measures that were included in the C(I)SIP. It should also be noted that part of the post-Fukushima measures were included in the C(I)SIP even before the Fukushima Daiichi accident.

The C(I)SIP was complemented with a series of measures to ensure fuel heat removal during severe accidents (measures for SG and spent fuel pool makeup, operability of essential service water system in case of water discharge in spray pools) and emergency power supply using mobile DGs in SBO conditions. The C(I)SIP also includes measures on qualification for harsh environments of components that may be involved in SAM strategies for primary system makeup under loss of power and/or ultimate heat sink, corium retention in RPV, etc. In total, NAEK *Energoatom* shall implement 101 new measures aimed at prevention of accidents similar to that at the Fukushima Daiichi for the total amount of 1,850.00 mln. UAH at all power units.

Besides, the operator shall perform 93 fire protection measures amounting to 911.5 mln. UAH based on requirement imposed after the Fukushima Daiichi accident.

NAEK *Energoatom* carries out a package of measures on NPP seismic resistance, namely:

- equipment qualification;
- confirmation of piping and structure robustness under potential seismic impacts;
- seismic study of NPP sites and introduction of systematic seismic monitoring.

To implement additional safety improvement measures upon stress-test results and to ensure a uniform engineering approach, NAEK *Energoatom* developed appropriate industrial conceptual decisions and agreed them with the SNRIU. These decisions deal with the strategy of SBO accident mitigation using mobile DGs, mobile pumping units and

motor pumps for each reactor design at Ukrainian NPPs (V-213, V-302/338, V-320). In 2013 each nuclear power plant has been provided with a set of required mobile equipment. The measures are to be implemented in full scope at each power unit before the end of their design lifetime but no later than 2017, which agrees with EC approaches towards implementation of post-Fukushima measures.

In addition, a package of measures on upgrading the emergency response system is underway at NPPs:

- additional measures to ensure uninterrupted operation of communication means on site and between the NPP and emergency response centre of NAEK *Energoatom* and SNRIU are under implementation;
- introduction of the system for prompt analysis of radiation situation in the NPP location area is on-going;
- mobile power supply units, additional mobile laboratories for radiological monitoring and individual dose monitoring are being provided.

To comply with Presidential Decree No. 585/2011 dated 12 May 2011, the Cabinet of Ministers of Ukraine issued Resolution No. 44-r dated 25 January 2012 "On Approval of the Action Plan for Establishment of Unified Automated Radiation Monitoring System for the period till 2015". Activities on integration of the on-site automated radiological monitoring systems into the Unified Automated Radiation Monitoring System of Ukraine are envisaged in the C(I)SIP.

Measures aimed at prevention of accidents similar to that at the Fukushima Daiichi are implemented in the framework of the National Action Plan following the stress tests that was approved by Resolution No. 38 dated 5 March 2013 at the open session of the SNRIU Board. The National Action Plan together with respective national plans of the European countries was discussed at the ENSREG working meeting in Brussels on 22-26 April 2013.

Implementation of safety improvement measures is an obligatory condition for NPP lifetime extension, which is one of the important strategic areas of the energy industry of Ukraine. In 2010 the design lifetime of Rivne NPP units 1 and 2 was extended by 20 years (with a requirement to reassess safety by the end of 10 years of long-term operation). The design lifetime of South Ukraine NPP unit 1 is expiring in 2012: since 5 March 2013, South Ukraine NPP unit 1 has been shut down to finalise all activities required for lifetime extension.

Taking into account the potential for long-term operation of NPP units, special attention is paid to ageing management and lifetime management. The most important tasks of aging management and lifetime management are associated with buildings, structures and components whose replacement is impossible or extremely expensive, e.g. RPV lifetime management. Therefore, the following is continuously monitored during operation:

- physical and mechanical properties of RPV materials by periodical testing of surveillance specimens;
- accumulation of fast neutron fluence on RPV wall material adjacent to the reactor core by using computational and experimental methods;
- impact of operating factors on the occurrence of defects in the most stressed areas of RPV by conducting periodic (every four years) non-destructive examinations (NDE)

of base metal, welds and corrosion-resistant cladding.

Based on the monitoring results, the safety of RPV operation throughout its designed lifetime is evaluated. The integrity and brittle fracture resistance are justified by calculation, taking account of NDE results, testing of surveillance specimens, fast neutron fluence accumulated by RPV wall, as well as IAEA recommendations on pressurized thermal shock analysis for different emergencies. At present, the Experimental Design Bureau *Hydropress* (Russian Federation) as Chief Designer has substantiated RPV brittle strength for Khmelnitsky NPP unit 1 for the design lifetime. Similar work was performed for RPVs of Khmelnitsky NPP unit 2, Rivne NPP unit 4 and South Ukraine NPP unit 2. In the scope of preparations for lifetime extension, the Řež Nuclear Research Institute (Czech Republic) assessed the technical condition of the reactor at South Ukraine NPP unit 1. Pursuing the safety culture principles and taking into account certain design deficiencies of the standard surveillance programme for WWER-1000 RPVs, upon request of the Ukrainian operator the Řež Nuclear Research Institute conducts research and analysis of surveillance specimens from RPV materials of Khmelnitsky NPP unit 2, Rivne NPP units 3,4 and Zaporizhzhya NPP unit 6, which were irradiated near the reactor core at Temelin NPP. This allows a comparative analysis and evaluation of changes in properties of RPV materials depending on irradiation conditions according to the standard and integral programmes.

Under the TACIS international regional project (TAREG) "Verification of Patterns of Radiation Embrittlement of WWER-1000 and WWER-440/213 RPVs Materials with the Purpose of the Integrity Assessment", which also involved international experts, significant scope of work was carried out to specify the fast neutron fluence accumulated by surveillance specimens during operation of Ukrainian and Russian power units.

The results of RPV monitoring and scheduled measures allow reliable prediction of their safe operation during the design lifetime and permit planning of long-term operation of Ukrainian NPP RPVs.

Thus, the measures implemented by the operator during the reporting period will assure implementation of the international obligations of Ukraine on safety improvement of operating Ukrainian NPPs.

The completed efforts ensure that Ukrainian NPPs can be operated in a safe manner during their designed lifetime and allow planning activities aimed at their lifetime extension.

SECTION III. LEGISLATION AND REGULATION

In accordance with requirements of the Convention on Nuclear Safety, Ukraine has established and supports the state nuclear and radiation safety regulatory system.

3.1. Legislative and Regulatory Framework (Convention Article 7)

Each Contracting Part shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations. The legislative and regulatory framework shall provide for:

3.1.1 Establishment of applicable national safety requirements and regulations.

Under Article 22 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", SNRIU as a state nuclear regulatory authority establishes regulatory criteria and requirements that define safety conditions for operation of nuclear installations and the use of radiation sources (rule-making). The same Law (Article 8) determines that national safety requirements and regulations are adopted taking into account the recommendations of international organisations in the field of nuclear energy use. Procedures for development and approval of national requirements and regulations are specified by Cabinet Resolution No. 163 dated 8 February 1997 and the Quality Manual on the Rule-Making Activity of the SNRIU. Besides, the SNRIU summarises the application of nuclear safety legislation and develops proposals on its improvement.

As mentioned in the previous National Reports, the legislative framework and regulatory system in the field of nuclear energy use fully embrace all safety principles and provisions of Article 7 of the Convention on Nuclear Safety.

It was confirmed by the overall conclusion of the IAEA Integrated Regulatory Review Service (IRRS) Mission that an integrated legislative infrastructure had been established in Ukraine to regulate compliance with international requirements and include all respective international conventions.

During the reporting period, the improvement of the regulatory and legislative framework on nuclear energy continued, taking account of state regulation and practices in the field of nuclear and radiation safety in Ukraine and experience of the advanced countries considering scientific and technical achievements, international standards, as well as documents of the European Union, documents and recommendations of the IAEA, WENRA and other international organisations for safety.

A number of important legislative acts were also developed and adopted. Basic legislative and regulatory acts in the field of nuclear energy use, which came into force from 2010 to 2013, are listed in Annex 2.

3.1.2 Nuclear installation licensing system and prohibition of nuclear installation operation without a licence.

At the legislative level, the nuclear installation licensing system is governed by the Law of

Ukraine "On Nuclear Energy Use and Radiation Safety" and the Law "On Licensing Activity in the Field of Nuclear Energy" throughout the life stages of nuclear installations and was described in Previous National Reports.

Article 26 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" prohibits legal entities or individuals to conduct any activity related to the use of nuclear installations or radiation sources without an appropriate licence.

Pursuant to the Law of Ukraine "On Licensing Activity in the Field of Nuclear Energy", the operators have licences covering all necessary life stages of their nuclear installations.

3.1.3 System of the regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and licensing conditions.

The legislative principles underlying the system of regulatory inspection and assessment of nuclear installations remained unchanged over the reporting period.

Under Article 5 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", supervisory activity is considered among the fundamental cornerstones of the national policy in nuclear energy use and radiation protection.

In accordance with Articles 22, 24 and 25 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", state regulation of nuclear energy use provides for supervision over compliance with regulatory requirements and conditions of permits granted to organisations, enterprises and individuals using nuclear installations, including enforcement measures (supervision).

Under Article 15 of the Law of Ukraine "On Licensing Activity in the Field of Nuclear Energy", nuclear regulatory bodies supervise compliance with licence conditions by conducting regulatory inspections and nuclear safety reviews of reporting documents submitted by the operator.

3.1.4 Enforcement of applicable regulations and the licensing conditions, including suspension, modification or revocation.

Under Article 24 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", the state nuclear regulatory body is empowered to supervise compliance with regulations and standards on nuclear and radiation safety as well as licensing conditions. In case of incompliance, the regulatory body may apply administrative sanctions to personnel, officials of enterprises, institutions and organisations. Article 25 of the Law determines the rights of inspectors regarding their responsibilities and application of enforcement measures towards individuals who fail to comply with legislation, regulations and standards on nuclear and radiation safety and licensing conditions. Article 81 of the Law determines the types of infringements for which personnel and officials dealing with nuclear installations and radiation sources, personnel and officials of enterprises, institutions and organisations dealing with any other nuclear energy activity, as well as citizens, are brought to disciplinary, civil (except for civil liability for nuclear damage), criminal and administrative responsibility. Article 17^1 of the Law of Ukraine "On Licensing Activity in the Field of Nuclear Energy" sets penalties that may be imposed on entities engaged in nuclear energy activities if they fail to fulfil completely or partially conditions of the licences and other permits and if they conduct activities without a licence. The Code of Ukraine on

Administrative Violations defines penalties that may be applied to officials and personnel that do not comply with nuclear and radiation safety law.

Article 16 of the Law of Ukraine "On Licensing Activity in the Field of Nuclear Energy" (amended by the Law of Ukraine "On Amendments to the Law of Ukraine *On Licensing Activity in the Field of Nuclear Energy*" adopted by the Verkhovna Rada of Ukraine on 11 February 2010) considers incompliance with licence conditions to be a reason for suspension and cancellation of the operator's licence, depending on the life stage of the nuclear installation.

Supervision over nuclear and radiation safety directly at NPP sites is performed by the on-site State Nuclear Safety Inspectorates. During the reporting period:

- development of the national nuclear legislation was in progress;
- Ukraine paid significant attention to and took important decisions on the state nuclear energy policy, in particular, with regard to enhancing the safety of nuclear installations, ensuring state safety regulation and developing the national nuclear power sector.

SECTION IV. REGULATORY BODY

4.1. Regulatory Body (Convention Article 8)

4.1.1. Each Contracting Party shall establish or designate a regulatory body for nuclear safety entrusted with the implementation of the legislative and regulatory framework and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

The main functions of the nuclear regulatory authority as determined by the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management are entrusted to the State Nuclear Regulatory Inspectorate of Ukraine, which acts in compliance with the "Provisions on the State Nuclear Regulatory Inspectorate of Ukraine" approved by Presidential Decree No. 403/2011 of 4 April 2011.

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In order to develop recommendations on topical issues and the most essential areas of nuclear and radiation safety supervision, there is the SNRIU Board working on a permanent basis.

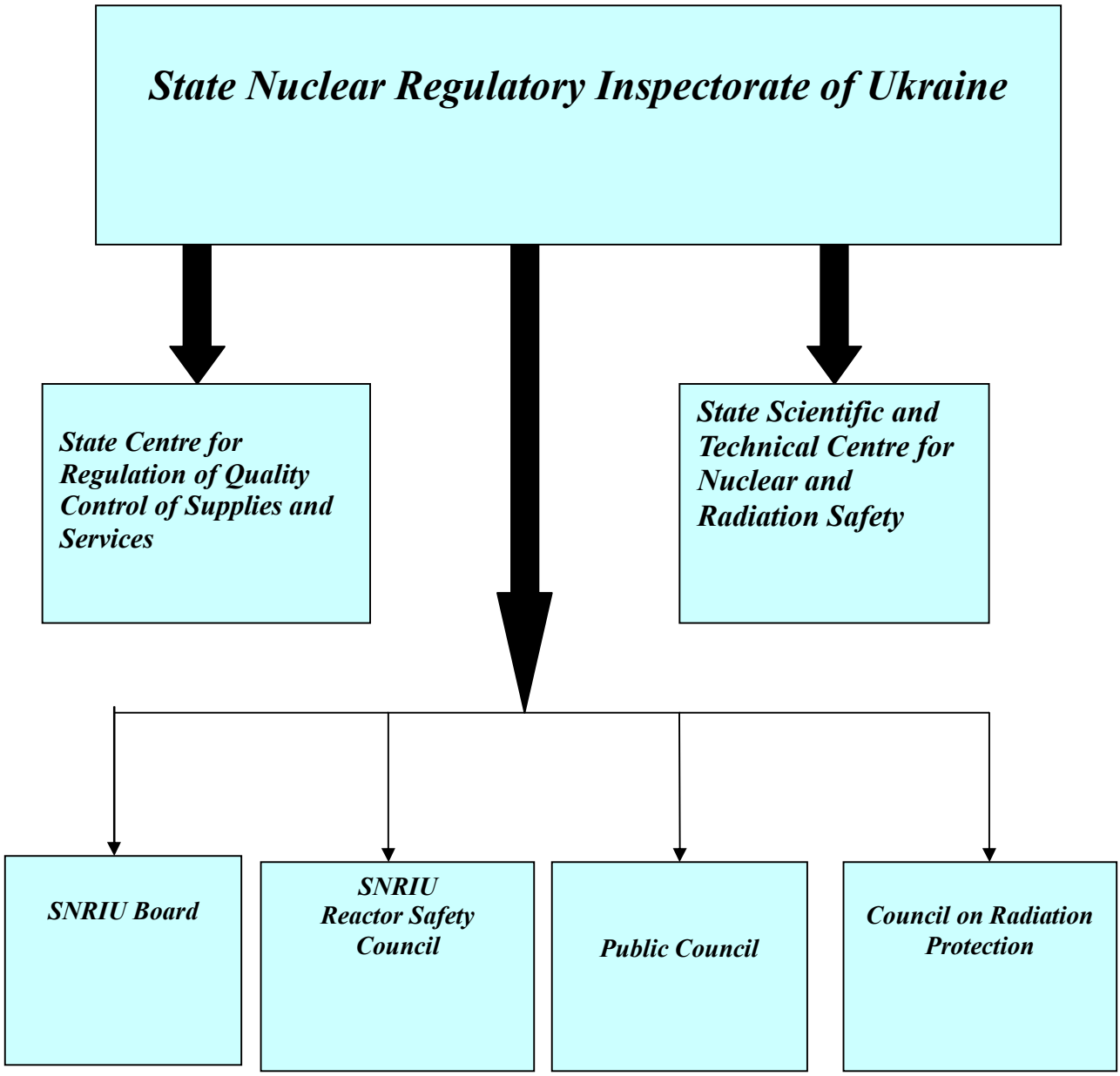
Advisory and consultative functions in the SNRIU decision-making process in the field of nuclear energy are exercised by the Council on Radiation Protection, Reactor Safety Council and Public Council.

The Public Council was established to ensure that the public is involved in administration of state affairs, to exercise public supervision of the SNRIU activities and promote effective interaction of the SNRIU with the public, taking into consideration public opinion during formulation and implementation of the state policy. The main tasks of the Public Council are to:

- create conditions for citizens to exercise their constitutional right for participation in administration of the state affairs;
- carry out public supervision over the SNRIU activities;
- assist the SNRIU in considering the public opinion during formulation and implementation of the state policy.

Within the system of the State Nuclear Regulatory Inspectorate of Ukraine, there are two state technical support organisations, namely:

- State Scientific and Technical Centre for Nuclear and Radiation Safety that provides analytical, scientific, expert, technical, engineering, informational, consultative and methodological support to the state nuclear regulatory body;
- State Centre for Regulation of Quality Control of Supplies and Services (*DerzhCentrYakosti)* that provides technical support to the SNRIU as well as methodological and consultative support in updating regulatory requirements for quality assurance of equipment and services intended for nuclear power facilities.



The organisational structure of the State Nuclear Regulatory Inspectorate of Ukraine is provided below.

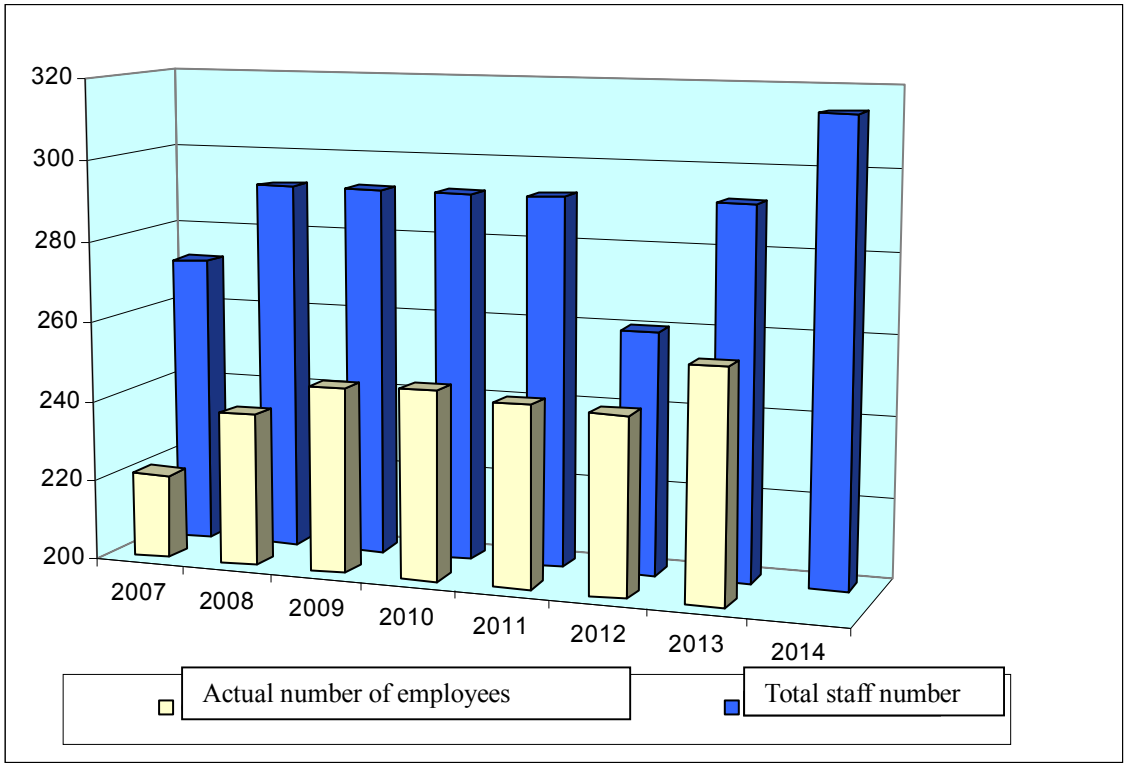
Annually, the SNRIU issues a report on nuclear and radiation safety in Ukraine. This document highlights implementation of the national policy in peaceful use of nuclear energy and compliance with nuclear and radiation safety requirements in Ukraine. The annual report is published in Ukrainian and English and posted at the SNRIU official site www.snrc.gov.ua.

It order to implement one of the fundamental safety principles in the nuclear industry, specifically, the safety culture principle, the regulatory body adopted the "Statement on the SNRIU Policy in the Field of Nuclear Energy Safety and Safety Culture

Development" that can be found on the SNRIU site at www.snrc.gov.ua.

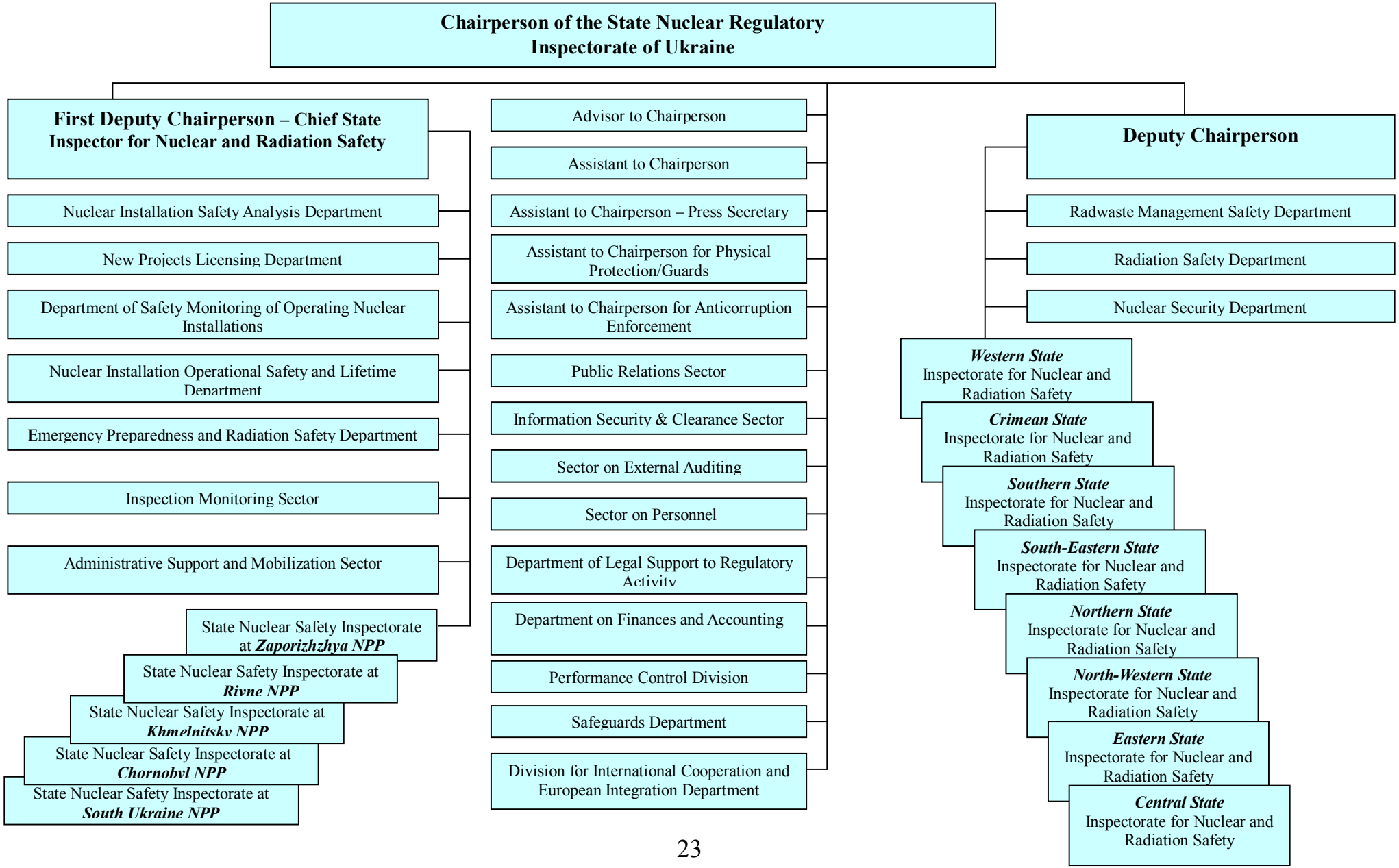
For implementation of the NSDC Resolution 8 of April 2011 “On Improvement of Operational Safety of Ukrainian Nuclear Power Plants”, which was enacted by Presidential Decree No. 585/2011 of 12 May 2011, the draft law of Ukraine “On the National Commission that Exercises State Regulation of Safety in the Field of Nuclear Energy Use” was developed. The draft law establishes grounds for the establishment of a competent, collegial central executive authority with special status, strengthening of its institutional stability, effectiveness and independence by formalising its status by the law. On 18 October 2011, the draft law was adopted in the first reading at the session of the Verkhovna Rada of Ukraine. At present, it is being followed up pending the second reading.

In pursuance of the Cabinet Resolution of 2013 with regard to organisational and managerial changes in the State Nuclear Regulatory Inspectorate of Ukraine, the ultimate number of employees in the State Nuclear Regulatory Inspectorate of Ukraine and the ultimate number of employees in the SNRIU territorial bodies were increased.



Distribution of the actual number of employees and total staff number (including vacancies) of the regulatory body of Ukraine in 2007-2014

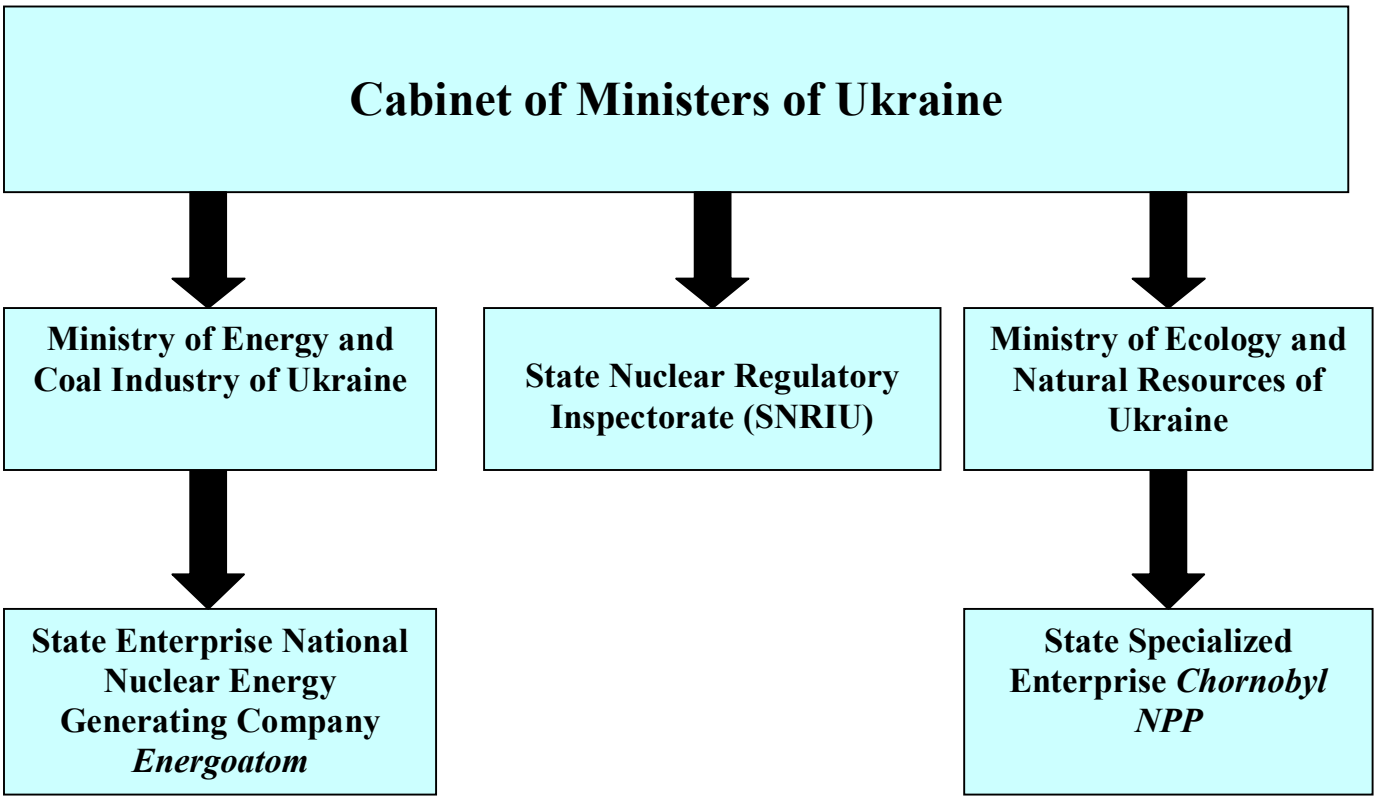
ORGANISATIONAL CHART OF THE STATE NUCLEAR REGULATORY INSPECTORATE OF UKRAINE (SNRIU)



4.1.2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organisation concerned with the promotion or use of nuclear energy

The national legislation of Ukraine clearly specifies and distinguishes functions of the regulatory authority and functions of any other agencies or institutions dealing with nuclear energy use. At the legislative level, this subject is regulated by Articles 21, 23 and 24 of the Ukrainian Law "On Nuclear Energy Use and Radiation Safety". At the level of subordinate legislation, this subject is regulated by the corresponding provisions of these bodies approved by the President of Ukraine and specifying their powers.

Law of Ukraine No. 1874-VI "On Amendments to the Law of Ukraine *On Licensing Activity in the Field of Nuclear Energy*" (dated 11 February 2010) states that any bodies, officers, officials, members of the public and their associations should not be allowed to interfere with resolution of the issues that fall within the SNRIU authorities unless otherwise provided by law.



4.2. Responsibility of the Licence Holder (Convention Article 9)

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant* licence *and shall take the appropriate steps to ensure that such* licence *holder meets its responsibility.

Laws of Ukraine establish a legally binding framework, which allocates responsibilities for the safety of nuclear installations.

Under Article 26 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", the use of nuclear installations in Ukraine shall be subject to licensing. The operating organisation (operator) obtains a licence to carry out activities at separate life stages of the nuclear installation. Article 32 of the Law states that the licensee is fully responsible for radiation protection and safety of the nuclear installation. Article 33 of this Law determines specific obligations of the operator.

There are two operators in the nuclear power sector of Ukraine, namely: National Nuclear Energy Generating Company *Energoatom* (NAEK *Energoatom*) and State Specialised Enterprise *Chornobyl NPP* (SSE *Chornobyl NPP*).

NAEK *Energoatom* has licences granted by the SNRIU for operation of South Ukraine NPP units 1, 2 and 3; Rivne NPP units 1, 2, 3 and 4; Khmelnitsky NPP units 1 and 2, and Zaporizhzhya NPP units 1, 2, 3, 4, 5 and 6 (including operation of the Dry Spent Fuel Storage Facility on the ZNPP site).

Under the licences for operation of NPP units, the NAEK *Energoatom* obtains individual permits to start up nuclear power units after scheduled refuelling outages.

SSE *Chornobyl NPP* has licences granted by the SNRIU for:
- decommissioning of the Chornobyl NPP;
- operation of the Shelter;
- operation of the Spent Nuclear Fuel Storage Facility (ISF-1)
- construction and commissioning of the Spent Nuclear Fuel Storage Facility (ISF-2).

The licence for decommissioning of the Chornobyl NPP enables the operator to implement a package of decommissioning-related activities and operations, including activities envisaged for the stage of nuclear installation shutdown.

According to the licence for Chornobyl NPP decommissioning, the SSE *Chornobyl NPP* shall obtain individual permits for proceeding to the next decommissioning stage of an individual nuclear installation and for certain activities or operations in the stages of decommissioning, which involve design, construction, commissioning and operation of radioactive waste management facilities as well as measures to remove spent and fresh nuclear fuel, solid and liquid operational radioactive waste of ChNPP, from the existing facilities.

On 20 February 2013, the SNRIU granted a licence to SSE *Chornobyl NPP* for construction and commissioning of a nuclear installation (spent fuel storage facility (ISF-2)).

As licence holders, the NAEK *Energoatom* and SSE *Chornobyl NPP* are fully responsible for radiation protection and safety of nuclear facilities.

According to the obligations of an operating organisation as specified by the applicable law of Ukraine, NAEK *Energoatom* and SSE *Chornobyl NPP* should:

- ensure nuclear and radiation safety (as described in paras. 2.1 and 5.5);
- develop and implement actions to improve the safety of nuclear installations (see para. 2.1 for further information);
- inform about events in operation of nuclear installations in a timely and comprehensive manner; investigate and implement corrective actions (see para. 5.3 for further information);
- secure financial coverage of liability for nuclear damage as required by the Ukrainian laws (see para. 5.2 for further information);
- impose requirements for the staff's proficiency (skills and knowledge) depending on their responsibilities for safety of the nuclear installation provide for staff training (see para. 5.2 for further information);
- provide for the radiation protection of staff, the public and the environment (see para. 5.6 for further information,).

Starting with review of the licence application and throughout all the licensee's operations, the SNRIU continuously monitors and verifies the licensee for compliance with the imposed requirements. In particular, the regulatory body verifies whether the nuclear facility complies with safety requirements, whether financial, material and other resources are available and the organisational structure is in place, whether the system for staff training and retraining is available. These requirements, which are mandatory preconditions for licensing, are included in the operator's licence for a certain life stage of the nuclear installation and are subject to continuous supervision by the SNRIU.

During the reporting period, the Ukrainian operators fully complied with their obligations to ensure safety in their nuclear energy operations.

As prescribed by the applicable laws, the operators fully implement and comply with the obligations and licence terms (individual permits) concerning the safety of licensed nuclear energy activities.

Implementation of the obligations and terms of licences (individual permits) concerning the safety of licensed activities is under continuous regulatory supervision.

SECTION V. GENERAL SAFETY CONSIDERATIONS

5.1. Priority to Safety (Convention Article 10)

Each Contracting Party shall take appropriate steps to ensure that all organisations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

The priority to safety in design and operation of nuclear installations, which is determined in the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", is the basic principle of the state policy in the use of nuclear energy.

During the reporting period, all legal entities in the area of nuclear energy use adhered, within their authorities, to legislative policy principles set forth in the Ukrainian laws. This and previous report of Ukraine describe the implementation of national policy principles regulating the issues covered by the Convention on Nuclear Safety.

In December 1997 the Verkhovna Rada of Ukraine ratified the Convention on Nuclear Safety. The Law on ratification explicitly reads that "… Confirming its adherence to the principles of nuclear safety culture and providing for their implementation, Verkhovna Rada of Ukraine has approved a responsible decision on ratifying the Convention on Nuclear Safety".

In 2003 the National Security Law of Ukraine came into force. This law determines nuclear and radiation safety as one of the areas and an integral part of the national security of the country.

Assurance of safety safeguards, reliability of nuclear power and implementation of relevant international commitments of Ukraine are priorities for the executive authorities. This is demonstrated by the continuous attention the national authorities pay to safety issues. The status of nuclear and radiation safety was regularly reviewed by the Cabinet of Ministers and the National Security and Defence Council of Ukraine at their meetings. NPP safety issues are addressed at the meetings of the SNRIU Boards and Boards of the Ministries concerned, and also at the interdepartmental commissions' meetings.

During the reporting period, reports on nuclear and radiation safety status in Ukraine were regularly developed according to the established procedure.

The Nuclear Safety Policy Statement by NAEK *Energoatom* was approved and published. It states the following:

- NAEK *Energoatom* takes overall responsibility for the safety of nuclear power plants throughout all stages of their life and prioritises the safety assurance activities over other tasks;
- activities of the operator are focused on establishing the environment of staff adherence to safety objectives, personal responsibility and fundamental principles of safety culture.

Since 2002 International Conferences "Safety Culture at Ukrainian NPP" have been regularly held by NAEK *Energoatom*. They took place in 2004, 2006 and 2008.

Safety Days are regularly held at NPPs at two levels (departments and plant as a whole) to introduce the safety culture principles, reveal operational occurrences and deviations from the requirements of applicable standards and regulations, technical specifications, operating procedures and operational documentation. NPP Safety Days are held according to the annual schedule, which is an integral part of the annual schedule for human resource development.

The agenda of a Safety Day can be adjusted, if necessary, to take account of the supervisory recommendations and events that occurred at NPP. Review reports define comments and associated corrective actions as well as responsible persons and deadlines.

The Safety Days contribute to implementing the safety culture principles, enhancing the nuclear and radiation safety, strengthening the control exercised by subdivision managers and plant administration over the fulfilment of the requirements.

The management's statements were developed and brought to the attention of NPP staff, determining the priorities assigned to NPPs activities on safety and quality assurance.

Programmes on Production Culture Assurance and Improvement as well as Occupational Safety and Fire Safety Programmes were elaborated and introduced at NPPs; long-term planning of safety culture-related activities is also envisaged.

Job descriptions of all-level managers responsible for nuclear safety determine the obligations related to fostering the safety culture of their subordinated staff.

Production Culture Days are held across all NPPs of NAEK *Energoatom*.

The Safety Culture course is a compulsory element of the position-specific training and retraining programmes for all NPP industrial and operational personnel. Training covers all safety culture aspects for operational personnel of all categories.

NAEK *Energoatom* developed complete sets of training materials covering the following topics:

- Fundamentals and Basic Characteristics of Safety Culture;
- Role of Human Factor in Safety Culture;
- Quality Assurance;
- Safety Management.

Safety culture elements were incorporated into the training courses conducted at a full-scope simulator, at laboratories and shops.

For implementing the principles of transparency and accessibility of information on nuclear energy use, specific PR departments and information centres were established at all NPPs and NAEK *Energoatom* headquarters to provide the public with explicit information on the environmental radiation situation. NPPs and their information centres organise guided tours

for citizens to get them acquainted with NPP operation. Each NPP issues a plant newspaper, has radio broadcasting and telecasting offices and its website.

NPPs prepare annual reports on the assessment of operational safety and technical condition of power units and reports on radiation safety and radiation protection at NPPs. NAEK *Energoatom* summarises the NPP reports to develop the final report on assessment of operational safety and technical condition and report on radiation safety and radiation protection at NPPs, which are submitted to the regulatory and governing state bodies of Ukraine.

The priority of nuclear and radiation safety established by Ukrainian law, as well as requirements for observing this priority, promote adherence to safety as a lifestyle.

5.2. Financial and Human Resources (Convention Article 11)

5.2.1. Financial resources

Each Contracting Party shall take appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.

Cash payments for the produced electric power accounted to 99.56% of the total electricity cost in 2010, and 100 % and 98.05% in 2011 and 2012, respectively. A slight variation in payments in 2010 and 2012 was due to a lower level of payments for electricity from the end-consumers at the wholesale electricity market.

A fixed tariff is imposed on electricity that *Energoatom* NPPs deliver to the *Energorynok* /Energy Market/. Decisions on the tariff amount, as well as breakdown of costs for electricity production, are approved by the National Electricity Regulatory Commission of Ukraine (NERC).

For continuously improving nuclear safety, ensuring effective and reliable operation of the power industry and upgrading the safety of Ukrainian NPPs to the level that meets the recognised international standards of nuclear safety and environmental protection, NAEK *Energoatom* prepared and is implementing the Comprehensive (Integrated) Safety Improvement Programme for Ukrainian NPPs (C(I)SIP). Nowadays, the estimated cost of C(I)SP implementation approximates EUR 1,404 mln.

Under the Memorandum of Understanding on Cooperation in the Field of Energy between the European Union and Ukraine, the EBRD/Euratom, on the one side, and the Ministry of Fuel and Energy of Ukraine and NAEK *Energoatom*, on the other side, made a decision on financing the Programme from the EBRD/Euratom Loan.

Law of Ukraine No. 1868-IV "On Settlement of Nuclear Safety Issues" dated 24 June 2004 and Cabinet Resolution No. 594 dated 27 April 2006 provided for establishing, accumulating and using a financial reserve for nuclear installation decommissioning.

Ukraine is a Contracting Party to the Vienna Convention on Civil Liability for Nuclear Damage dated 1963 (as prescribed by the Law of Ukraine "On Accession of Ukraine to the Vienna Convention on Civil Liability for Nuclear Damage" dated 12 July 1996).

The insurance coverage of civil liabilities of NAEK *Energoatom* (operator) for nuclear damage has been provided since 2004. Annually, NAEK *Energoatom* enters into an agreement with an insurance company that is duly authorised by member companies of the Nuclear Insurance Pool of Ukraine.

5.2.2. Human Resources

Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.

During the reporting period, the national system for nuclear industry personnel training and training, as described in para. 5.2.2 of the Fifth National Report, was further improved.

To date, the NPP personnel training system is in place and keeps functioning in Ukraine. This system is based on the IAEA-recommended systematic approach to training and experience acquired by the leading IAEA member states in the staff training areas.

The staff training system functions in interaction with research organisations, enterprises, state administrative and regulatory bodies and other educational systems in order to provide each staff member with high-standard training, retraining and skill improvement, which are aimed at acquiring and maintaining the knowledge, sustaining skills and proficiency necessary for safe operation of NPPs.

The SNRIU licenses the training of NPP staff according to the requirements of the regulation "Rules for Licensing of the Training of Staff for Operation of a Nuclear Installation". The State Inspectorate also licenses the officials according to the “Conditions and Procedure for Licensing the Activities of Operating Organisation Officials” and the operational personnel in accordance with the “Rules for Licensing of Personnel for Direct Control of NPP Reactor”.

NAEK *Energoatom* developed and put into effect "Provisions for Organisation of Staff Development Activities of the National Nuclear Energy Generating Company *Energoatom*" PL-K.0.07.005-13 incorporating the state-of-the-art international experience in the area of NPP staff training. The Regulation also declares the principles based on which the safety culture of the staff is developed through systematic staff management, which secures the required proficiency level and keeps the staff continuously ready to fulfil their professional duties that is critical for nuclear and radiation safety of NPPs and especially for protection and integrity of defence-in-depth barriers.

The effectiveness of the staff training system is clearly demonstrated by a steady trend towards improving the staff availability factor, reducing the number of events in NPP operation and improving other performance indicators.

Forming a basis of the training system, the training centres of NPPs continue developing. The structure and staff list for the training centres were developed taking account of NPP-specific features. The NPP training centres are staffed with skilled and knowledgeable instructors. The technical training materials are continuously improved.

NAEK *Energoatom* has training centres in place at all nuclear power plants and at the *AtomRemontService* Enterprise. All centres have appropriate licences and permits issued by state regulatory bodies to train the staff of different categories.

At present, the NPP training centres use eight full-scale simulators, namely, FSS for WWER-1000 units (KhNPP-1, ZNPP-1, 3 and 5, RNPP- 3 and SUNPP 1 and 3) and FSS for WWER-440 unit (RNPP-2), along with simulators for emergency control rooms (KhNPP-1, ZNPP-3 and 5, SUNPP-1 and 3; and RNPP–2 and 3). In addition, there are multi-functional and local simulators as well as computer training systems for staff training.

The staff training is based on training methodologies and guidelines developed in accordance with the NAEK *Energoatom* standard "Requirements for Training Materials". The development of training materials is one of the preconditions for obtaining a licence for staff training.

The staff to be licensed are trained using individual training programmes developed on the basis of standard programmes agreed by the SNRIU.

Annex 6 shows dynamics in number of licensed plant experts and information on NPP staff training.

During the reporting period, the Ukrainian system for training and retraining of nuclear power plant staff was continuously improved, providing occupational training of employees for activities throughout the nuclear installation life.

All Ukrainian NPPs are provided with trained and skilled staff.

The effective system of NPP staff training contributes to improvement of performance indicators and safety of nuclear installations.

5.3. Human Factor (Convention Article 12)

Each Contracting Party shall take appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

The staffing policy of NAEK *Energoatom* is specified in the section "Statement on the Staffing Policy" of "Statements of NAEK *Energoatom* Management" (PR-Z.0.06.130-11). The policy is focused on professional and psychological awareness of personnel recognising safety assurance as a first priority and inherent need of each employee, leading to self-consciousness, responsibility and self-control in all activities that are important to NPP operational safety.

Recognising the role of human factor in NPP safety assurance, the operator management declares that priority is to be given not only to search and punishment but also to detection, resolution and prevention of problems and non-conformances related to human factors.

In order to prevent and avoid any influence of human factors that may cause NPP deviations and failures if psychophysical state and proficiency level of the staff do not meet the safety requirements, NAEK *Energoatom* employs the system of operating experience feedback in personnel training at NPP training centres.

With due regard to human factor, the effectiveness of training systems for Ukrainian NPP staff is assessed as follows:

- analysis of reports on events describe abnormal occurrences related to personnel errors;
- audits of NPP training centres by SNRIU experts to verify whether licences can be granted for position-specific training of staff;
- analysis of reports on causalities due to drawbacks in training.

To assess the operational personnel's technical proficiency to operate a power unit under different operating modes, the operational personnel availability factor is calculated. Erroneous actions that caused occurrences during transients and wrong actions or omissions of the operational personnel are taken into account.

The licensed personnel (shift supervisors and control room operators) are certified by NPP commissions headed by NPP chief engineers. The rest of operational personnel are certified by commissions headed by deputy chief engineers or heads of NPP departments. Personnel's knowledge is assessed as prescribed in the relevant regulations.

When conducting individual programme-based training, the instructor evaluates the training progress. In addition, intermediate evaluations are made by instructors upon completion of each stage of training.

Upon completion of training, a post-training knowledge test is conducted by NPP training centres. If results of the post-training test are positive, the trainee is sent for further knowledge verification by the commission.

The following additional certification procedures are envisaged for the staff whose training is subject to licensing:

- preparation for knowledge verification by the NPP central commission, during which previously gained knowledge and skills are refreshed, requirements, rules and standards on NPP safety and operation are specified. Based on the results of pre-training tests, trainees gradually and successively refresh the topics of individual programmes through their self-training and by means of interviews and consultations with instructors;
- drills using a full-scale simulator.

Simulator drills are conducted under the supervision of one of the deputy chief engineers. Proficiency and skills of trainees are tested to check their ability to control production process from the main control room in:

- normal operation;
- abnormal operation;
- emergencies.

Teamwork capabilities are checked as well.

Final post-training tests are administered by deputy chief engineers. They verify if the knowledge obtained by trainees is sufficient for self-guided work and if trainees are prepared for knowledge verification.

Test results are incorporated into records and along with other documents are handed over to the central knowledge verification commission.
In case the test results are not satisfactory, extra time is provided for further preparation.

The knowledge level is verified by the commission headed by the NPP chief engineer with a state inspector as a representative of the State Nuclear Safety Inspectorate at NPP.

Upon successful knowledge verification, as well as shadow training and exercises, a package of documents for licensing is prepared and sent to the SNRIU for further review. If results of the review are positive, the SNRCU issues a licence for reactor operation with the NPP units being specified.

Staff training activities and other measures aimed at safety culture improvement allowed substantial reduction in the number of events induced by human errors.

In 2009-2012, no events were recorded at NPP that would be related to drawbacks in staff training.

The following provisions are made to prepare the staff for actions on accident mitigation, accident management and prevention of event recurrence in NPP operation:

- emergency response exercises as incorporated into the individual position-specific training programmes;
- emergency response exercises for shift operational personnel;

- full-scale simulator training for operational personnel under the proficiency support programme;
- full-scale training on mitigation of beyond design basis accidents.

To date, symptom-based emergency operating procedures have been implemented at power units to enhance reliability of the operating personnel during emergencies.

To minimise effects of the human factor, the following administrative arrangements are implemented, namely:

- individuals are permitted to work at a nuclear installation and with nuclear materials only following special examination and training;
- psychophysical state of the operational personnel is checked annually;
- all staff's health is monitored annually and operational personnel are subject to mandatory medical examination before shifts;
- staffing, staff training and safety culture improvement are controlled at the interdepartmental level;
- as prescribed in the staff development plan, general-station and power unit emergency response and fire protection exercises are held annually for operational personnel, including individual training with administrative and technical staff;
- emergency operating procedures were developed to enhance human reliability in power unit control during mitigation of emergencies.

Thus Ukraine fulfils the provisions of Article 12 under the Convention.

5.4. Quality Assurance (Convention Article 13)

Each Contracting Party shall take appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation

The NAEK *Energoatom* has the management system that meets requirements set forth in NP 306.1.190-2012 "General Requirements for the Management System for Activities in the Use of Nuclear Energy" and NP 306.1.182-2012 "Requirements for the Management System for Activities of the Operating Organisation (Operator)".

This system integrates all elements needed to achieve objectives of the organisation. These elements include the organisational structure, organisational processes and all types of resources.

The quality management system of the NAEK *Energoatom's* Integrated Management System (IMS) has full account of requirements of the ISO 9001:2008 Standard, while the ecological management system takes due account of requirements of the ISO 14000 Standards.

Basic components of the management systems are as follows:

- processes;
- documentation;
- obligations and responsibilities of the management;
- provision of resources;
- control and supervision of safety-related activities;
- continuous monitoring of compliance with safety requirements;
- development and support of safety culture and security culture;
- review of activities and implementation of corrective and preventive actions;
- development of management system improvements.

In order to identify the areas for improvement, NAEK *Energoatom* conducts internal audits of IMS processes such as electricity production planning, NPP equipment operation support, management of maintenance and repairs, emergency management, emergency preparedness, modernization, upgrading and lifetime extension, spent fuel and radwaste management control, environmental monitoring, internal notification of ecological effectiveness, etc.

In addition, as per the approved annual schedule, NAEK *Energoatom's* separate entities are checked for compliance with regulations and standards on nuclear safety, fire safety and occupational safety. The checks also cover measuring laboratories and metrological services, as well as emergency preparedness, plant physical protection, financial and economic activities.

Based on the certification and re-certification audits, the Certifying Authority TÜV NORD

CERT confirmed that the Quality Management System of NAEK *Energoatom* conforms to the requirements of ISO 9001:2008.

In order to make sure that vendors/manufacturers can ensure that their products will conform to the prescribed requirements, the operator carries out audits of the vendors that provide products for safety-related systems.

Vendors are selected on a tendering basis as required by the effective legislation on procurement of goods, activities and services using state funds.

Great attention is paid to providing NPPs with highly-skilled staff to ensure a high safety level during nuclear installation operation. Personnel are trained and retrained on a regular basis. Training is based on a graded approach reasoning from the roles and functions of employees: managerial staff, quality assurance officers and other specialists.

5.5. Assessment and Verification of Safety (Convention Article 14)

5.5.1. Each Contracting Party shall take appropriate steps to ensure that comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information and reviewed under the authority of the regulatory body.

Operation of nuclear installations envisaged their detailed and comprehensive safety analysis taking into account design features and operating practice. Ukrainian laws, regulations and standards require safety assessments and verifications.

The operator's safety assessment of power units is aimed at developing the main basic safety substantiation document, Safety Analysis Report (SAR), which presents both comprehensive safety assessment and technical and administrative measures to ensure safety.

Safety assessment and verification represent a continuous process and require the safety analysis to be detailed and the safety assessment procedures to be improved continuously in order to take account of the best world practices and actual events that occurred or might occur at nuclear facilities.

Safety analysis efforts, which comply with then-effective legal nuclear and radiation safety framework and the IAEA's recommendations, were launched in Ukraine in the 1990s and included developing SAR initially for pilot units (RNPP-1, SUNPP-1, ZNPP-5) and afterwards for the other power units. Safety analysis for NPPs was a subject of great attention of the international organisations (IAEA, STUK, GRS, IRSN, etc.) under international projects.

In 2010, the development of the Final Safety Analysis Reports (FSAR) for KhNPP-2, RNPP-4 and SAR for pilot power units (RNPP-1, SUNPP-1 and ZNPP-5) was completed in the scope of regulatory requirements.

In 2012, the SARs that were developed for pilot power units were adapted to non-pilot units of Ukraine (RNPP-2, SUNPP-2, RNPP-3, ZNPP-1, 2, 3, 4 and 6, SUNPP-3).

According to quantitative assessments, it can be concluded that the safety of pilot units of Ukrainian NPPs meets the requirements of NP 306.2.141-2008 "General Safety Provisions for Nuclear Power Plants" with regard to safety criteria.

According to the regulation "Requirements for Safety Assessment" put in force in October 2010, to assess more accurately the safety of power units by using probabilistic methods, in 2011 the operator started activities to include a full range of initiating events for all normal states of the reactor and spent fuel pool (SFP) in the SAR section "Probabilistic Safety Assessment (PSA)". The scope of analysis is expected to be extended for all operating units under C(I)SIP. Nowadays, the activities for ZNPP units 1 and 2, SUNPP units 1 and 2 and RNPP units 1, 2, 3 and 4 are in progress.

In addition, in 2010 the procedure for implementing the living PSA started at NPPs to

evaluate changes in the safety level and to implement risk-oriented programmes. The probabilistic assessments in SAR will be subsequently revised as safety improvements are implemented. This activity is also planned to be implemented under C(I)SIP. To date, the activities are in progress for ZNPP units 1 and 2, SUNPP units 1 and 2, RNPP units 1, 2, 3 and 4. The living PSA for KhNPP unit 2 was completed in 2012.

In 2012, the severe accidents analysis was completed and SAMG for full power state was developed for pilot SUNPP-1, ZNPP-1 and RNPP-1. For SUNPP-1 and RNPP-1, severe accident analysis was carried out along with development of SAMG for the SFP for full power state. The SFP SAMG is under development for ZNPP-1. SAMG for full power state is expected to be implemented for pilot power units in 2013.

The developed SAMG take into account upgrades focused on the severe accident management strategies involving mobile power supply sources and pumping units.

Following the analysis of the Fukushima Daiichi NPP and upon the SNRIU request, the scope of programme activities was extended. At present, the operator is carrying out the severe accident analysis and developing SAMG for shutdown reactor and spent fuel pool. The development of SAMG for shutdown state and spent fuel pool is expected to be completed for pilot units in 2014.

After the activities are completed for pilot units, SAMG is expected to be adapted to all other Ukrainian NPP units. One year after SAMG implementation for pilot units, SAMG is expected to be adapted to other power units.

After completing all modernisations envisaged by the C(I)SIP, SAMG for each unit will be revised to take into account additional technical and engineering features installed at power units for implementing the severe accident management strategies.

As prescribed by the nuclear law and national safety requirements and regulations, the operator shall periodically, at least every 10 years, perform periodic safety review for NPP units and report its results to the regulatory body. For safety review, the Ministry of Fuel and Energy of Ukraine approved the regulation "Requirement for the Structure and Content of Safety Review Report" taking into account IAEA Safety Standard NS-G-2.10 and incorporating recommendations of the IAEA experts.

The periodic safety review report (PSRR) was developed for RNPP units 1 and 2 within activities on their design lifetime extension. PSRR for SUNPP-1 is almost completed and development of PSRR for SUNPP-2, ZNPP-1 and 2, RNPP-3 and 4 and KhNPP-2 has started.

After the Fukushima Daiichi accident, Ukraine undertook necessary actions to arrange for and conduct a targeted safety reassessment of power units (stress tests).

The SNRIU in cooperation with the State Committee for Technology-Related Safety and NAEK *Energoatom* developed the “Action Plan for a Targeted Safety Reassessment and Further Safety Improvement of Ukrainian NPPs in the Light of the Fukushima Daiichi Accident”.

The Action Plan was approved by the SNRIU Board on 19 May 2011.

The Action Plan consisted of short-term and long-term activities. Short-term actions provide for a targeted safety reassessment of NPP safety (stress tests), targeted review of emergency preparedness and revision/amendment of C(I)SIP and the schedule of measures for 2011. With

respect to the long-term actions in response to the Fukushima Daiichi accident, safety improvement measures identified after the targeted safety reassessment should be implemented.

The stress tests of Ukrainian NPPs included detailed analysis of:

- natural hazards (earthquakes, floods, fires, tornado, extreme high/low temperatures, extreme precipitations, strong winds);
- station blackout (SBO) and/or loss of ultimate heat sink;
- issues of severe accident management.

Reports on stress tests of Ukrainian NPPs and Zaporizhzhya DSF were submitted to the SNRIU on 14 October 2011 for further regulatory review.

On 24–25 November 2011, an extended meeting of the SNRIU Board took place. According to Resolution No. 13 "On Results of Targeted Safety Reassessment of Operating NPPs and ZNPP Dry Spent Fuel Storage Facility in the Light of the Fukushima Daiichi accident", results of the stress tests conducted for ZNPP, RNPP, SUNPP and KhNPP were approved. Taking account of the targeted safety reassessment results, the SNRIU Board pointed out the following:

- the sequence of events that occurred at the Fukushima Daiichi NPP is practically impossible for Ukrainian NPPs;
- no new external hazards or their combination additional to those incorporated in NPP designs and analysed in detail in NPP safety cases were revealed.

In order to extend NPP lifetime beyond 30 years, the operating organisation should:

- ensure robustness of equipment, piping, buildings and structures required for the main safety functions (safe reactor shutdown and maintaining its safe condition, heat removal from the reactor core and spent fuel pool, prevention of radioactive releases to the environment) to the earthquake of 7 points on the MSK-64 scale at minimum, but with PGA not less than 0.1g (0.12 g for the SUNPP site);
- ensure performance of safety functions by NPP equipment in harsh environmental conditions;
- implement forced containment venting systems at WWER-1000 NPPs to decrease steam and gas pressure in the containment;
- implement measures for NPP units to provide SG and SFP makeup (cooldown) under long-term SBO and/or loss of ultimate heat sink;
- introduce severe accident management guidelines to control accidents that may cause severe fuel damage in the core and spent fuel pool;
- introduce symptom-based emergency operating procedures for low power states.

NAEK *Energoatom* implements a series of measures to improve the seismic resistance by:

- completing the equipment qualification;
- completing the activities to confirm seismic resistance of piping and structures;
- completing seismic studies of SUNPP and introducing continuous seismic monitoring across all NPP sites.

The C(I)SIP contains a series of measures to provide heat removal from nuclear fuel during severe accidents, including:

- SG makeup in SBO conditions;
- SFP makeup and cooldown in SBO conditions;
- operability of essential service water systems in case of dewatering of spray pools;
- measures for emergency power supply during sever accidents:
  - emergency power supply in SBO conditions;
  - installation of in-house standby transformers–5, 6 to improve reliability of in-house power supply (only for ZNPP).

The severe accident analysis and SAMG development are almost completed.

The following measures are implemented to improve the emergency response system:

- additional actions to provide uninterruptible operation of communication means on site and communication between NPP and Emergency Response Centre of NAEK *Energoatom* and the SNRIU;
- implementation of the system for online radiation monitoring in the area of NPP location continues;
- mobile power sources, additional mobile laboratories for radiation monitoring and individual dose monitoring are being provided.

On 20 December 2011, an open session of the SNRIU Board was held to address the National Report of Ukraine on stress tests. The meeting was attended by the representatives of non-governmental organisations and mass media, top management of the NAEK *Energoatom* and SSE *Chornobyl NPP*, representatives of the National Security and Defence Council of Ukraine, Ministry of Energy and Coal Industry of Ukraine, dedicated committees of the Verkhovna Rada of Ukraine, international organisations. The main provisions of the National Report on stress tests of Ukrainian NPPs were presented at the meeting of the SNRIU Board.

In the context of cooperation with the EC, the National Report was sent for consideration by the EC and ENSREG (subject to further peer review). Besides, national reports of member states of ENSREG and the national report of Switzerland were sent for consideration to the Ukrainian experts who issued detailed comments in this respect. During the peer review missions, the Ukrainian experts answered questions on the National Report of Ukraine asked by the European experts.

On 4-9 February 2012 in Luxemburg, the EC Secretariat's meeting took place to review the stress tests. During this meeting, Ukraine presented successfully its National Report along with the review results and also participated in discussions of responses to questions and comments on the national reports of member states.

On 18-22 March 2012, Ukraine hosted a Review Mission of the team of independent experts assigned by the ENSREG Secretariat to reach understanding on open issues and to prepare a final report based on conclusions of the topical peer review of Ukrainian NPP stress-test results. The agenda of this Review Mission included working meetings with the top managements and experts of the SNRIU, NAEK *Energoatom*, as well the visit to SUNPP. Upon completion of the Mission, a report was developed and submitted to the ENSREG' s

Secretariat.

In May 2012 the approved final report was sent to Ukraine.

Based on the ENSREG mission results, the EU experts determined the following issues:

- insufficient compliance with IAEA NS-R-1 in terms of equipment qualification, severe accidents, seismicity and completeness of probabilistic and deterministic safety analysis;
- severe accident analysis was not completed in Ukraine. These activities shall be of highest priority;
- activities under the national safety improvement programme have to be intensified.

Based on the ENSREG conclusions, the following recommendations were issued to be considered by the SNRIU:

1. It should be demonstrated, with a higher level of confidence that key functions required for severe accident management, are fulfilled.

2. The strategy and programme for equipment qualification in severe accident conditions should be fulfilled.

3. Risks of the reactor core and SFP damage in severe accident conditions should be assessed.

4. SFP accidents should be analysed in various configurations in order to supplement symptom-oriented EOPs and develop SAMGs.

5. It is necessary to improve the sufficiency of SFP cooling features in case of damage to the reactor core and internal piping as a result of hydrogen explosion.

6. It is necessary to analyse the accessibility and habitability of the main control room and emergency control room in case of severe accidents.

7. Staff and public protection in severe accident conditions should be considered.

8. For multi-unit NPPs, it is necessary to verify in greater details whether immediate emergency actions can be undertaken to avoid reactor core melt, large release and population evacuation.

9. It is necessary to assess whether seismic resistance of buildings accommodating the emergency centre is sufficient.

In addition, the EU experts identified the following strong points of Ukrainian NPPs:

1. High level of redundancy of structures, systems and components SSCs and power supply sources (DGs) at Ukrainian WWERs offers additional possibilities and flexibility for accident management;
2. Large water inventory at WWER NPPs increases the time available for SAM.
3. Risk of common-cause failures is addressed through additional mobile equipment and diesel generators intended for recovering the core cooling function.

Basic conclusions upon results of stress tests are as follows.

1. The design basis of Ukrainian NPPs considers all potential natural hazards. The NPP safety under design-basis events is justified in SAR and additionally verified stress-test

reports. Vulnerability of power units under conditions of severe accidents was assessed for all types of Ukrainian NPP units.

2. NPP designs have safety margins with respect to severe external impacts whose characteristics override the design values.

3. In case of such an accident, the core cooling functions can be recovered and maintained using mobile pumps and diesel generators and SAMGs for the reactor and SFP covering all operational states.

4. To implement SAMG strategies, a series of additional actions should be undertaken, including equipment qualification, installation of hydrogen recombiners, implementation of containment venting system, post-accident monitoring systems and so on.

All upgrades and safety improvements determined as a result of the stress tests have been included into and are underway within the updated C(I)SIP. C(I)SIP measures are implemented and monitored according to the developed schedules, which were agreed with the SNRIU.

To exercise control over the implementation of safety improvements for Ukrainian NPPs, which were identified upon the results of stress tests, as well as the implementation of recommendations issued by the peer review of Ukrainian NPP stress tests, the SNRIU developed a National Action Plan presented at the working meeting of ENSREG on 22-26 April 2013 in Brussels.

5.5.2. Verification by analyses, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

Since the previous Report, the nuclear installations were verified for their compliance with requirements, standards and rules of nuclear and radiation safety.

Regulatory inspection is carried out by the State Nuclear Safety Inspectorates and state inspectors of the SNRIU Headquarters. Inspector activity is governed by applicable regulations, special programmes and inspection schedules. The experts of relevant divisions of SNRIU and resident State Nuclear Safety Inspectorates are involved in comprehensive inspections.

Pursuant to requirements of NP 306.2.141-2008 "General Safety Provisions for Nuclear Power Plants", the operator ensures that the NPP safety is permanently monitored.

To that end, a departmental control service was established and operates at NAEK *Energoatom*.

The mission of that service is to monitor the Energoatom's verifying whether requirements, standards, criteria and rules on nuclear and radiation safety are fulfilled along with requirements for environmental protection, licence terms and operational documents.

Each NPP has a department control service whose mission includes regular (daily) control of

operating modes, conditions of safety-important equipment and systems and their compliance with requirements of operational documentation, regulations and rules of nuclear and radiation safety.

Pursuant to requirements of "Nuclear Safety Rules for WWER Reactor Installations", each NPP conducts internal nuclear safety inspections and submits appropriate certificates to the nuclear regulatory body.

According to the approved programme, internal inspections are carried out by the operator every two years. Radiation protection and environmental conditions are also inspected on a regular basis.

Based on inspection results, the measures are developed to eliminate the revealed shortcomings, as required.

Safety-important systems and components usually undergo direct and complete inspection for compliance with design specifications during commissioning, after maintenance and repairs, as well as throughout NPP life on a regular basis.

The design provides for diagnostics (testing) of conditions of safety-important systems and components referred to class 1 and 2. In-service inspection is carried out in compliance with conditions and limits of safe operation as prescribed by safety analysis report and technical specifications.

Specific measures on tests and inspection, their scope and frequency, are determined in technical specifications, ad-hoc programmes and procedures applied at NPPs. As prescribed by the regulations, the operator carries out:

- inspections and testing of equipment and process systems;
- monitoring of design life of major equipment;
- regular non-destructive testing of equipment and piping metal and welds;
- assessment of fuel rod cladding integrity;
- primary and secondary chemistry control;
- checks of reactor cooling system integrity;
- monitoring of radioactive releases and discharges and radiation conditions around the NPP site,

and other monitoring actions as prescribed by special programmes and procedures.

Upon maintenance and repair, the systems and equipment are checked for their operability and compliance with design characteristics, with inspection results being recorded.

To limit degradation of safety-related structures, systems and components (as a result of aging, wear, corrosion, erosion, fatigue, etc.) and to support their operability and reliability during operation, NAEK *Energoatom* developed and fulfils programmes on equipment aging management, equipment qualification and lifetime extension of operating units. Also, the Comprehensive (Integrated) Safety Improvement Programme was developed and implemented along with the NAEK *Energoatom* programme on NPP operation improvements for 2013-2016.

The legislative and regulatory framework was established in Ukraine to allow a comprehensive and systematic safety assessment throughout the life stages of nuclear installations.

5.6. Radiation Protection (Convention Article 15)

Each Contracting Party shall take the appropriate measures to ensure that in all operational states the radiation exposure to the personnel and the population caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

The Law of Ukraine "On Human Protection Against Ionising Radiation" aimed to ensure the protection of citizens' life, health and property against negative effect of ionising radiation, prescribes practical steps to implement the provisions of basic Law "On Nuclear Energy Use and Radiation Safety" and establishes the main dose limits for personnel and the public. This Law also outlines the scope of authority and obligations of state bodies responsible for radiation protection.

In 2001, 2009 and 2012, the Law of Ukraine "On Human Protection against Ionising Radiation" was amended to bring the provisions of the Law in full compliance with the recommendations of the International Commission on Radiological Protection (ICRP).

The regulatory document "Radiation Safety Standards of Ukraine" (NRBU-97) and its annex "Radiological Protection Against Potential Radiation Sources" (NRBU-97/D-2000) correspond to the main provisions of the Law of Ukraine "On Human Protection Against Ionising Radiation". They are based on accumulated international experience and reflect up-to-date trends and fundamental approaches toward law-making and radiation protection, take into account recommendations of the international organisations, such as the IAEA and ICRP.

The Radiation Safety Standards of Ukraine (NRBU-97) determine the basic principles of radiation protection applied to practices and intervention situations, establish radiation and health and safety regulations to ensure acceptable exposure levels for individuals and society as a whole. Specifically, they standardise the effective dose limit for category A personnel (20 mSv/year) and for the public (1 mSv/year), as well as limits for equivalent doses of external exposure for the eye lens, skin, hands and feet that comply with recommendations of ICRP Publication 60.

Document NRBU-97/D-2000 complements and extends NRBU-97, incorporating potential radiation sources into the system of radiation and health and safety regulation. The document introduces a series of new provisions, including the latest achievements in the sphere of radiation protection against potential exposure, namely:

- concept of potential exposure;
- groups of potential exposure sources;
- system of regulations specifying reference levels of doses and risks of potential exposure as well as reference probability of critical events;
- radioactive waste classification complying with provisions of the Law of Ukraine "On Radioactive Waste Management".

The basic principles of radiation protection and the ALARA (optimization) principle are implemented in Ukraine through development and introduction of regulatory standards and

rules as well as through development and introduction of proper operational procedures. A number of organisational and technical measures can be referred to the activities on ALARA principle implementation. These organisational and technical measures are implemented at Ukrainian NPPs with the purpose of reducing individual and collective doses of personnel, minimising releases and advancing the radiological monitoring systems.

Adherence to the radiation safety rules and hygiene and sanitary standards at nuclear energy enterprises is monitored by State Sanitary and Epidemiologic Service of Ukraine under the Ministry of Health of Ukraine.

Efficiency of measures on radiation protection is assessed directly through collective and individual dose rates, as well as based on dynamics of their changes and level of releases from nuclear installations.

Figure 1 (Annex 6) shows the dynamics of collective doses for Ukrainian NPP personnel for the period from 2003 to 2012.

Figure 2 (Annex 6), respectively, reflects the dynamics of average annual individual dose for NPP personnel over the same period of time. As one can see from the diagrams, over the recent few years the exposure doses to the personnel of Ukrainian NPPs steadily tend to reduce. The increased annual dose rates are recorded in years with a significant scope of radiation hazardous operations performed during NPP scheduled outages.

Figure 3 (Annex 6) shows individual dose distribution for the personnel of Ukrainian NPPs over the period from 2010 to 2012. It can be concluded from the bar chart that individual doses to the majority of individuals monitored at all Ukrainian NPPs (more than 80 % of the personnel) are below 1 mSv. In 2010-2012 there were no individuals at Ukrainian NPPs registered to have the irradiation dose exceeding 20 mSv/year.

Figure 4 (Annex 6) shows the percentage of individuals among the NPP personnel whose annual effective dose exceeds 15 mSv. The analysis testifies that the number of such individuals is decreasing every year, therefore the personnel exposure level is decreasing at Ukrainian NPPs.

Figure 5 (Annex 6) shows the percentage of NPP personnel collective dose related to the amount of the electric power produced, person.cSv/MW.year. According to the diagram, the level of total collective dose of NPP personnel has a steady decreasing trend, while the indicator of electric power generated by NPP was stable during the last years. Lately, in 2007 and 2009, the higher level of collective dose to SUNPP and RNPP personnel is connected with increase of scope of radiation hazardous activities performed during scheduled outages.

Figures 6, 7 and 8 (Annex 6) show the dynamics of gas-aerosol radioactive releases at Ukrainian NPPs for the last years.

Values of actual releases recorded by the regular radiation monitoring systems at Ukrainian NPPs are much lower than levels of permissible releases established taking into account appropriate dose limit quotas for category B individuals (the public).

The total indices (percentage of actual release to the permissible one) of gas-aerosol releases to the environment in terms of main nuclides (noble radioactive gases, iodine radionuclides and long-lived nuclides: ^{137}Cs, ^{134}Cs, ^{60}Co, ^{54}Mn, ^{90}Sr) in 2012 accounted for 0.113 % at ZNPP, 0.531 % at RNPP, 0.182 % at SUNPP, 0.160 % at KhNPP.

Figure 9 shows dynamics in the total indices of gas-aerosol releases of radioactive substances into the environment at NPPs operated by the Energoatom for the period from 2003 to 2012.

As one can see from Figure 9, over the recent years there is a steady trend to reduction of releases, which results in decrease of population exposure on the territories of NPPs. As for the last period starting from 2007, a higher releases index at RNPP is connected with the technique being introduced at RNPP, measurement and control activities related to gas-aerosol releases of tritium through NPP ventilation stacks. At KhNPP in 2010 they started to perform the radiation monitoring of gas-aerosol releases of tritium but only for ventilation stack of Unit 2.

Total indices (percentage ratio of actual discharges to the permissible ones) of registered water discharges to the environment in terms of main nuclides (^{137}Cs, ^{134}Cs, ^{60}Co, ^{54}Mn, ^{90}Sr, ^{3}H) in 2012 accounted for 0.54% at ZNPP, 0.87% at RNPP, 2.43% at SUNPP, 4.95 % at KhNPP.

Figure 10 shows the dynamics of total indices of radioactive substance releases into the environment at NAEK *Energoatom* NPPs for the period from 2003 to 2012.

As one can see from Figure 10, over the recent years there is a steady trend to reduction of indices of releases and discharges that results in decrease of population irradiation on the territories of NPP location.

The state of the environment on the territory where nuclear installations are located is monitored by means of standard radiation monitoring systems in accordance with current regulations on radiation monitoring applicable at each NPP. The scope and methods of monitoring are prescribed in regulations.

There are several thousands of samples in the radiation control and sanitary-protective areas, which are selected annually for further analysis. They characterise the radiological condition of the surface air, surface water and components of terrestrial and aquatic ecosystems. Sample analysis of surface layer of atmosphere in the areas of NPP location shows that the radionuclide composition is predominantly presented by ^{137}Cs, ^{60}Co and ^{90}Sr radionuclides.

In 2012 the radioactive substances content in atmospheric air of ZNPP boundaries constituted for ^{137}Cs - < 1.0 -1.3 μBq/m^3, for ^{90}Sr - < 0.05 - 0.13 μBq/m^3. At RNPP, the content of ^{137}Cs radionuclide in atmospheric air varied from 2.3 to 17.6 μBq/m^3. At SUNPP the registered content of radioactive materials in atmospheric air was for ^{137}Cs < 2.6 μBq/m^3, and varied for ^{90}Sr - from 0.1 to 0.9 μBq/m^3. At KhNPP the content of radioactive materials in atmospheric air varied for ^{137}Cs - from 0.9 to 3.0 μBq/m^3, for ^{90}Sr - from 0.2 to 0.6 μBq/m^3.

For all NPPs, the concentrations of radionuclides in the surface layers of atmosphere are essentially lower than the permitted values for these radionuclides and are at the "zero

background" level.

Thus, Ukraine fulfils Article 15 of the Convention.

5.7. Emergency Preparedness (Convention Article 16)

5.7.1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency.

Emergency plans of NAEK *Energoatom* and NPPs are developed on the basis of IAEA practical recommendations concerning emergency planning stated in the following documents:

- "Preparedness and response for a nuclear or radiological emergency. Safety Requirements. Series No. GS-R-2, IAEA, Vienna, 2004 – basic IAEA document in the area of emergency preparedness and response;
- "Method for the development of emergency response preparedness for nuclear or radiological accidents" IAEA, Vienna, 1998, IAEA-TECDOC-953/R;
- "Method for developing arrangements for response to a nuclear or radiological situation" IAEA, Vienna, 2009, Modifying IAEA-TECDOC-953/R.

Each NPP developed and put in place a number of regulating documents ("Radiation Safety Instruction", "Instruction for the personnel to act in the event of a radiological emergency", "Plant shift supervisor procedure in case of receiving the information about dangerous natural and hydrological phenomena" etc.) which specify the actions of plant operating personnel in emergency situations.

Standard Emergency Plan of Nuclear Power Plants of Ukraine and Emergency Plans of operating Nuclear Power Plants developed on its basis were repeatedly inspected during IAEA, OSART, WANO missions.

Scheduled revision of Standard Emergency Plan of Nuclear Power Plants of Ukraine and Emergency Response Plan of NAEK *Energoatom* were revised by schedule in 2012 and as part of C(I)SIP aimed at enhancing the efficiency of response to the emergency events at nuclear power plants and ensuring emergency preparedness of NPP considering IAEA Resolution of the Seventh Plenary Meeting of the 55-th IAEA General Conference dated 22 September 2011, section 11 "Preparedness and response in case of nuclear and radiological incidents and emergency situations" as well as the detailed analysis of WANO suggestions:

- WANO SOER 2011-2 "Fukushima Daiichi Nuclear Station Fuel Damage Caused by Earthquake and Tsunami",
- WANO SOER 2011-3 "Fukushima Daiichi Nuclear Station Spent Fuel Pool/Pond Loss of Cooling and Makeup",
- WANO SOER 2011-4 "Urgent actions to Address Extended Loss of All AC power"

"General provisions of organisation of preparedness and response of *Energoatom* to accidents and emergencies at nuclear power plants of Ukraine" - the main document that establishes the principles of Emergency Response System defines its goals, objectives, structure, sequence of function, shares duties and responsibilities between the structural subdivisions and officials of *Energoatom* on emergency planning, preparedness and response, interaction with the external bodies, companies and organisations were also revised.

External response and external support (off-site) in case of accidents and emergencies at

operating nuclear power plants are covered by Emergency Plans of Ukrainian NPPs and Emergency Response Plan of *Energoatom* and "Radiological Emergency Response Plan" approved by a joint order of the State Nuclear Regulatory Inspectorate of Ukraine and the Ministry of Emergencies (the Ministry of Emergencies was reorganised according to Presidential Decree No. 726/2012 dated 24 December 2012 "On the Reorganisation of the Ministry of Emergencies and the State Inspectorate of Technology-Related Safety of Ukraine" to the State Emergency Service of Ukraine acting as a central executive body whose activities are directed and coordinated by the Cabinet of Ministers of Ukraine via the Minister of Defense of Ukraine).

Management, action and interaction of management body of forces and means involved in this case to prevent or eliminate emergencies at nuclear power plants of Ukraine (including - additional resources of external organisations) are performed in accordance with procedure prescribed in "Emergency Response Plan of State Level" approved by the Cabinet of Ministers of Ukraine.

Organisation and implementation of emergency measures in the event of radiation accidents are regulated by "Radiological Emergency Response Plan" and "Exemplary Response Plan to Radiation Accidents of Territorial Subsystems of the Unified System of Civil Defense whose territory in the whole or in part belongs to the radiation control area of nuclear power plant". In the event of nuclear or radiological emergency at operating NPPs of Ukraine, central and local authorities should, in accordance with applicable law, take decisions and act in accordance with the relevant departmental and regional plans taking into account the recommendations of NPP and operator and other authorised agencies.

"Radiological Emergency Response Plan" establishes that "... in order to timely respond to radiation accidents and to take effective measures to protect the population and territories... the following plans to respond to radiation accidents are developed:

- emergency plans of facilities where the practical activities associated with radiation or radiation and nuclear technology are carried out;
- emergency response plans of the territorial sub-systems of the Unified System of Civil Defense system of the local level;
- emergency response plans of the territorial sub-systems of the Unified System of Civil Defense of the regional level …"

Emergency plans of operating NPPs stipulate that within 30 minutes from the time of the accident classification the nuclear power plant provides guidance to the management of Unified System of Civil Defense in terms of iodine prophylaxis and evacuation of population from 5-km zone around the plant, as well as the protective measures for population living in other areas of 30-km zone of nuclear power plant in accident. Territorial subsystem authorities shall take a decision on evacuation of population and provide public notification to implement the protective measures.

The adequacy of solutions as the timeliness and effectiveness of local and central authorities in case of emergency events at nuclear power plants is conditioned by the general level of training and preparedness of authorities to act in emergency situations, as well as the previously drilled algorithm of their interaction with all members of emergency response.

The effectiveness and consistency of emergency plans of the level of *Energoatom* Directorate and the level of NPP are systematically examined during emergency exercises at various levels, as well as during routine annual comprehensive inspections of NPP preparedness and separated subdivisions with their tasks to provide and to implement emergency measures under the threat and (or) radiation and nuclear accidents occurrence, technological emergencies and natural disasters.

In order to train NPP emergency crews and brigades to act under accident conditions, to improve their knowledge and skills to eliminate accident consequences or emergencies, the following is carried out:

- state-level emergency exercises planned by the Ministry of Emergency of Ukraine conducted every 5 years;
- joint general emergency exercises conducted every 3 years;
- general plant emergency exercises conducted once a year;
- emergency exercises for emergency crews and brigades conducted once per quarter

No.	Type of emergency exercises	Frequency of emergency exercises
1	State-level emergency exercises planned by Ministry of Emergency of Ukraine	Every 5 years at one Ukrainian NPP
2	Joint general plant emergency exercises	Every 3 years for each NPP
3	General plant emergency exercises	Once a year
4	Exercises for emergency crews and brigades of NPP	Twice a year for each emergency crew and brigade

The operator conducts joint full-scale general plant emergency exercises at each NPP once in three years according to "The schedule of plant emergency exercises held jointly with NAEK *Energoatom* involving the representatives of ministries and agencies, and representatives of local authorities" developed by NAEK *Energoatom* for the period from 2009 to 2018 and agreed by SNRIU.

According to this schedule the operator takes part in the state level emergency exercises once in five years conducted by Ministry of Emergency Ukraine according to "Radiological Emergency Response Plan".

Operator representatives (experts of emergency preparedness and response) supervise state level emergency exercises conducted annually at each operating nuclear power plant.

Moreover, according to the certain international agreements and interaction plans the emergency response specialists of NAEK *Energoatom* are regularly (annually) involved in training and exercises conducted at Nuclear Power Plants of Russia. For instance, in 2012 representatives of *RosEnergoAtom* Concern took part in plant emergency exercises at ZNPP as observers. In its turn, the representatives of NAEK *Energoatom* were involved in the

emergency exercises (as observers) in 2010 at the Smolensk NPP and in 2012 at Novovoronezh NPP.

Representatives of the State Nuclear Regulatory Inspectorate of Ukraine take part in the plant emergency exercises as supervisors.

5.7.2. Each Contracting Party shall use the appropriate steps to ensure that its own population and competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for the emergency planning and response.

Providing information on civil protection and warning about the threat or emergency situations are performed in accordance with the provisions of Articles 30 and 31 of the Code of Civil Defense of Ukraine, adopted on 2 October 2012 (as amended by Laws No. 224-VII dated 14 May 2013 and No. 353-VII dated 20 June 2013). In particular, national, territorial, local automated system to notify about the threat or emergency, special, local and site-warning system have been established and operated in Ukraine. Telecommunications networks, including mobile communications, departmental telecommunications networks and entity's telecommunications network in the manner established by the Cabinet of Ministers of Ukraine, as well as a network of national, regional and local radio and television broadcasting and other technical means of information transmission (display) are centrally used.

According to the current legislation in the field of civil protection all operating nuclear power plants are equipped with facilities of communications and notifications that provide immediate transfer of signals and notices to the NPP management and personnel, to the responsible persons of the operator, state regulation and supervision authorities, central and local executive authorities and local self-governments, other organisations, institutions and bodies in accordance with the approved scheme of notification.

Notification on occurrence of emergencies at operating nuclear power plants are performed using special warning system, created with NPP funds. These systems provide the possibility to transmit the established signals and notifications at the NPP site and its industrial area, at settlements near the plant, from the workplace of the plant shift supervisor (duty operator), as well as notifications to duty services of territorial authorities in the field of civil protection.

Signals and notifications at NPP sites and industrial areas as well as at the areas of settlements near the plant are transmitted from the workplace of the plant shift supervisor. Direct telephone communication is established between the plant shift supervisor and duty services of territorial authorities in the field of civil protection.

To ensure reliable communication of Ukraine NPPs in case of emergency, there was a system of emergency satellite communications, video conferencing system established at NAEK *Energoatom*. A system for collecting, transmission, receiving and processing of manufacturing parameters of NPP was developed and implemented. Data transmission system (DTS) of NAEK *Energoatom* provides for prompt real-time transmission and display of NPP process parameters, the safety state of individual power units and NPP in general, the results of radiation monitoring at the site, at the sanitary protection area and the surveillance area.

To inform local and central authorities about the expected dose loads of population, providing forecasts and recommendations to protect population, NAEK *Energoatom* uses an object-

oriented decision support systems (DSS) in emergencies at facilities designed for NPP 30-km zone. Input data for DSS are provided by meteorological stations and posts of control of automated radiation monitoring system (PAMS).

NAEK *Energoatom* uses an object-oriented DSS based on KADO software (RNPP), DSS "VYKID" (SUNPP), DSS INTERRAS (ZNPP). At the KhNPP and SUNPP the DSS based on updated KADO software is in trial operation. DSS based on KADO software is being created at ZNPP.

Object-oriented DSS KADO uses calculating methods that allow on-line processing of meteorological and radiological input data.

NAEK *Energoatom* continues implementation of the DSS improvement programme at the NPP, the essence of which is to develop and adapt for all the NPP sites the KADO calculating software complex developed by the Research Institute of Radiation Protection of Academy of Technical Sciences, Ukraine. KADO DSS software complex is in trial operation at RNPP since 2003. By 2015, installation and adaptation of the specified complex is planned at all NPPs of Ukraine.

At the same time, in Ukraine, supported by the EC in the frames of the Instrument for Cooperation in the field of nuclear safety, an innovative DSS is implemented for managing radiation accidents at nuclear power plants based on the European system RODOS.

The general goal of the project is to expand the technical capabilities of Ukraine in the field of identification, planning, initiation and practical implementation of countermeasures for protection of personnel, population and environment in the event of a radiological accident at the Ukrainian nuclear power plants. This will be achieved through the creation of a specialised central DSS for the management of nuclear and radiological emergency situations outside the NPP sites.

It is assumed that RODOS DSS for managing radiation accidents at nuclear power plants will be adapted for the whole territory of Ukraine, as well as for specific conditions of Zaporizhzhya NPP and Rivne NPP under Project U3.02/08 "Support of the SNRIU in the implementation of RODOS in the Information and Emergency Centre (IEC) of Ukraine ".

Completion of RODOS DSS implementation is planned in the frames of *Energoatom* Project U1.05/09T6 "Development of improved, fully integrated management system into the NAEK *Energoatom*/NPPs for the effective management and coordinated response to emergencies". During the project implementation RODOS DSS should also be adapted to the conditions of Khmelnitsky and South-Ukraine NPPs.

Furthermore, in the frames of the above project it is planned to create the National Analytical Centre intended to provide operational analysis of the received estimates and assumptions, consultative support of the personnel of emergency crisis centre of NAEK *Energoatom* and other bodies involved in emergency response in case of NPP accident. The project also provides for supply a complete set of appropriate equipment for the end users, collecting missing country-specific and NPP-specific data, developing detailed digital maps for the 30-km zone of Ukrainian NPPs, etc.

It is planned to create the National Analytical Centre on the basis of the Ministry of Emergencies of Ukraine, a central executive authority in charge of development and pursuing the national policy in the field of civil protection, with the final version of RODOS DSS to be installed in the Ministry of Emergencies (letter No. 03-120 /1620 of the Ministry of Emergencies dated 10.01.2012), and with the distant workplaces to be organised at in emergency (crisis) structures of the SNRIU, NAEK *Energoatom* and four operating nuclear power plants. It is assumed that creation and implementation of RODOS DSS at the national level is possible in the next 2-3 years.

On-site (at NPP site) and off-site (in the surveillance area) emergency response centres were established at each nuclear power and brought in compliance with regulatory requirements NP 306.202/3.077-2003 "Requirements for the internal and external emergency response centres". All emergency response centres of NAEK *Energoatom* are combined into a single system with the reserved channels of communication, including space communication channels, and have unified data transmission system.

All NPP emergency systems and communications are maintained alert for immediate use. Their further improvements are performed in the context of adaptation to modern innovative technologies in their respective fields.

Overall coordination and openness of measures of the emergency response system in case of nuclear or radiation accident is ensured by interaction of NAEK *Energoatom* with the state authority in the field of nuclear energy, specially authorised central body of executive power on civil protection and state nuclear regulatory body of Ukraine, with other central executive authorities, and is carried out by means of information exchange and through direct participation of their representatives in the work of the Commission for Emergencies of NAEK *Energoatom*.

The current normative document "Regulations on the procedure for investigation and registration of violations in nuclear power plants operation" (Regulations) establishes the following procedure for informing the regulatory body about the incidents (violations) related to drop and/or damage of fuel assemblies, fuel elements, absorber elements during handling of fresh or spent fuel (category P01, P02, P06):

- Prompt notification of an incident (violation) shall be transmitted by the plant shift supervisor or an official on his behalf by telephone either immediately (P01, P02) or within one hour (P06) after detection of an incident (violation) to the duty officer of the SNRIU and to the Head of the State Nuclear Safety Inspectorate on-site.
- Preliminary notification of an incident signed by the NPP Chief Engineer and by the Head of the State Nuclear Regulatory Inspectorate on-site shall be reported by telephone (fax) or by electronic network of the SNRIU during the day.

If required, an additional (clarifying) notification signed by the same persons shall be sent to the same addresses where the previous notification was sent, up to 5 days.

“The Action Plan for Educational Work with the Population Living in the Surveillance Areas of Nuclear Power Plants” was approved by Cabinet Resolution No. 58-r dated 1 February

2012. According to this plan, the Ministry of Energy and Coal Industry, SNRIU, NAEK *Energoatom* are responsible for informing the public about the work of nuclear power plants and nuclear power industry in accordance with the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" by coverage in the mass-media of the activities of the operating organisation, nuclear power industry and NPP operation, by on-line response to unreliable information based on the results of the analysis of relevant publications in the printed media, by holding information meetings with target audiences and targeted groups, etc. The Ministry of Emergencies and the Ministry of Education, Science, Youth and Sports are also involved in the educational work with population.

In its day-to-day activities the operator systematically carries out activities to inform people living near nuclear power plants about radiation risks associated with nuclear power plants activities. It is done by:

- dissemination of information materials and publications of the relevant content for executive authorities of different levels, mass-media and public institutions, as well as on the official websites and in printed media of Ukrainian NPPs;
- responding inquiries of the public, mass-media, executive authorities of various levels, etc.;
- lecturing with visits to nuclear facilities organised for the public, including school children, of the 30-km zone around the plant;
- broadcasting the topical television and radio programmes, addresses of NPP managers and specialists, and development and dissemination of special printed and information materials (placards, booklets, leaflets, etc.). among population of surveillance areas

To implement the “Plan of measures to ensure transparency and accessibility of information related to the use of nuclear energy, and to improve nuclear safety culture in nuclear power industry”, approved by Cabinet Resolution No. 736-r dated 3 August 2011, taking account of IAEA documents (SF-1, GS-R-3) and European best practices, "The General Requirements for Management System in the Field of Nuclear Energy" were developed and approved (SNRIU Order No. 190 dated 19 December 2011).

The Unified State System of Civil Protection of the Public and Territories is created and operates in Ukraine. It is continuously improved based on the gained practical experience and changes, which take place in the regulatory and legal framework and structure of the central executive authorities. Requirements for emergency planning of activities and for periodic testing of these activities both on-site and off-site are established. Measures are taken to inform the public and the relevant state authorities.

Thus, Ukraine implemented the provisions of the Article 16 of the Convention.

SECTION VI. SAFETY OF INSTALLATIONS

6.1. Siting (Convention Article 17)

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented.

6.1.1. Evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime.

The siting requirements are established by Ukrainian legal and regulatory documents. The decision-making procedure and requirements for documents substantiating the construction of a nuclear installation are determined by Article 37 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety". In particular, the submittals should describe:

- characteristics of the environment in the area of possible location of the installation;
- environmental impact assessment (EIA), planned activities on construction, commissioning, operation and decommissioning;
- designed measures to prevent and mitigate adverse environmental impact.

Criteria for evaluating factors that can affect safety of nuclear installations are determined by nuclear and radiation safety regulations and state civil engineering standards. These documents identify performance indicators that characterise natural, economic and demographic conditions in the site area, data of pre-operational monitoring of the environment and meteorological, climatic, geological, seismic, hydrological, hydrogeological, engineering-geological and geochemical characteristics.

The SNRIU developed and endorsed the regulatory document "Safety Requirements for NPP Siting" (NP 306.2.144-2008) that defines safety requirements for siting of a nuclear power plant and takes into account the IAEA recommendations (NS-R-3).

The Cabinet of Ministers of Ukraine approved the "Energy Strategy of Ukraine for the Period until 2030" by Resolution No. 145-r of 15 March 2006 that envisages construction of new NPP units, including those at new sites.

The Ministry of Energy and Coal Industry of Ukraine also elaborated the updated "Energy Strategy of Ukraine for the Period until 2030". This document considers scenarios of energy sector development in Ukraine depending on economic growth and gross domestic product calculated using forecasts of the Ukrainian Government. The draft updated Energy Strategy plans commissioning of units to generate additional 5-7 GW till 2030 under the basic scenario.

According to Cabinet Resolution No. 436-r of 27 July 2006 on implementation of the Energy Strategy of Ukraine, documents justifying the siting of new nuclear power units were developed in 2012. Based on these documents, a draft cadastre including seven candidate sites

complying with regulations on NPP operation and environmental impact was developed.

6.1.2. Evaluating the likely safety impact of the proposed nuclear installation on individuals, society and the environment.

The legal and regulatory documents of Ukraine regulate the evaluation of potential safety impact of a new nuclear installation on individuals, the public and the environment.

According to Ukrainian legislation, the potential impact from the nuclear installation is evaluated through the state environmental review.

According to Article 13 of the Law of Ukraine "On Environmental Review", the state environmental review is organised and performed by environmental expert teams, expert organisations, institutions or ad-hoc commissions of the central executive authority of the Ministry for Environment and Natural Resources of Ukraine.

In accordance with Article 36 of the Law of Ukraine "On Environmental Review", the environmental impact assessment of planned or on-going activity shall justify its expediency and ways of implementation, possible alternatives, characteristics of the environment, types and levels of environmental impact under normal and extreme conditions, possible changes in its qualitative state, ecological and economic consequences and measures to reduce ecological risks and meet ecological safety requirements.

As a rule, the state environmental review is carried out either as a part of the state comprehensive review or as an individual review when it is not aimed at evaluating the construction design and EIA is developed as an individual document and is not included in the design documentation.

The recent environmental review in Ukraine was performed in 2011 for the EIA within the feasibility studies of Khmelnitsky NPP units 3 and 4. Positive review results were obtained in 2012.

6.1.3. Re-evaluating as necessary all the above relevant factors to ensure the continued safety acceptability of a nuclear installation.

Article 33 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" states that the operating organisation (operator) should periodically re-evaluate safety of a nuclear installation or a radioactive waste storage facility according to the nuclear and radiation safety regulations and standards and should report on its results to the SNRIU.

Safety reassessment is also performed upon request of the state nuclear regulatory authority in case of substantial changes in the design of the nuclear installation or storage facility and if operating experience revealed deficiencies of the previous evaluation.

In order to maintain the safety level and implement corrective actions (if necessary) in a timely manner, re-evaluation of specific factors and nuclear facility site characteristics can be requested. Such re-evaluation may be necessary in the following cases:

- a decision is made to arrange a new nuclear facility at the site (in Ukraine such re-evaluations were part of the state environmental review at ZNPP in connection with the construction of the spent fuel storage facility as well as at KhNPP and RNPP in connection with the construction of KhNPP units 2, 3, 4 and RNPP unit 4);

- safety improvement programmes are planned (environmental review was performed within the C(I)SIP as a part of feasibility studies. The review resulted in positive findings. The main conclusion was that safety would be improved after implementation of the C(I)SIP in full scope, which in due course would reduce the risk of incidents and accidents that can potentially affect the health of personnel and the public);
- new scientific data that indicate the need to revise the design data on natural factors are obtained (corresponding studies were carried out at RNPP to predict potential development of internal erosion and karst processes; additional seismic studies were carried out at ChNPP and SUNPP, detailed information is provided in para. 5.1.3 of the 4th National Report of Ukraine);
- negative trends of monitoring data (hydrogeological, engineering-geological, etc.) are revealed: for example, subsidence or sloping of buildings.

6.1.4. Consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

According to State Civil Engineering Standards of Ukraine, if planned activity may affect neighbouring states, transboundary EIA should be developed in compliance with the "Convention on Environmental Impact Assessment in a Transboundary Context" (Espoo Convention) ratified by Ukraine on 19 March 1999.

Under Law of Ukraine No. 2861-IV dated 08.09.2005 "On Decision-Making Procedure for Siting, Design and Construction of Nuclear Installations and Radioactive Waste Management Facilities of National Importance", reports on measures aimed at notification of neighbouring states of a potential transboundary impact shall be developed for new nuclear installations and radwaste management facilities of national importance.

In 2008 the mass media published the Declaration of Intentions to build Khmelnitsky NPP units 3 and 4.

In 2009-2011, feasibility studies (FS) were conducted for the construction of KhNPP units 3 and 4, including EIA for consequences of transboundary releases under normal operation and in emergencies.

The comprehensive state review of the FS for the construction of KhNPP units 3 and 4 was conducted by the State Specialized Expert Review Organisation (Central Service for Ukrainian State Civil Engineering Review) and resulted in positive conclusions.

According to the Espoo Convention, the document "Notification of Planned Activities…" was developed and submitted to the neighbouring countries by the Ministry of Environmental Protection of Ukraine, the national coordinator for the Convention implementation.

The notified countries provided the response and confirmed their interest and intention to participate in the impact evaluation proceedings.

"Informational and Analytical Overview of the FS for the Construction of KhNPP units 3 and 4" was prepared to provide environmental and engineering data required by the Espoo Convention as well as the evaluation of transboundary release consequences under normal operation and in emergencies. It was sent to the neighbouring countries as well.

Experts responded to all questions, remarks and comments received.

The Cabinet of Ministers of Ukraine approved the FS for the construction of KhNPP units 3 and 4 by Resolution No. 498-4 dated 4 July 2012. Law of Ukraine "On Siting, Design and Construction of Khmelnitsky Nuclear Power Plant Units 3 and 4" No. 5217-VI dated 6 September 2012 became effective on 4 October 2012.

After the approval of this Law , Ukraine received additional questions related to the EIA. Following the provisions of Article 5 of the Espoo Convention, Ukraine organised additional consultations with the involved parties in May 2013 regarding the construction and operation of KhNPP units 3 and 4.

In 2008, a report was prepared concerning measures aimed at notification of neighbouring states of a potential transboundary impact from the Centralised Storage Facility for Spent Nuclear Fuel from Ukrainian WWER NPPs (CSFSF), and corresponding consultations were held with the Republic of Belarus as the Party that could be potentially affected by the storage facility operation.

In 2009 the Cabinet of Ministers of Ukraine approved the FS of investments into construction of the CSNFSF, and Ukrainian Parliament adopted the Law of Ukraine on the CSNFSF siting, design and construction on 9 February 2012.

Ukraine also developed necessary legislative and regulatory basis to ensure compliance with the justification principle of all radiation-related activities.

Extraordinary safety evaluations and re-evaluations of natural and man-made factors are carried out on a regular basis in accordance with the established procedure.

In siting and construction of new nuclear installations, legally imposed measures should be taken to inform neighbouring states of any potential impact in the transboundary context.

6.2. Design and Construction (Convention Article 18)

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

6.2.1. The design and construction of a nuclear installation provides for several reliable levels and methods of protection (defence in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur.

In 2008 SNRIU approved the regulatory document "General Safety Provisions for Nuclear Power Plants" (NP 306.2.141-2008), which takes into account IAEA recommendations specified in the Basic Safety Principles for Nuclear Power Plants (INSAG-12). The regulatory document NP 306.2.141-2008 identifies safety criteria, fundamentals, general organisational and engineering safety requirements with defence-in-depth strategy based on five levels relying on:

- successive physical barriers to the spread of ionising radiation and radioactive substances to the environment;
- engineering and organisational measures aimed at protection of physical barriers and maintaining their efficiency.

After the adoption of this and other safety regulations, the designs of operating NPPs in Ukraine were revised for compliance with the established requirements. Corrective actions were developed and implemented for the identified deficiencies. Now, NPP upgrading and reconstruction projects are being developed in accordance with the new safety regulations.

The technical and organisational measures incorporated in the design to prevent any damage of physical safety barriers, strengthen defence-in-depth levels, prevent limits and conditions of safe operation and design-basis accidents from being violated, mitigate their consequences and ensure safety in case of any design-basis initiating events.

Based on the results of the Joint EC-IAEA-Ukraine Project on comprehensive design safety assessment of NPPs the team of international experts confirmed that no inconsistency was discovered at Ukrainian NPPs as related to IAEA NS-R-1 requirements.

The Fukushima Daiichi accident also necessitated further improvement of regulatory requirements for operating NPPs and additional criteria and safety regulations to be used in the design of new power units.

In 2011 SNRIU comprehensively analysed nuclear safety regulations to take account lessons of the Fukushima Daiichi. The analysis resulted in a list of regulations whose individual provisions should be revised, including:

- requirements on systems for reactor emergency cooldown and heat removal to the ultimate heat sink;
- requirements on seismic design and seismic safety assessment of NPPs;
- requirements on fresh and spent fuel management;

- requirements on containment safety systems.

Revision of the basic nuclear safety regulation – Basic Safety Provisions for Nuclear Power Plants – was started in 2012. The areas for revision of the Basic Safety Provisions were discussed and agreed at the SNRIU Board meeting on 20 November 2012, "On Safety Criteria and Requirements for Construction of New Nuclear Power Units in the Light of Fukushima Daiichi lessons".

The main areas include:
- revision of the approach to severe accident management, revision and establishment of acceptance criteria;
- revision and establishment of greater safety margins relative to the extended range of potential natural and man-induced hazard and their combinations;
- requirements for long-term performance of safety functions in station blackout and loss of ultimate heat sink.

In identifying key requirements, IAEA standards and WENRA documents are taken into account (in particular, Safety of New NPP Designs).

6.2.2 The technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis.

According to the regulatory document "General Safety Provisions for Nuclear Power Plants" (NP 306.2.141-2008), technical and organisational decisions made to upgrade and improve the safety level also incorporate scientific and technical achievements and are implemented in accordance with the established requirements, namely: they should be proven by experience or trial operation. The requirements for upgrading are defined by the SNRIU regulation "Requirements for Modifications of Nuclear Installations and Their Safety Evaluation Procedure" (NP 306.2.106-2005), which was based on the IAEA standard (NS-G-2.3).

According to nuclear and radiation safety regulations and standards, the licensing procedure provides for introduction of a technology first at a "pilot" unit and then, after favourable results of trial operation, for its adaptation to other units. This procedure fully complies with international experience and permits implementation of measures on the basis of operating experience and proven practices.

Following the IAEA full-scope Integrated Regulatory Review Service (IRRS) mission, international experts identified a good practice: application of the "pilot approach concept" to obtain permission for similar modifications at several plants is efficient if appropriate attention is given to plant differences.

6.2.3 The design of a nuclear installation allows for reliable, stable and easy manageable operation, with specific consideration of human factors and the man-machine interface.

According to new safety regulations, the NPP modernisation and upgrading projects are developed with account of human factor, introduction of systems and hardware for diagnostics of operational modes and conditions, including self-diagnostics of hardware and software.

The design envisages informational support system of the operator, as a part of NPP instrumentation and control system, including also a system displaying integrated information on the current safety status of the reactor and plant unit in general.

The I&C incorporated in the design and implemented at the units ensure the most favourable conditions for the operators to make correct decisions on NPP control, minimise erroneous decisions, as well as to ensure collection, processing, documentation and storage of appropriate data sufficient for prompt and reliable identification of initiating, their evolution, determination of the actual operation mode of safety systems and components important to safety (especially those of safety classes 1 and 2) and deviations from standard algorithms of personnel actions. Measures are underway to preserve this information in beyond design basis accident conditions.

Therefore, Ukraine complies with the requirements for introduction of new technologies with regard to positive experience or trial operation, as well as human factor.

6.3. Operation (Convention Article 19)

6.3.1. Each Contracting Party shall take the appropriate steps to ensure that the initial authorisation to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements.

The legal grounds for granting the initial licence for operation of a nuclear installation at a specific life stage are determined in the Laws of Ukraine "On Nuclear Energy Use and Radiation Safety" and "On Licensing in the Field of Nuclear Energy Use" and are specified in the regulation "General Safety Provisions for Nuclear Power Plants" (NP 306.2.141-2008).

The licence granted to the operator for a specific life stage determines activities or operations that may be conducted during construction, commissioning and operation only under a written permit issued by the SNRIU. The terms and procedure for issuing such permits are determined by the SNRIU and specified in safety regulations and standards.

6.3.2. Operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation.

The main document defining safe operation of NPP units is technical specifications for safe operation, which defines the limits and conditions of safe operation as well as requirements and methods and general procedure for operations associated with NPP safety.

The technical specifications for safe operation are based on the plant design, SAR, and technical documentation for equipment.

The limits and conditions of safe operation are continuously monitored and specified through operating experience analysis, evaluation of the current safety level and new scientific and technical information, as well as in case of equipment upgrades and introduction of new systems, in accordance with regulatory requirements.

The technical specifications for safe operation and other operational documents are amended when necessary, on a permanent basis. Operational documentation is subject to periodical revision every three years.

6.3.3. Operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures.

Operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with the approved technical specifications for safe operation, operating and inspection procedures.

To ensure compliance of safety-related systems with the design requirements, regular maintenance and inspection activities are carried out. These activities are arranged according to the procedures, programmes and schedules and are carefully documented. Conditions for maintenance, repair and inspection of safety systems are established in the SAR and

respective specifications. Administrative and technical measures are determined to prevent possible unauthorised changes in circuits, instrumentation and algorithms of the control safety systems. After maintenance, the systems and equipment are checked for operability and compliance with the design characteristics, the results being recorded.

Operability of safety systems, safety-related systems, monitoring and control systems and condition of the base metal and welds of safety-related systems and components are inspected prior to NPP start-up after outage and periodically according to the of technical specifications for safe operation and operating procedures. The frequency and scope of periodic inspections are determined in the design and established by NPP schedules. Unscheduled inspections can be conducted upon demand of the regulatory body.

During the reporting period, the independent international operational safety review missions addressing also maintenance and testing were conducted: OSART mission to KhNPP and WANO peer review to ZNPP. The SNRIU conducted planned regulatory inspections.

Besides, NAEK *Energoatom* conducts internal inspections according to the approved programmes such as: standard programme for NPP nuclear safety verification, programme for safety culture review, etc. Following internal inspections, corrective actions are developed and implemented to eliminate the deficiencies in operational safety.

NAEK *Energoatom* submits the results of internal operational safety inspections and periodical safety assessment reports to the regulatory body. The frequency and requirements for the reports are defined by regulatory documents.

6.3.4. Procedures are established for responding to anticipated operational occurrences and to accidents.

Currently, the following NAEK *Energoatom* documents define emergency response actions for events and accidents that may occur during NPP:

- symptom-based emergency operating procedures (EOPs);
- emergency response plan of the NAEK *Energoatom* headquarters;
- standard emergency response plan for Ukrainian NPPs and NPP response plans based on the standard plan.

According to SNRIU Board Resolution No. 13 dated 24-25 November 2011 "On Results of Targeted Safety Reassessment of Operating NPPs and ZNPP Dry Spent Fuel Storage Facility in the Light of the Fukushima Daiichi accident", the operator should implement:

- severe accident management guidelines (SAMG) to control accidents may cause severe core damage in the core and SFP and mitigate their consequences;
- symptom-oriented emergency operation procedures to mitigate accidents that may occur in low power operation and shutdown states during refuelling (EOPs for low power mode).

At present, SAMGs have been developed for reactor operation at full power for pilot units: SUNPP unit 1, ZNPP unit 1 and RNPP unit 1. For SUNPP-1 and RNPP-1, the SAMGs for full power modes have been also developed for the SFP; the same work is underway for ZNPP unit 1. Implementation of SAMG for reactor full power operation is to be completed at the

pilot units in 2013.

EOPs for lower power mode have been developed and are under review at the SNRIU for pilot SUNPP unit 1, ZNPP unit 1 and RNPP unit 1. Implementation of the EOPs for low power mode at the pilot units is planned for 2013.

After development of supplementary emergency documentation for the pilot units, it is planned to adapt the documents to other NPP units of Ukraine.

To study and summarise the operating experience, exchange information on resolution of issues, analyse and review administrative and technical measures related to symptom-based EOPs at NPPs during their implementation since 2010, the NAEK *Energoatom* performed peer reviews of all units. The peer review reports were provided to NPPs. Peer review results confirmed expediency of the above measures, so their implementation will continue in the future.

6.3.5. Necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation

Engineering support of nuclear installations is provided by the corresponding NAEK *Energoatom* departments, Ukrainian and foreign institutes and expert organisations.

Engineering support activities are performed by Ukrainian design institutes, scientific organisations and establishments of the Academy of Science of Ukraine, companies and organisations from the Russian Federation (including those involved in NPP design), Czech Republic, Slovak Republic, and other countries.

Engineering support within NAEK *Energoatom* is provided by the corresponding engineering departments established at each NPP; the industry-level tasks are performed by NAEK *Energoatom* departments and Scientific and Technical Centre.

Responsibilities and activities are distributed according to the organisational documents that define responsibilities, interactions, and organisation of the activities.

Engineering support covers the following areas:

- NPP safety analysis,
- implementation of new technologies,
- ageing management,
- equipment qualification,
- radiological materials science,
- strength and resistance of systems, structures, and components,
- reactor core operation,
- radwaste and spent fuel management.

6.3.6. Incidents significant to safety are reported in a timely manner by the holder of the

relevant licence to the regulatory body

The regulatory document "General Safety Provisions for Nuclear Power Plants" obligates the operator to inform the national regulatory body about all operational occurrences at NPPs.

According to the "Procedure for Investigation and Recording of NPP Operational Events", the following information is submitted to the regulatory body and other organisations for every operational occurrence or accident (incident):

- prompt notification (within one hour);
- preliminary notification (within one day);
- additional notification (within 5 days following the event if any changes are defined);
- investigation report (within 5 days after the investigation completion);
- report on corrective actions determined based on investigation results (on a quarterly basis).

All operational occurrences are investigated by commissions established by the NPP or operator management or by the Ministry of Energy and Coal Industry of Ukraine. If necessary, the event investigation commission includes representatives of the national regulatory body.

The investigation results are presented in a report that qualifies the events against the INES scale. The event investigation report is distributed to all NPPs, to the operator, to the regulatory body and other institutions specified in the regulations.

The operator analyses the report (for events of level 2) and, if necessary, requests in-depth investigation or report updating. If the event is of general nature, the operator requests other NPPs to take corresponding corrective actions.

Corrective actions aimed at mitigation of the event and prevention of its reoccurrence are obligatory. All such actions are included into corresponding action plans.

The SNRIU performs analysis of all events that occurred during the year and monitors the investigation process, development and implementation of prevention and corrective actions. Based on the analysis of events, the data are compared to those for the previous year and corresponding regulatory decisions are made if necessary.

There were 22 operational events at NPPs in 2010, 15 events in 2011 and 15 events in 2012. During the last three years, there was no violation of safe operation limits and conditions.

In the first quarter of 2013, there was one operational event. This is less by four events than in the same period of 2012.

6.3.7. Programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and existing mechanisms are used to share important experience with international bodies and with other operating organisations and regulatory bodies

The operator provides for collecting, processing, analysing and storing of information on equipment failures and human errors, ensures systematisation and prompt transfer of the information obtained. The information on equipment failures and human errors is included into the annual safety status reports.

Safe operation of NPPs is supported by the information event database being a part of the unified information system of the operator: information system on operational events at Ukrainian NPPs.

NAEK *Energoatom* implemented programmes for operating experience exchange:

- Ukrainian reliability database (for engineering support of the equipment rejection system and determination of reliability characteristics of safety-related systems and components);
- Information system on operational events (for collection, processing, analysis and storage of data on equipment failures and human errors);
- Operational safety and technical assessment system (for development of reports on NPP performance indicators current safety state of power units).

Operating experience, both internal and external, is thoroughly analysed. There are special divisions dealing with these aspects within the operating organisation.

Notifications on significant events at Ukrainian NPPs are submitted to the IAEA and WANO on a regular basis within the operating experience exchange programmes. Similarly, the Ukrainian operator receives information about significant events at NPPs worldwide from the IAEA and WANO.

The operator also exchanges significant event investigation reports at WWER plants with the Russian operator. The exchange is performed within the cooperation programme between the operators of Ukraine and Russian Federation.

Appropriate contacts are maintained with the plant design institutions, research organisations, and equipment manufacturers to bring the operating experience to their knowledge and to receive their recommendations, if necessary.

In 2013 the Ukrainian operator developed and implemented the company standard SOU N NAEK 035:2013 "System for Accumulation, Analysis and Application of Operating Experience" that sets forth general requirements for effective functioning of the Ukrainian and worldwide NPP operating experience feedback system. The standard contains general requirements for implementation of all activities ensuring effective functioning of the system for operating experience accumulation, analysis and application.

In the reporting period, Ukraine actively participated in all meetings and work groups of the Forum of WWER Regulators and exchanged information on WWER operating experience.

6.3.8. The generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

Every NPP is provided with process systems and facilities for collection and preliminary treatment of solid and liquid radioactive waste on site. NPP management ensures accounting of the amount, transfer, and location of all fission and radioactive materials, fresh and spent nuclear fuel, dismantled equipment, contaminated tools, cloths, radwaste and other radiation

sources.

Within the National Target Environmental Programme for Radioactive Waste Management and the Comprehensive Radioactive Waste Management Programme of NAEK *Energoatom* for 2012–2016, technical measures are planned and implemented to implement radwaste treatment and conditioning lines, individual facilities for radwaste retrieval from storages and state-of-the-art conditioning technologies and select the liquid radwaste treatment technologies without fusion cake generation.

Special attention is paid to construction and commissioning of the liquid and solid radwaste treatment systems allowing volume reduction of both historical and operational radwaste. Commissioning of solid radwaste treatment systems at ZNPP and RNPP within the international technical assistance projects is planned before 2016. Within regulatory supervision, the SNRIU evaluated the design documents associated with commissioning of the solid radwaste treatment systems at ZNPP and RNPP.

To improve the technical policy in radwaste management, determine and allocate funds for implementation of the first-priority radwaste management measures and monitor their implementation, the " Comprehensive Radioactive Waste Management Programme of NAEK *Energoatom* for 2012–2016" was developed and is under implementation.

Currently, the following activities are underway: development of conditioned radwaste acceptance criteria for disposal and requirements for the final product of NPP radwaste treatment, agreement of standardised types of containers, improvement of radwaste classification, development of methodological and regulatory documentation for release of contaminated materials from regulatory control, etc.

Detailed information on NPP radwaste management is provided in the Fourth National Report of Ukraine under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management that was presented by Ukraine at the Fourth Review Meeting of the Contracting Parties in May 2012 in Vienna (Austria).

ANNEX 1

List of Nuclear Power Plants Operating in Ukraine

1. Power Units in Operation

NPP	Power Unit No.	Power capacity, MW	Reactor Type	First Grid Connection
Zaporizhzhya	1	1000	V-320	December 1984
	2	1000	V-320	July 1985
	3	1000	V-320	December 1986
	4	1000	V-320	December 1987
	5	1000	V-320	August 1989
	6	1000	V-320	October 1995
South Ukraine	1	1000	V-302	December 1982
	2	1000	V-338	January 1985
	3	1000	V-320	September 1989
Rivne	1	420	V-213	December 1980
	2	415	V-213	December 1981
	3	1000	V-320	December 1986
	4	1000	V-320	October 2004
Khmelnitsky	1	1000	V-320	December 1987
	2	1000	V-320	August 2004

2. Power units to be constructed

NPP	Power Unit No.	Power capacity, MW	Reactor Type	Date of Commissioning (as scheduled)
Khmelnitsky	3	1000	V-392	Initial project preparation is underway
	4	1000		

ANNEX 2

List of Basic Legislative and Regulatory Documents in the Area of Nuclear Energy Implemented in 2010-2012

1. Legislative Acts

1.1 Law of Ukraine No. 3255-VI "On Ratification of Agreement between the Cabinet of Ministers of Ukraine, the Russian Federation Government and the Slovak Republic Government on Transportation of Nuclear Materials between Russian Federation and Slovak Republic through the Territory of Ukraine" dated 20 April 2011.

1.2 Law of Ukraine No. 4175-VI "On Amendments to the Law of Ukraine on Nuclear Energy Use and Radiation Safety Related to the Supplement of the List of Nuclear Installations" dated 20 December 2011.

1.3 Law of Ukraine No. 4384-VI "On Spent Nuclear Fuel Management and the Location, Design, and Construction of a Centralised Storage Facility for Spent Nuclear Fuel from Domestic WWER-type NPPs" dated 9 February 2012.

1.4 Law of Ukraine No. 4716-VI "On Amendments to the Laws of Ukraine on Solving the Issues Related to the Social and Economic Remuneration for Risks of Population Residing on the Territory of Plant Monitored Area" dated 17 May 2012.

1.5 Law of Ukraine No. 4717-VI "On Amendments to the Law of Ukraine on Nuclear Energy Use and Radiation Safety in Relation to the Improvement of the Mechanism of Social Protection of the Population Residing on the Territory of Plant Monitored Area" dated 17 May 2012.

1.6 Law of Ukraine No. 5217-VI "On Siting, Design and Construction of Khmelnitsky Nuclear Power Plant Units 3 and 4" dated 6 September 2012.

1.7 Law of Ukraine No. 5442-VI "On Ratification of the Agreement on the Amendments N 11 to the Grant Agreement No. 006 (Nuclear Safety Project of Chornobyl NPP) between the European Bank for Reconstruction and Development and (EBRD) as the Administrator of the Funds, Provided in accordance with the Grant from the Nuclear Safety Account, and the Cabinet of Ministers of Ukraine and the State Specialised Enterprise "Chornobyl Nuclear Power Plant" dated 16 October 2012.

1.8 Law of Ukraine No. 5460-VI "On Amendments to Some Legislative Documents of Ukraine…" changes were made to the Law of Ukraine "On Radiation Safety and Nuclear Energy Use" dated 16 October 2012.

2. Legal acts of the Cabinet of the Ministers of Ukraine

2.1. Cabinet Resolution No. 2256-p dated 15 December 2010 "On Approval of the Agreement (in terms of notification exchange) between the Government of Ukraine and the Government of the USA on the Renewal of the Executive Agreement between the Government of Ukraine and the Government of the USA concerning the Project for Qualification of Nuclear Fuel for Ukraine".

2.2. Cabinet Resolution No. 1164 dated 22 December 2010 "On Financial Support regarding Civil Liability for Nuclear Damage made by the State Specialised Enterprise "Chornobyl Nuclear Power Plant".

2.3. Cabinet Resolution No. 591 dated 1 June 2011 "On Approval of the List of paid Administrative Services provided by the State Nuclear Regulatory Inspectorate and its Regional Offices, including the Size of Payment for their Provision and Recognition voided the Sizes of payment for Implementation of the Allowing Procedures in the Field of Nuclear Energy Use".

2.4. Cabinet Resolution No. 1270 dated 7 December 2011 "On Approval of the Comprehensive (Integrated) Safety Improvement Programme of NPPs".

2.5. Cabinet Resolution No. 44-p dated 25 January 2012 "On Approval of the Action Plan for Establishing the Integrated Automated Radiation Monitoring System for the Period up to 2015".

2.6. Cabinet Resolution No. 498-p dated 4 July 2012 "On Approval of the Feasibility Study for Construction of Units 3 and 4 of Khmelnitsky Nuclear Power Plant".

2.7. Cabinet Resolution No. 380 dated May 29, 2013 “On Amendments to Certain Acts of the Cabinet of Ministers of Ukraine” (Cabinet Resolution No. 1270 dated 7 December 2011 "On Approval of the Comprehensive (Integrated) Safety Improvement Programme of NPPs" was amended).

2.8. Cabinet Resolution No. 419 dated 19 June 2013 "On Amendments to Annexes of Cabinet Resolutions No. 937 dated 7 September 2011 and No. 1184 dated 14 November 2011 regarding the Approval of Boundary Amount of SNRIU Staff in 2013, Approval of Boundary Amount of Staff in SNRIU Regional Offices and Considering the Changes in Work Management in SNRIU".

3. Regulatory and Legal Acts of the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU)

3.1 SNRIU Order No. 84 dated 1 July 2010 "On Approval of the Procedures of Radioactive Materials Release from Regulatory Control in the Framework of Practical Activity".

3.2 SNRIU Order No. 93 dated 16 July 2010 "Response Plan of the Functional Subsystem of the Integrated Sate System for Prevention and Response to the Anthropogenic and Natural Emergencies "Safety of Nuclear Facilities".

3.3 SNRIU Order No. 117 dated 8 September 2010 "On Approval of Conditions and Procedures of Providing Certain Written Permits for Work and Operations related to the Transformation of the Shelter into an Environmentally Friendly System".

3.4 SNRIU Order No. 121 dated 21 September 2010 "On Approval of Requirements and Safety Conditions (Licensing Conditions) during Activities with Ionised Radiation Sources in Radioisotope Non-destructive Testing".

3.5 SNRIU Order No. 124 dated 22 September 2010 "On Approval of Requirements to NPP Safety Assessment".

3.6 SNRIU Order No. 163 dated 22 November 2010 "On Approval of Requirements to the Plan of Cooperation between the Facilities in Case of Sabotage".

3.7 SNRIU Order No. 164 dated 23 November 2010 "On Approval of Requirements to the Security in the Physical Protection System of Nuclear Installations and Facilities

Designed for Radioactive Waste Management, including other Sources of Ionised Radiation and Radioactive Materials".

3.8 SNRIU Order No. 169 dated 30 November 2010 "On Approval of the Procedures related to the Vulnerability Assessment of Nuclear Installations and Nuclear Materials".

3.9 SNRIU Order No. 179 dated 20 December 2010 "On Approval of Requirements to the Assessment of Physical Protection System of the Nuclear Installation".

3.10 SNRIU Order No.153/766 dated 7 November 2011 "On Approval of Requirements to the Size and Scope of the Plant Monitored Area".

3.11 SNRIU Order No. 154 dated 8 November 2011 "On Approval of the Procedures for Taking Immediate Actions related to the Iodine Treatment of the Population of Ukraine in case of Radiation Accident".

3.12 SNRIU Order No.176 dated 5 December 2011 "On Approval of Requirements to the Engineering and Technical Tools of the Physical Protection System of Nuclear Installations, Nuclear Materials, Radioactive Waste and other Sources of Ionised Radiation".

3.13 SNRIU Order No. 177 dated 5 December 2011 "On Approval of Requirements to the Restricted Areas, Control and Management of the Access to the Restricted Areas".

3.14 SNRIU Order No. 190 dated 19 December 2011 "On Approval of General Requirements to the Activity Management System in the Field of Nuclear Energy Use".

3.15 SNRIU Order No. 195 dated 28 December 2011 "On Approval of the Procedures on Providing Licences for Executives of the Operating Organisation".

3.16 SNRIU Order No. 8 dated 16 January 2012 "On Approval of the Procedures on Providing Permits for Use of Land and Water Ponds located in the Control Area of the Nuclear Installation, Radioactive Waste Treatment Facility and Uranium Facility".

3.17 SNRIU Order No. 51 dated 2 March 2012 "On Approval of Requirements to the Operator Control System".

3.18 SNRIU Order No. 84 dated 9 April 2012 "On Approval of Requirements to the Assessment of Nuclear Materials Accounting and Control System".

3.19 SNRIU Order No. 153 dated 6 August 2012 "On Approval of the Provision on the List and Requirements to the Form and Content of the Documents Submitted for Obtaining Licences on Certain Activities Implementation in the Field of Nuclear Energy Use".

3.20 SNRIU Order No. 188 dated 18 October 2012 "On Approval of Training and Knowledge Testing Procedure regarding Nuclear and Radiation Safety Issues among Operator Personnel and Companies involved by Utilities as Contractors".

ANNEX 3

List of Safety Improvement Programmes

1. "Comprehensive (Integrated) Safety Improvement Programme for Operating NPPs" approved by Cabinet Resolution No. 1270 dated 7 December 2011.
2. "Programme on Reconstruction of the Radiation Monitoring Systems at Nuclear Power Plants in Ukraine" PM-D.0.08.428-10.
3. "Programme on Safe Operation of Steam Generators at WWER-1000 Power Units in 2010-2013" PM-D.03.500-09.
4. "Programme on Prevention of Reoccurrence of Events Involving Damage of Main Coolant Pump Motors at Ukrainian NPPs" PM- D.0.03.503-09.

ANNEX 4

Summary on Implementation of IAEA Recommendations within Safety Improvement Programmes

4.1 Status of IAEA recommendations provided in the Reports as follows:

- "Safety Issues and their Ranking for WWER-1000 Model 320 Nuclear Power Plants", IAEA-EBP-WWER-05;
- "Safety Issues and their Ranking for Small Series WWER 1000 Nuclear Power Plants", IAEA-EBP-WWER-14;
- "Safety Issues and their Ranking for WWER-440 Model 213 Nuclear Power Plants", IAEA-EBP-WWER-03.

Most of the safety recommendations specified in the Reports have been implemented. The remaining activities are incorporated into the existing safety improvement programme.

The information on the status of recommendations for Rank-III safety issues (issues of high safety concern) at NPPs is provided below.

4.1.1 For WWER-1000/V-320 Nuclear Power Plants:

Nine of eleven recommendations have been implemented. The remaining two recommendations are on-going under the Comprehensive (Integrated) Safety Improvement Programme (C(I)SIP):

Issue No.	Title	Rank	Status	Comments
G2	Qualification of equipment	III	On-going	The activities are carried out under No.10101 of C(I)SIP. The deadlines are as follows: ZNPP-1, 2, KhNPP-2, RNPP-4 – 2013; ZNPP-3 – 2014; ZNPP-4, 5, 6, KhNPP-1, RNPP-3, SUNPP-3 – 2015.
S9	Qualification of SG PORV and BRU-A (Steam Dump Valve into the Atmosphere) for water and	III	On-going	The SG pilot-operated relief valves have been replaced at all V-320 reactor units. The replacement of BRU-A drives is carried out under No.13302 of C(I)SIP. The deadlines for V-320 reactor units are as follows: ZNPP-1, 2, 3, 4, 5 – 2014; ZNPP-6, RNPP-3, KhNPP-1 – 2015; KhNPP-2, RNPP-4, SUNPP-3 – 2016.

Issue No.	Title	Rank	Status	Comments
	steam-water discharge			

4.1.2 For WWER-1000/V-302, V-338 Nuclear Power Plants:

Nine of twelve recommendations have been implemented. The remaining three recommendations are on-going under C(I)SIP:

Issue No.	Title	Rank	Status	Comments
G2	Qualification of equipment	III	On-going	The activities are carried out under No. 20101 of C(I)SIP. The deadlines are as follows: SUNPP-1: 2013; SUNPP-2: 2014.
CI 6	Steam and feedwater piping integrity	III	On-going	The accident scenarios for various points of steam line break when filled with hot water have been studied within the SAR. The activities meant to prevent consequences entailed by a secondary piping rupture outside containment are carried out under No.22201 of C(I)SIP. The calculation-based justification has been carried out for steam and feedwater piping integrity in emergency modes (no-break zone concept). In 2013 the work is well underway on installation of LISEGA hydraulic snubbers on main steam and feedwater lines of SUNPP-1. The deadlines are as follows: SUNPP-1: 2013; SUNPP-2: 2014.
S 14	Boron injection system capability	III	On-going	Both units have been subject to an engineering analysis with critical components being identified for the first priority qualification under emergency conditions. The safety analysis was performed to assess the capability of HP ECCS to provide primary pressure control. The procedure of HP ECCS phased shutdown during compensated flow control was introduced into the

Issue No.	Title	Rank	Status	Comments
				instructions on liquidation of accidents (ILA). Upgrades are done with respect to providing operating HP ECCS with coolant inventory from adjacent tanks of LP ECCS. The throttling device was installed on HP ECCS discharge to ensure due operation of HP ECCS in the primary circuit when primary pressure is less than 40 kgf/cm^2. The activities are well underway on installation of bypass lines with control valves on the HP ECCS discharge and modernisation of HP ECCS & LP ECCS to control discharge pressure under primary circuit pump operation. (Measures No. 23402, 23403 of C(I)SIP). The deadlines are as follows: SUNPP-1: 2013; SUNPP-2: 2014.

4.1.3 For WWER-1000/V-213 Nuclear Power Plants:

All (8) recommendations have been implemented at RNPP units 1&2.

4.2 Status of IAEA recommendations provided in the Final EC/IAEA/Ukraine Report ("Design Safety").

The design safety assessment revealed that all Ukrainian NPPs are in full compliance with most of 192 safety requirements set by the IAEA for plant design (NS-R-1). It was also admitted that all fifteen power units of Ukrainian NPPs meet 172 requirements of NS-R-1.

There were five generic areas defined having partial compliance with the IAEA requirements. These areas are related to the following issues: equipment qualification, consideration of severe accidents, confirmation of seismic margin, completeness of probabilistic safety analysis and complementary safety analyses, I&C and post-accident monitoring equipment.

An effective work is being done on removal of the revealed non-compliances at all power units within the framework of Comprehensive (Integrated) Safety Improvement Programme of Nuclear Power Plants.

The information on the status of activities on implementation of the IAEA recommendations at NPPs is provided below.

	WWER-1000/V-320		
Measure ID	**Title**	**Status**	**Deadlines**
10101	Elaboration of documents and qualification of NPP components	On-going	The activities are carried out under No.10101 of C(I)SIP. The deadlines are as follows: ZNPP-1, 2, KhNPP-2, RNPP-4 – 2013; ZNPP-3 – 2014; ZNPP-4, 5, 6, KhNPP-1, RNPP-3, SUNPP-3 – 2015.
14101	Instrumentation during and after beyond-design basis accidents	On-going	The activities are carried out under No.14101 of C(I)SIP. The deadlines are as follows: ZNPP-1, 2 – 2014; ZNPP-3, 4 & RNPP-3 – 2015; ZNPP-5, 6, KhNPP-1, 2, RNPP-4 – 2016; SUNPP-3 – 2017.
16201	Introduction of containment hydrogen control system for beyond-design basic accidents	On-going	The activities are carried out under No.16201 of C(I)SIP. The deadlines for V-320 reactor units are as follows: ZNPP-1, 2 – 2014; ZNPP-3 & RNPP-3 – 2016; ZNPP-4, 5, 6, KhNPP-1, 2, RNPP-4, SUNPP-3 – 2017.
18101	Providing seismic resistance of systems, structures and components important to safety	On-going	The activities are carried out under No.18101 of C(I)SIP. The deadlines are as follows: ZNPP-1, 2, 3 – 2014; ZNPP-4, 5, 6, KhNPP-1, RNPP-3, SUNPP-3 – 2015; KhNPP-2, RNPP-4 – 2017.

19101	Elaboration of full scope SAR in compliance with regulating requirements	Done	
19202	Development, technical justification, validation and introduction of EOPs to manage design and beyond-design basis accidents	Done	
19203	Improvement of emergency operating procedures for low power and shutdown states.	On-going	The activities are carried out under No. 19203 of C(I)SIP. The deadlines are as follows: ZNPP-1 – 2013; ZNPP- 2, 3, 4, 5, 6, RNPP-3, RNPP-4, KhNPP-1, 2, SUNPP-3 – 2014.
19204	Performing severe accident analysis. Elaboration of SAMG.	On-going	The activities are carried out under No. 19204 of C(I)SIP and proceed in two phases: 1st – for full power mode, 2nd – for shutdown reactor. The deadlines are as follows: ZNPP-1 – 1st phase – 2013, 2nd phase-2014; For other units: 1st phase – 2014, 2nd phase – 2015.
	WWER-1000/V-302,V-338		
20101	Elaboration of documents and qualification of NPP components	On-going	The activities are carried under No. 20101 of C(I)SIP. The deadlines are as follows: SUNPP-1: 2013; SUNPP-2: 2014.
22201	Preventing consequences induced by primary piping rupture outside containment	On-going	The activities are carried out under No. 22201 of C(I)SIP. The deadlines are as follows: SUNPP-1: 2013; SUNPP-2: 2014.
24101	Instrumentation during and after beyond-design basis accidents		
26201	Introduction of containment hydrogen control system for beyond-design basic accidents	On-going	The activities are carried out under No. 26201 of C(I)SIP.

			The deadlines are as follows: SUNPP-1: 2013; SUNPP-2: 2014.
28101	Providing seismic resistance of systems, structures and components important to safety	On-going	The activities are carried out under No. 28101 of C(I)SIP. The deadlines are as follows: SUNPP-1: 2013; SUNPP-2: 2014.
29101	Elaboration of full scope SAR in compliance with regulating requirements	Done	
29204	Performing severe accident analysis. Elaboration of SAMG.	On-going	The activities are carried out under No. 29204 of C(I)SIP and proceed in two phases: 1st phase – for full power mode, 2nd phase – for shutdown reactor. The deadlines are as follows: SUNPP-1: – 1st phase – 2013, 2nd phase - 2014; SUNPP-2: 1st phase – 2014, 2nd phase - 2015.
	WWER-440/B-213		
30101	Elaboration of documents and qualification of NPP components	On-going	The activities are carried out under No. 30101 of C(I)SIP. The deadlines are as follows: RNPP -1, 2 - 2015.
33503	Providing habitability of MCR and ECR during design and beyond-design basis accidents (installation of iodine filters)	Done	
34101	Instrumentation during and after beyond-design basis accidents	On-going	The activities are carried out under No. 34101 of C(I)SIP. The deadlines are as follows: RNPP -1, 2 - 2014.
34408	Introduction of hydrogen control system into SG box, RCP (A201) and pressurizer compartment (A527/1) (to be done on RNPP-1)	Done	
38101	Providing seismic resistance of systems, structures and components	On-going	The activities are carried out under No.

	important to safety		38101 of C(I)SIP. The deadlines are as follows: RNPP -1, 2 - 2015.
39101	Elaboration of full scope SAR in compliance with regulating requirements	Done	
39204	Performing severe accident analysis. Elaboration of SAMG.	On-going	The activities are carried out under No. 39204 of C(I)SIP and proceed in two phases: 1st phase – for full power mode, 2nd phase – for shutdown reactor. The deadlines are as follows: RNPP-1 – 1st phase – 2013, 2nd phase - 2014; RNPP-2: 1st phase – 2014, 2nd phase - 2015.

ANNEX 5

Dynamics in the Number of Licenced NPP Personnel for 2009–2013

Number of NPP licensed staff in 2009 – 2013					
Entity	***2009***	***2010***	***2011***	***2012***	***2013***
ZNPP	163	155	157	165	165
RNPP	106	107	111	113	113
SUNPP	79	80	82	83	82
KhNPP	54	54	59	64	63
Total	**402**	**396**	**409**	**425**	**423**

Data on NPP staff training in 2010-2012

Training Type	NAEK *Energoatom*				Including in 2012					
	2010	2011	2012		ZNPP	RNPP	KhNPP	SUNPP	ARS	Head Office
	Actual	Actual	Target	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Initial Vocational Training	2017	1646	655	2046	587	759	395	261	44	
Retraining	1038	659	966	848	462	78	143	165	0	
Qualification Maintenance	16564	17788	14957	18809	5025	5031	2739	5837	177	
Ad-hoc Training	27180	32825	25940	35699	12541	5696	9010	6513	1939	
Advanced Training	11508	11951	6996	12250	4656	5538	729	1133	85	109
Total (man*course)	**58307**	**64869**	**49514**	**69652**	**23271**	**17102**	**13016**	**13909**	**2245**	**109**

ANNEX 6

Radiation Safety and Protection Indicators

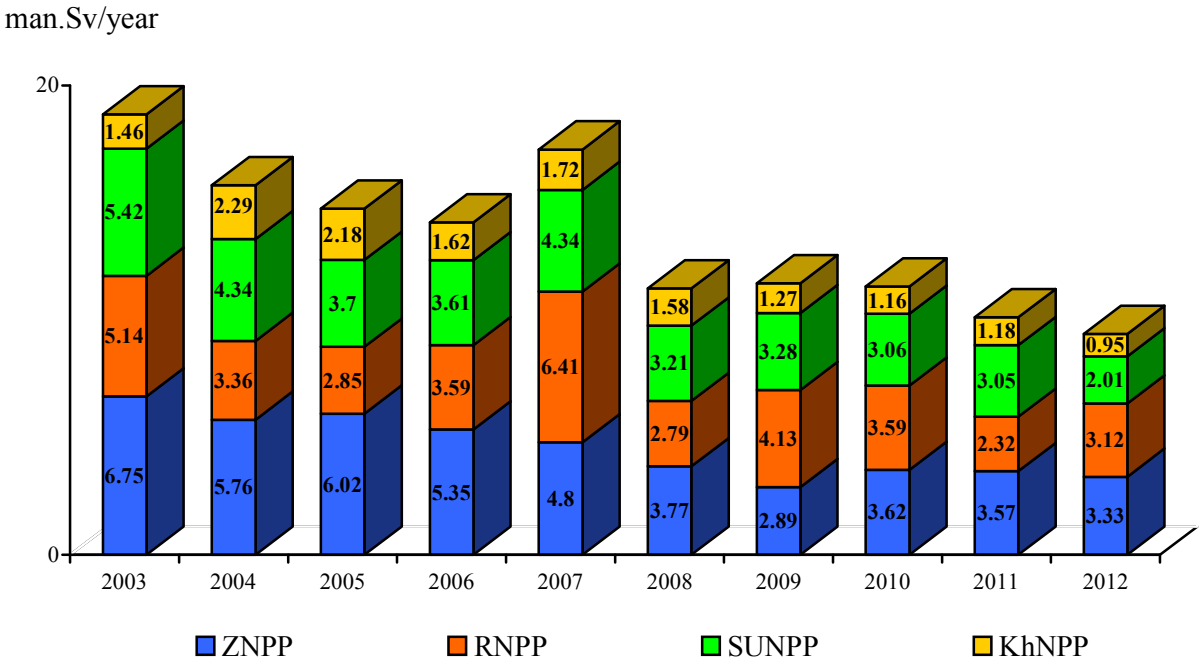


Fig. 1. Collective Dose to WWER NPP Staff (including personnel on assignment) in 2003–2012

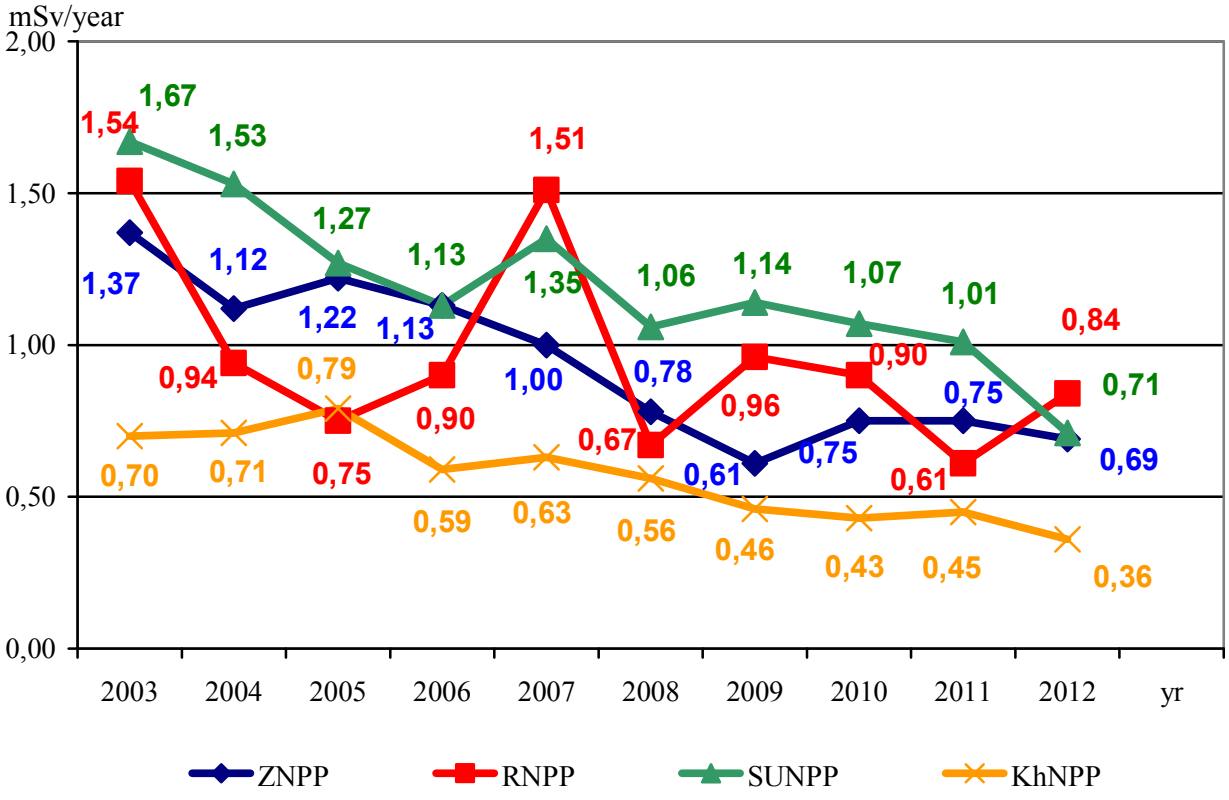


Fig. 2. Average Individual Dose to WWER NPP Staff in 2003-2012

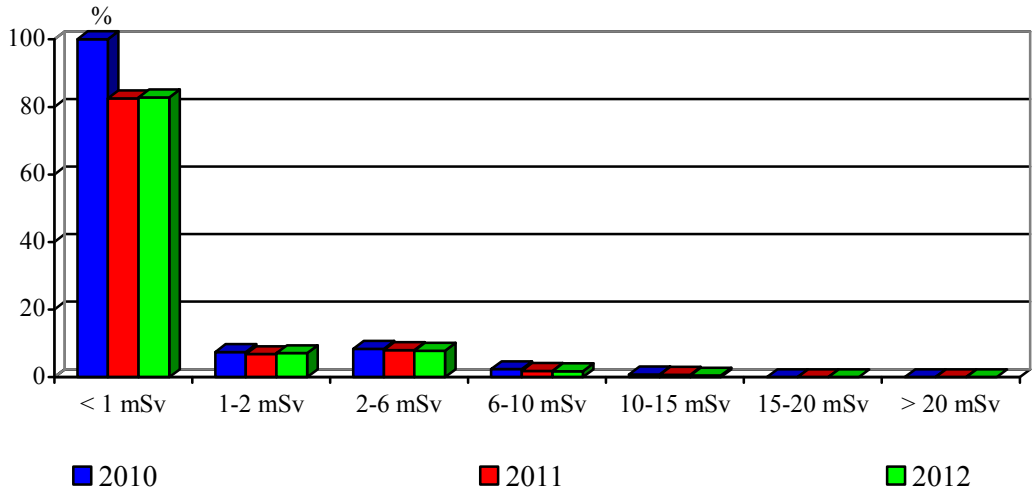


Fig. 3. Percentage Distribution of the Staff Working at NPPs Operated by NAEK *Energoatom* within the Range of Average Individual Doses in 2010-2012

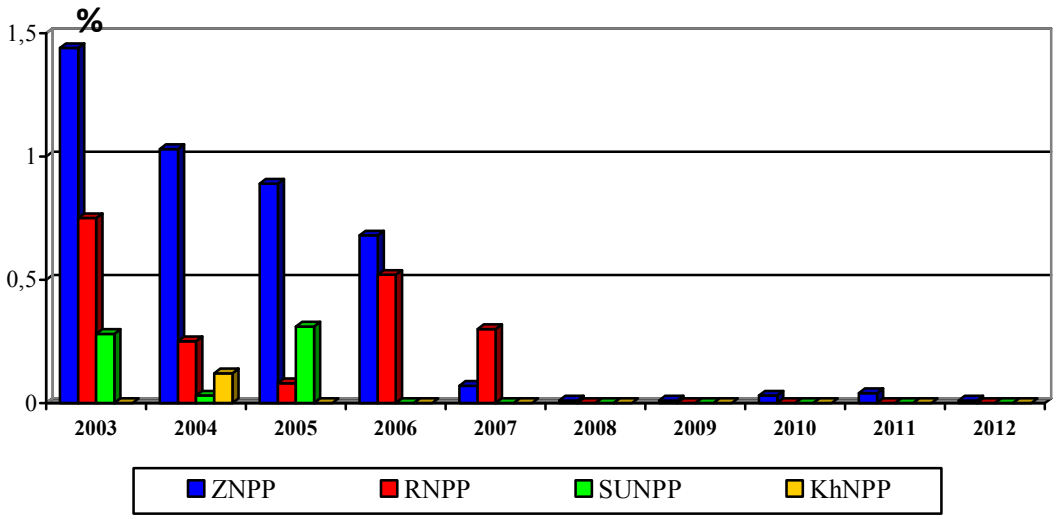


Fig. 4. Percentage of Individuals Whose Annual Effective Dose Exceeds 15 mSv to the Total Number of Staff at Ukrainian NPPs in 2003 – 2012

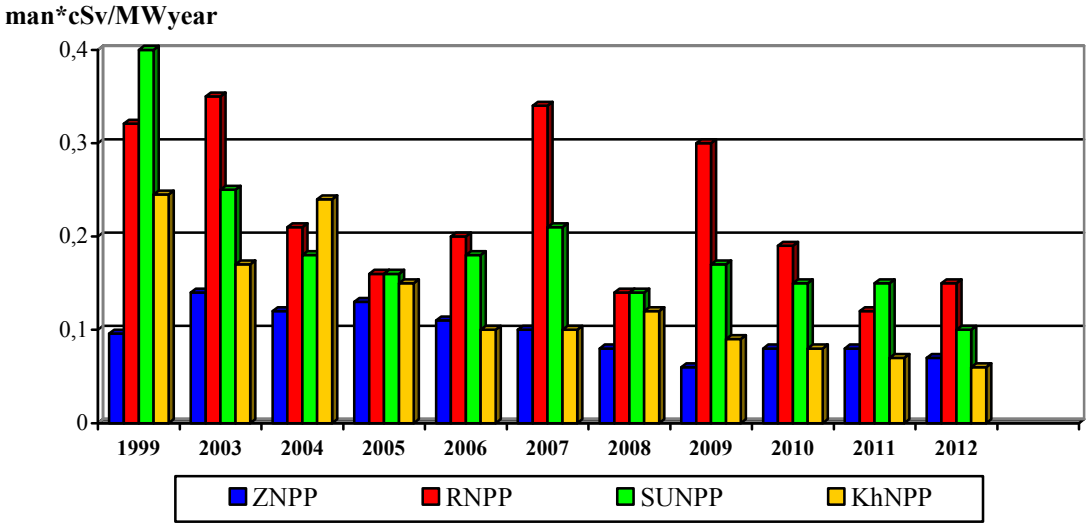


Fig. 5. Ratio of Collective Dose to Electric Power Output for Ukrainian NPPs in 2003-2012, man*cSv/MWyear

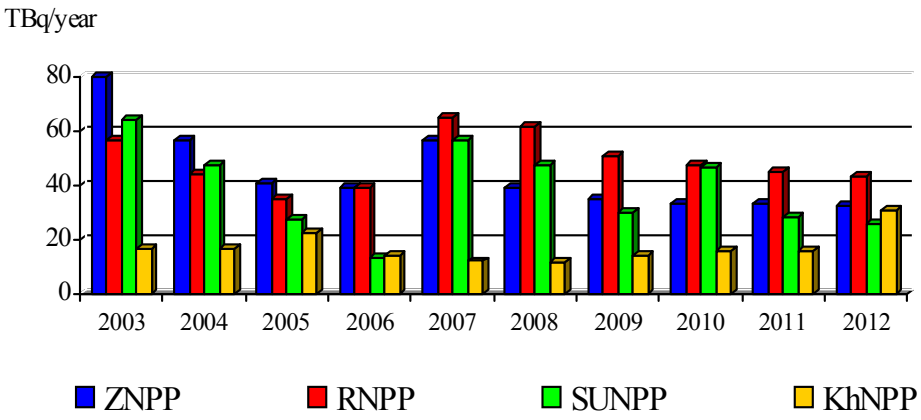


Fig. 6. Total Release of Noble Radioactive Gases from NPPs in 2003-2012

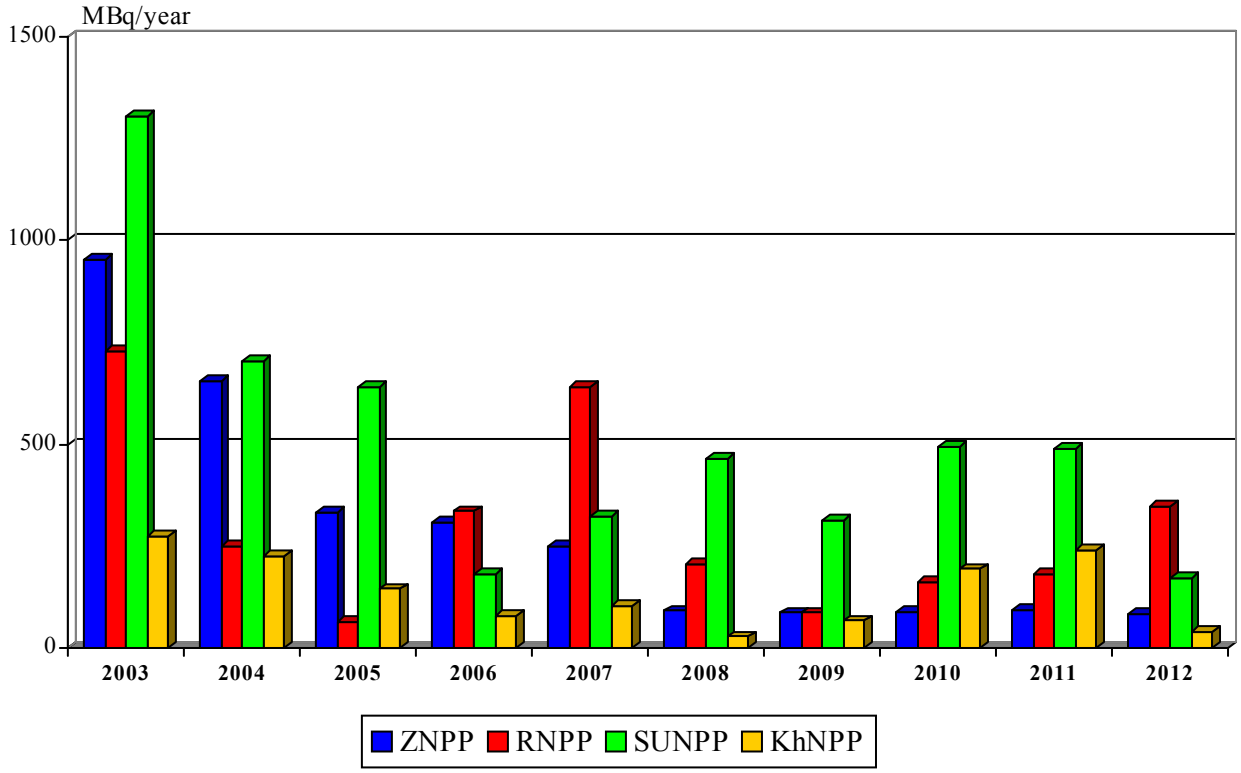


Fig. 7. Total Release of Iodine Radionuclides from NPPs in 2003-2012

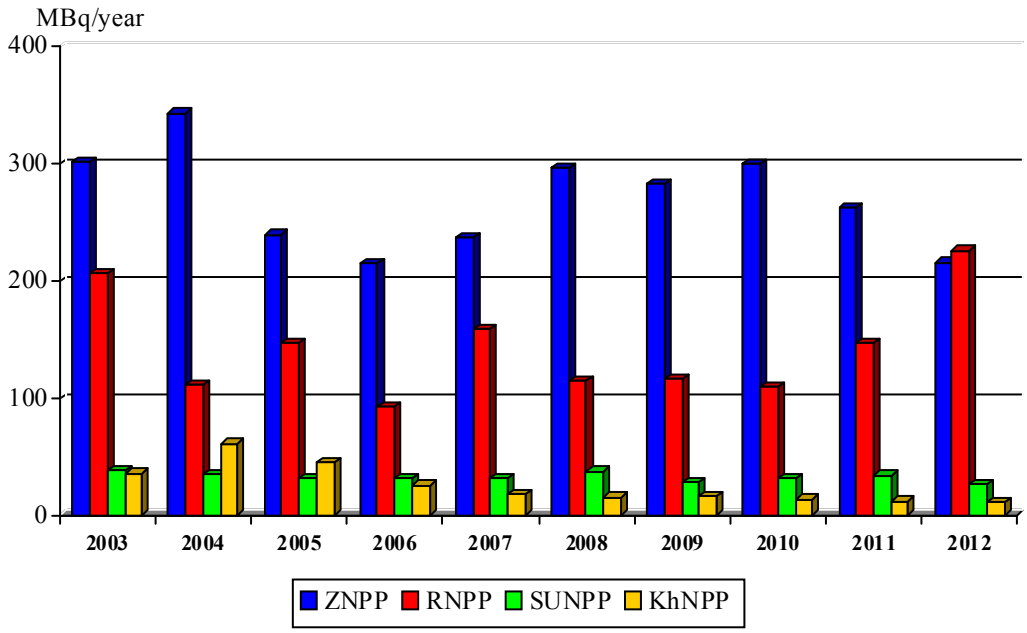


Fig. 8. Total Release of Long-Lived Radionuclides from NPPs in 2003 - 2012

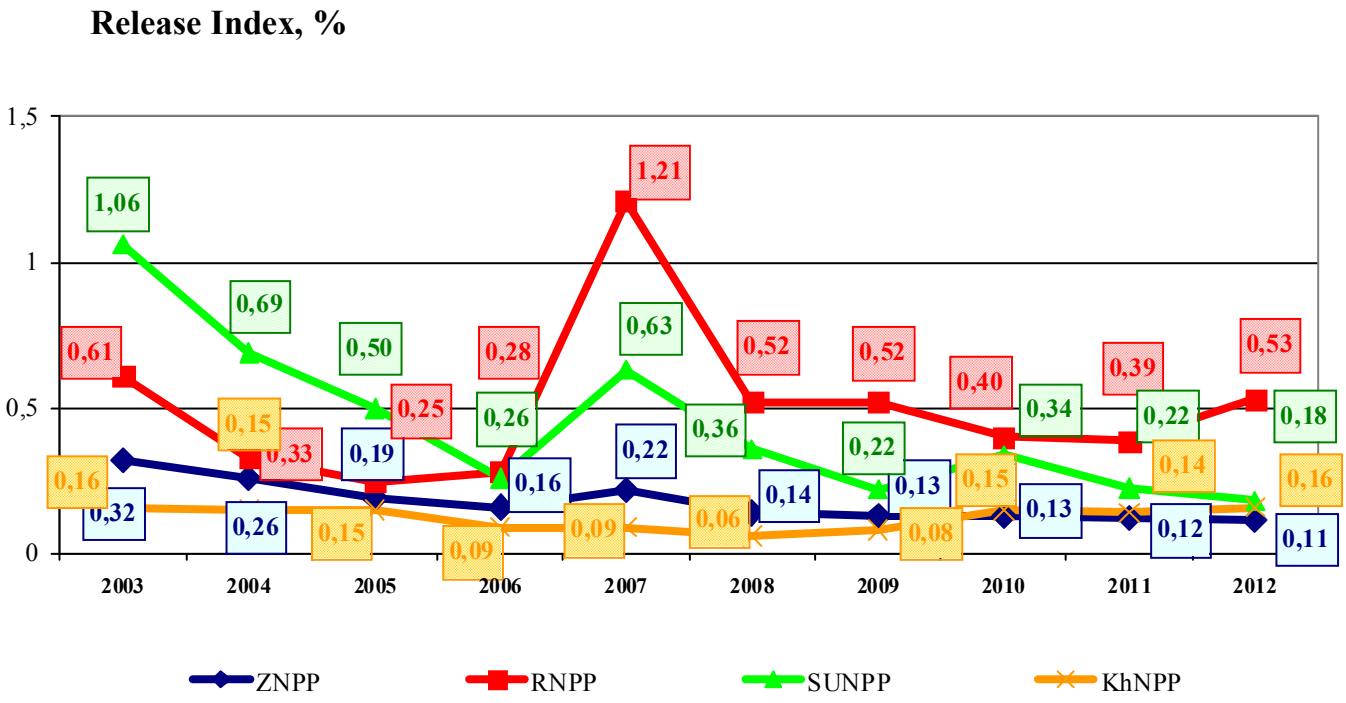


Fig. 9. Trends in Overall Indexes of Gaseous & Airborne Radioactive Releases from Company's NPPs to the Environment in 2003 – 2012

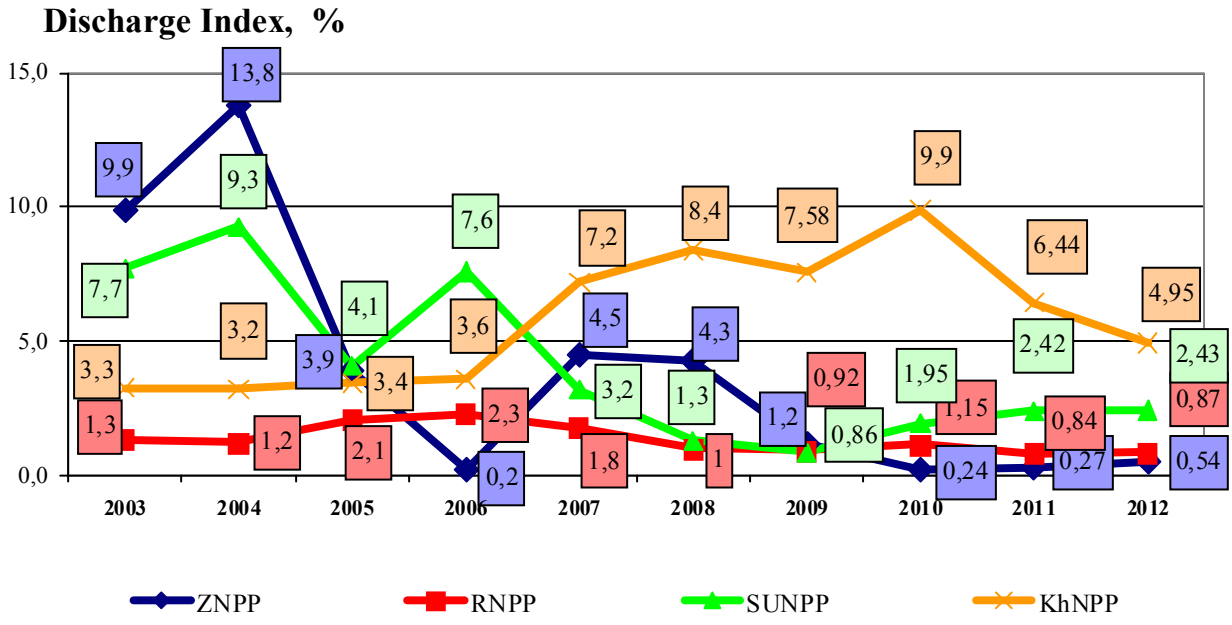


Fig. 10. Trends in Overall Indexes of Radioactive Material Discharge from Company's NPPs in 2003 – 2012

ANNEX 7

Information on Chornobyl NPP

Article 6. Existing Nuclear Installations

At present, spent nuclear fuel is unloaded from the reactor cores of all three Chornobyl NPP units. In addition, spent fuel from the spent fuel pools of the ChNPP unit 3 was transported to the Interim Storage Facility (ISF-1), therefore, the State Nuclear Regulatory Inspectorate of Ukraine made a decision to consider the nuclear facility – "Chornobyl NPP unit 3" to be the facility designed for the radioactive waste (radwaste) management. All conditioned (undamaged) spent fuel was transported from the ChNPP unit 2 spent fuel pools to ISF-1. Currently the conditioned spent fuel is being transported from Unit 1 spent fuel pools to ISF-1, the scheduled completion date is 30 November 2013.

Implementation of the project on removal of the spent nuclear fuel, damaged during operation, from the ChNPP units 1, 2 will start upon completion of this activity. Prior to the commissioning of spent fuel "dry" storage facility (ISF-2), the spent fuel pools of Units 1, 2 are considered to be backup locations to ensure, if required, unloading one of the cells of ISF-1 spent fuel pools.

In order to remove the damaged spent fuel from Units 1, 2, the activities under the Project "Equipment and Technology to Stabilise, Transport and Store the Specially Designed Canisters with Damaged Spent Fuel" are being performed. The implementation of the above project will enable placing the damaged spent fuel into the unified specially designed canisters for the safe storage, and also to perform handling operations to transport the damaged spent fuel between the ChNPP units 1, 2 and the existing storage facility.

With regard to the fresh fuel management, it was transported to the Russian Federation (in the amount of 68 fuel assemblies and 3 fuel elements) at the beginning of March 2010.

Interim Spent Nuclear Fuel Storage Facility (ISF-1)

ISF-1 is a "wet" type spent fuel storage facility, and is in operation since 1986. At the moment (as of 17 May 2013) 20565 spent fuel assemblies are stored in ISF-1; acceptance of the conditioned (undamaged) spent fuel from the ChNPP unit 1 is on-going.

The significant delay in ISF-2 commissioning requires using ISF-1 as the main spent fuel storage facility at the ChNPP in the next few years.

Following the events at Fukushima Daiichi in 2011 a targeted safety re-assessment (stress-tests) of Chornobyl NPP nuclear facilities was carried out, including ISF-1. In compliance with the recommendations set forth in the "Conclusion of the state nuclear and radiation safety review of results of the targeted safety re-assessment (stress-tests) of Chornobyl NPP nuclear facilities", as well as measures specified in the "Report on targeted Chornobyl NPP safety re-assessment (stress-tests)", the "Action Plan to Improve the ChNPP Nuclear Facilities Safety" was developed. Following the results of

implementation of actions, established in the "Action Plan to Improve the Chornobyl NPP Nuclear Facilities Safety", and also in the "Action Plan to Improve ISF-1 Safety" the re-assessment of ISF-1 safety was carried out, which enabled obtaining the authorisation to place the spent fuel from Units 1, 2 into the 5th cell of ISF-1 spent fuel pool.

Interim Spent Nuclear Fuel Storage Facility (ISF-2)

ISF-2 is the key component in the ChNPP decommissioning process. The ChNPP requires the long-term storage of the spent fuel, currently stored in the ChNPP units 1, 2 SFP and ISF-1. Considering that ISF-1 is a "wet" type storage facility (spent fuel is stored in water) and that it is not designed for the long-term spent fuel storage, construction of ISF-2 will enable solving the issue of the long-term storage of the ChNPP spent fuel. The activities are financed by EBRD from the Nuclear Safety Account; the Contractor is *Holtec International* (USA).

ISF-2 is designed for acceptance, pre-conditioning and storage of the spent fuel assemblies (for the exception of damaged ones), accumulated at the ChNPP. ISF-2 will ensure acceptance for storage, pre-conditioning and storage of 21217 RMBK-1000 (High-Power Channel Type Reactor) spent fuel assemblies for 100 years.

At the moment the following activities are completed and are on-going under the Contract:

- Design of "Construction Completion of the Interim Dry Spent Fuel Storage Facility (ISF-2) at Chornobyl NPP site" was developed;

- ISF-2 preliminary safety analysis report, rev. 6.1 of 02.11.2012 was developed;

- the conclusion of the State Nuclear and Radiation Safety Review was obtained for the ISF-2 preliminary safety analysis report, which was agreed by the SNRIU Board Resolution No. 16 of 30 November 2012;

- the expert review report (positive) on review of the project design documentation was obtained from the State Enterprise *Ukrderzhbudekspertyza* ;

- *Chornobyl NPP* obtained the Licence of the State Nuclear Regulatory Inspectorate of Ukraine No. EO 001002 for the right to construct and commission the nuclear facility (Interim Storage Facility (ISF-2);

- support to the nuclear and radiation safety expert review of the technical specifications and technical documentation for the safety-related equipment and safety-related systems is on-going;

- preparation for the construction recommencement on ISF-2 site is on-going.

The scheduled ISF-2 commissioning date is 2015.

Article 7. Legislative and Regulatory Framework

2(ii) System of Licensing

In compliance with Article 7 of the Law of Ukraine "On Licensing Activity in the Field of Nuclear Energy", *Chornobyl NPP* carries out specific activities in the field of the nuclear energy use being subject to licensing in accordance with the following licences, issued by the State Nuclear Regulatory Inspectorate of Ukraine:

- licence series OB No. 000983 of 04.10.2012 for the right to perform activity related to the radwaste transportation;

- licence series OB No. 010470 of 25.04.2012 for the right to perform activity related to the ionising radiation sources use.

In compliance with Article 8 of the Law of Ukraine "On Licensing Activity in the Field of Nuclear Energy", implementation of activity by the operator at the specific stage of the life cycle of the nuclear facility or the storage facility for the radwaste disposal shall be carried out in accordance with the following licences, issued by the State Nuclear Regulatory Inspectorate of Ukraine:

- licence series EO No. 000033 of 30.12.2001 for the right to perform activity on the ChNPP Shelter operation;

- licence series EO No. 000040 of 22.03.2002 for the right to perform activity on "Chornobyl NPP decommissioning";

- licence series EO No. 000859 of 25.06.2008 for the right to perform activity at the life cycle stage "Operation of the Nuclear Facility – Interim Storage Facility "(ISF-1);

- licence series EO No. 001002 of 20.02.2013 for the right to perform activity on construction and commissioning of the nuclear facility (Interim Storage Facility)" (ISF-2).

In compliance with Article 11 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" and Article 8 of the Law of Ukraine "On Radioactive Waste Management", to fulfil provisions of Cabinet Resolution No. 1122 of 18 July 1998 "On Approval of the Public Hearings Procedure on the Issues of Nuclear Energy Use and Radiation Safety" public hearings on implementation of the "Project on Final Shutdown and Preservation of Chornobyl NPP units 1, 2, 3 were conducted in 2013.

Article 10. Safety Priority

Safety priority during construction and operation of the nuclear facilities is specified in the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" and defined by the Chornobyl NPP senior management in its statements on quality and safety policy. The statements are the integral part of the enterprise general policy, brought to notice of all personnel and published in the mass media.

Article 11. Financial and Human Resources

Financial Resources

Financing of the budget programme "Maintaining the Power Units and Shelter in Safe

State" and preparatory measures for Chornobyl NPP decommissioning are financed annually from the State Budget of Ukraine.

The Law on the State Budget of Ukraine for the respective year envisages allocation of funds to finance the activities on preparation to the ChNPP units decommissioning and to ensure social protection of Chornobyl NPP personnel and Slavutich city citizens, as well as allocation of funds to finance the Shelter transformation into ecologically safe system.

The main priority at financial resources planning is first of all ensuring the measures to prevent decrease of the achieved safety level.

Human Resources

The specially established subdivision, Training Centre (TC), implements the *Chornobyl NPP* policy in the field of training, re-training and qualification maintaining.

In compliance with the regulatory requirements of the Regulatory Authorities of Ukraine, the TC performs its activity based on the following licences and permits, obtained for:

operating personnel training, carried out considering peculiarities of each stage of NPP units decommissioning and related organisational and technical safety measures (in compliance with the SNRIU licence on the personnel training in TC);

training in the methods of hazardous activities safe performance and activities performed during Shelter Implementation Plan (based on the certificate of the State Committee of Ukraine for Industrial Safety, Health Safety and Mining Supervision);

vocational training in the most demanding trade professions required for performance of the ChNPP on-site activities, namely: health physicist, radwaste processer, slinger, welder (according to the licence of the Ministry of Education and Science of Ukraine);

psychological support of professional activity of the Chornobyl NPP personnel involved into SIP (based on the certificate of the National Academy of Education entitling psychological and psycho-physiological diagnostics of personnel).

To analyse the competence requirements and training needs for the activity related to safety at a specific stage of the nuclear facility life-cycle, the methods of long-term planning are applied, based on the approved National programme for Chornobyl NPP decommissioning and Shelter transformation into ecologically safe system.

Training of the contractors' personnel, involved into the activities at Shelter, is carried out in accordance with the specially developed and approved programme covering all the issues of safe activities in the conditions of increased radiation and nuclear risks. The contractor's personnel is authorised to perform activities only in case of passing the knowledge examination with positive results, which is confirmed by respective documents.

Article 12. Human Factor

In accordance with the "Action Plan on Enhancement of the Chornobyl NPP nuclear

facilitates safety" agreed by the State Nuclear Regulatory Inspectorate of Ukraine with regard to the "personnel training" activity:

the emergency trainings are carried out throughout every year with all round-the-clock shifts personnel including practical skills training in the situations related to the numerous failures of the regular systems and equipment in the extreme natural conditions;

when accepting the personnel to the Chornobyl NPP emergency crews, the psycho-physiological examination is carried out in order to select the individuals able to successfully manage and liquidate the severe accidents on the basis of their psycho-physiological skills level.

Training programmes "Psychology of activity in the extreme conditions" were developed for the operating personnel, middle-level managers and emergency personnel. The training programmes are aimed at improvement of resistance to psychological stresses, self-control, development of interaction and mutual assistance under liquidation of the emergency situations and accidents management.

Self-assessment of managerial and organisational issues by the operator

Chornobyl NPP carries out the assessment of administrative and organisational decisions on permanent basis in accordance with the established NPP procedures. In particular, when introducing organisational changes, each change is classified in accordance with the level of impact on safety (the category of the safety impact level is defined), and depending on the category the assessment of the safety related organisational changes is carried out. When implementing the administrative decisions, all the measures related to the risks reduction are carried out in compliance with the approved safety impact assessment and full responsibility for meeting safety requirements and monitoring the compliance with them is continuously ensured.

Article 13. Quality Assurance

In accordance with the requirements set forth in NP 306.5.02/3.017-99 "Requirements for the quality assurance programme at all stages of the nuclear facilities lifecycle", the quality management system was in effect at the ChNPPP up to February 2012. After putting into force NP 306.1.190-2012 "General Requirements for the Activity Management in the Field of Nuclear Energy Use" and NP 306.1.182-2012 "Requirements for the Activity Management System of the Operating Organisation (the Operator)" the programmes for organisational and technical measures were developed and implemented at the ChNPP in order to bring the activity into compliance with the requirements set forth in the above mentioned newly introduced regulatory documents.

The main components of the ChNPP management system are as follows:

working quality board – the main joint administrative decisions making body on quality assurance;

62 functioning processes, covering the main NPP activity, including safety assurance activity – nuclear, radiation, environmental, etc. The respective monitoring and

measuring methods are applied for all the processes, enabling efficient processes management–analysing each process progress, registering deviations and making decisions related to necessity and appropriateness to develop the remedy and preventive actions;

quality programmes, developed and introduced first of all for the processes and activities impacting safety and demonstrating in what way the existing management system is applied to every specific case, project or contract;

independent assessment of management system and its components to define the efficiency of processes, state of compliance with the safety and quality requirements, possibilities to improve the management system;

audits of the goods suppliers' quality management systems, first of all for the safety related systems in order to confirm the supplier's ability to ensure the goods compliance with the respective requirements.

Article 14. Assessment and Verification of Safety

The comprehensive assessment of the Shelter safety state was carried out in 2006. The safety assessment of systems and components of the ChNPP unit 1 and safety assessment of the ChNPP unit 2 was carried out in 2009. The safety analysis of the Interim Storage Facility (ISF-1) and targeted safety re-assessment of Chornobyl NPP (stress tests) were performed in 2012. Nuclear safety substantiation of the ChNPP units 1, 2 spent fuel pools taking into consideration the fuel burnup was carried out in 2012. Preliminary safety analysis of ISF-2 under construction was carried out in 2013.

Article 15. Radiation Protection

Within the reporting period there was no exceeding of the dose limit and reference level of external exposure dose (Hd), the reference level of skin exposure dose (Hskin) and lens exposure dose (Hlense), specified for the ChNPP personnel.

The collective and individual exposure doses of the Chornobyl NPP personnel during 2010-2012 are as follows:

Year	Collective, mSv	Average, mSv
2010	7122.1	2.04
2011	7403.1	2.22
2012	5800.6	2.20

The reference level of individual equivalent doses of the personnel exposure in 2010-012 is 13 mSv.

Generally, there is a tendency for stabilisation of the monitored level of air contamination. During the reporting period changes of the radioactive aerosols activity inside the Chornobyl NPP premises and adjoining territories were within the frames of dynamics and did not exceed the reference levels.

Releases of the long-lived radionuclides from the Chornobyl NPP facilities (kBq/day) are as follows:

Nuclide type	2010	2011	2012
α-emitting	3.5	4.1	1.6
β-emitting	771.7	617.5	263.7

The activities to estimate the radioactive aerosols release from the Shelter through leakages in its structures ("fugitive" release) are carried out by ISP NPP of National Academy of Sciences of Ukraine. Based on the measurement results the rate of mixture of α-emitting (241Am, 238+239+240Pu) and β-emitting (137Cs, 90Sr+90Y, 241Pu) radionuclides release through the Shelter roofing leakages was assessed.

The assessment of the nuclides mixture release rate, MBq/year ("uncontrolled release") is as follows:

Nuclide type	2010	2011	2012
α-emitting	4,1	5,2	2,7
β-emitting	336	410	210

The ChNPP radioactive substances are not discharged into the open surface water. The radioactive substances discharge in the cooling pond results mainly from washing-off by storm water and atmospheric precipitation from the Industrial Site territory of accident-origin residual contamination.

Radionuclides discharge in the Chornobyl NPP cooling pond is as follows:

	Discharge, GBq/year			RL
	2010	2011	2012	GBq/year
137Cs	2.66	3.50	2.89	27
90Sr	3.77	2.96	6.94	13

Article 16. Emergency Preparedness

Chornobyl NPP emergency preparedness and response system is an integral part of the emergency preparedness and response system of the State Service of Ukraine for Emergency Situations.

The main guiding document to prepare and perform organisational, engineering and technical, radiation and sanitary, evacuation and other measures to reduce the level of radiation impact on the personnel and environment in case of an accident or emergency situation at the ChNPP is "Chornobyl NPP Response Plan to Accidents and Emergency Situations".

The required drills and trainings are carried out periodically at the ChNPP in order to check operation and preparedness of the actions system in case of emergency situations.

The main ChNPP organisational structures carry out all the activities related to emergency planning, ensuring the emergency preparedness and response in case of an accident and emergency situations at the ChNPP.

The emergency organisational structures of ChNPP are composed of:

Manager of emergency activities at the ChNPP facilities industrial sites;

coordination and controlling body – headquarters of the emergency activities Manager or ChNPP commission for emergency situations;

permanent controlling body – emergency preparedness and response department;

emergency teams and groups.

The ChNPP site is equipped with two protective buildings to protect the personnel. The equipped internal ChNPP crisis centre is located inside of one of the protective buildings and is designed to ensure elimination of emergency situations at the ChNPP.

Article 17. Siting

i) Evaluation of site-related factors

The operator has performed the targeted unscheduled assessment of the ChNPP site safety for Units 1, 2, 3 and ISF-1 with regards to the external extreme natural conditions resulting in failures of the main safety functions and, consequently, in severe accidents (beyond-design-basis accident involving nuclear fuel damage). The main conclusions are as follows: the extreme natural conditions are ranged as listed below:

1) Earthquake and tornado are the most hazardous for the ChNPP nuclear facilities.

2) Extreme wind, snow, rain and temperature are less hazardous since:

The effect of extreme wind, snow and rains is significantly less then effect of the tornado;

The nuclear facility structures have high heat retention;

The following is ensured: temperature control inside the premises, snow removal and discharge sewage functioning.

3) external floods and fire do not endanger the ChNPP nuclear facilities due to the following facts:

The ChNPP industrial site elevation marks (113,7 -114,0m) are significantly higher than the extreme water level (111,3m);

The distance from the area of significant fire to the nuclear facilities exceeds 1 km, at the nuclear facilities sites there is a hard surface, concrete enclosure, etc.

ii) In accordance with the requirements set forth in the regulatory documents, the

monitoring of radioactive aerosols operational emission and monitoring the radioactive discharge is carried out at the ChNPP.

The controlled discharge of the radioactive aerosols at the ChNPP into the atmosphere is realised through:

1st and 2nd stage Ventilation Stacks of the ChNPP Main Building (VS-1 and VS-2);

Stacks of RSF and ISF-1 detached facilities.

The information on radiation monitoring of the radioactive substances releases and discharges values into the environment is submitted to the Regulatory Authorities and mass media on monthly and quarterly basis respectively.

iii) Re-evaluation of site-related factors

The operator's activity related to the targeted safety re-assessment (stress-tests) confirmed the following:

The structures and buildings of the first NRS category of the ChNPP units 1÷3 and ISF-1 comply with the design documentation and can resist the external extreme impact, including grade 6 safe shutdown earthquake and class F 1.5 tornado.

The mutual redundancy (interrelations) of the ChNPP nuclear facilities as regards power supply, fire and technical water supply, charging system supply with chemically purified water is ensured, providing support (or renewal of possibility to support) of the safety functions in case of design-basis accidents caused by the extreme natural conditions at Units 1÷3 and ISF-1.

As a result of the targeted safety re-assessment the plan for the ChNPP nuclear facilities safety improvement was developed and is being implemented. Also the Plan for ISF-1 nuclear facilities safety improvement is being implemented. The operator efforts are aimed at increasing the resistance margin of the on-site facilities to the external extreme impacts.

Results of recent re-evaluations.

The main results of the ChNPP nuclear facilities safety re-assessment are as follows:

creation of conditions for safe storage of all ChNPP spent fuel;

substantiation of safety when placing the spent fuel in the 1st stage SFP in case of an emergency situation in ISF-1;

reducing the number of nuclear facilities where the spent fuel is located;

testing the mobile diesel generator to ensure ISF-1 make-up in case of the station blackout;

full scale exercises;

development of an action plan to improve the emergency preparedness system in case of beyond-design-basis accidents as a result of extreme natural conditions;

the detailed theoretical practicing of the scenario “Numerous failures of standard systems and equipment in extreme natural conditions” was developed and incorporated into the plans.

Article 19. Operation

During the reporting period the ChNPP evaluated the ISF-1 safety and proved that all spent fuel can be safely stored in it. During the safety assessment the limit values of admitted discharges and releases from this nuclear facility were reduced (ISF-1 quota is accepted at level of 50% from the reference one, specified by the regulatory body for all sources at the ChNPP site). Also the technical decisions were performed enabling increasing the leakage compensation from under the storage facility cooling pond coating by ten times compared to the one specified in the design (designed - 1,6 m3/hour, new limit value - 16 m3/hour).

Monitoring the operational limits and safe operation conditions is carried out by the enterprise operating and engineering technical personnel.

All the personnel involved into the safety related activities shall undergo the professional selection, training in the training centre and examination of knowledge by the examination commissions. Availability of the required documentation is ensured by the quality system existing at the enterprise. The workplaces of the operating personnel are equipped with the required documents (regulations, production and emergency instructions), engineers and technicians are granted access to the electronic documents base.

In order to maintain degradation of safety related structures, systems and elements within acceptable margin (as a result of ageing, wear, corrosion etc.), and also to maintain their operability and reliability during operation, the programmes for managing the equipment ageing, action plan to improve safety of the Chornobyl NPP nuclear facilities were developed, agreed with the State Nuclear Regulatory Inspectorate of Ukraine and are being implemented at the ChNPP.

Following the Fukushima Daiichi events and based on the technical requirements of the Western European Nuclear Regulators Association and recommendation of SNRIU, the targeted safety assessment of the spent fuel storage locations was carried out. Having analysed the worst scenarios and their combinations, the worst from among probable safety risks and the main risks were determined. To increase resistance of ISF-1 nuclear facility to the external extreme impacts, to ensure safety in the conditions of complete station blackout, to extend possibilities of accidents management and their consequences mitigation:

ISF-1 was equipped with the independent mobile back-up power source;

organisational and technical measures were developed and implemented to create possibility to connect the mobile diesel generating power station to the ISF-1 power supply system without changing the existing power supply system;

the respective changes were introduced into the document “Guide for Beyond-Design-Basis Accidents Management at Chornobyl NPP units 1, 2, 3 and ISF-1” (109 P-

S).

5) Engineering and technical support

Chornobyl NPP ensures continuous engineering and technical support with the help of permanent relations with:

Kyiv Research, Design and Engineering Institute *Energoproekt* (General Designer);

ISP NPP of the National Academy of Sciences of Ukraine (Research Supervisor)

6) Notification on incidents

The procedures to inform the regulatory body were developed in compliance with the "Provisions on Procedure of Investigation and Accounting Nuclear Power Plants Operational Events" (NP 306.2.100-2004) and agreed with the regulatory body.

7) Operation Feedback Accounting

Chornobyl NPP ensures collection, processing, analysis, storing the information on equipment failures and personnel errors, ensures systematisation and immediate transmittal of the obtained information. The information on equipment failures and personnel errors shall be incorporated into the quarterly reports on current safety state. The operation feedback shall be analysed carefully. The data are used to maintain qualification level of the operating personnel and NPP management, and considered during development of programmes for the emergency exercises. Notification on significant events shall be transmitted regularly to NAEK *Energoatom* and WANO based on the bilateral information exchange.

8) Spent fuel and radwaste management on the site

In accordance with the Licence for Chornobyl NPP decommissioning EO No.000040, issued on 22.03.2002, *Chornobyl NPP* is entitled to perform activity related to decommissioning of the nuclear facilities and radwaste management facilities in the framework of process complex.

In the framework of international technical assistance rendered to Ukraine with regard to the ChNPP decommissioning, the following projects on construction of facilities for the ChNPP radwaste management are implemented: Liquid Radwaste Treatment Plant, Industrial Complex for Solid Radwaste Management, Long-length radwaste Cutting Facility. These facilities shall ensure removal of accumulated radwaste from the facilities existing at the ChNPP and storage facilitates, radwaste treatment to the condition acceptable for temporary storage and disposal, and also shall ensure safe disposal of the radwaste packages in the near-surface storage facility and temporary storage of the long-lived and high-level radwaste to be disposed in the geological repository.

To implement the procedure for radioactive materials release from regulatory control at *the Chornobyl NPP*, it is planned to create a facility to release the materials from regulatory control in the framework of international technical assistance. Implementation of project "Procedure and methodology for materials release from regulatory control" will start in 2013.

ANNEX 8

Information on Shelter

A special place among the nuclear facilities of Ukraine is held by the unique for the international practice Shelter, destroyed in 1986 by the beyond-design-basis accident Chornobyl NPP unit 4, which lost all its functional characteristics of the power unit, and where the top-priority measures were taken to mitigate the accident consequences and the activities to ensure monitoring its state, nuclear and radiation safety are on-going.

The Shelter is not a facility constructed in compliance with the regulations for the site selection, designing, constructing, commissioning, operation and decommissioning of the nuclear facilities. The Shelter current state fails to comply and cannot comply with the respective existing safety regulations in the nuclear energy field and general industrial safety requirements.

The Shelter in its current state is qualified as a location for the near-surface storage of unorganised radwaste (temporary storage facility for unorganised radwaste at the stabilisation and reconstruction stage). That is, all nuclear and radioactive materials located inside the Shelter are radioactive waste. Activity regulation at the Shelter is performed in compliance with the qualification, specified by NRBU- 97/D- 2000, based on the existing regulatory acts on nuclear and radiation safety.

The nuclear materials comprised of various modifications of fuel containing materials amounting to (in accordance with the conservative estimate) approximately 200 tons are located in the Shelter. Since there are no technical means of their criticality active impact, there is a potential risk of the self-sustained chain reaction.

The accident-originated radwaste with the total activity about 5.6E+17 Bq representing ionising radiation open sources and located inside the Shelter in vast volume without protective barriers represent significant current and potential danger for the personnel, population, and also future generations and environment.

In 1997 SNRIU issued a licence (series EO, No.000033) entitling to operate the Chornobyl NPP Shelter. In compliance with the licence conditions, the purpose of any activity at the Shelter (including activity on the Shelter transformation into an ecologically safe system) is protection of personnel, population and environment from impact of radioactive materials, located inside the facility or at its site. Activity implying any other purpose is prohibited at the Shelter.

In compliance with the licence conditions, based on the experience of the Shelter operation and on-line operation data, obtained by the operating organisation, considering the comments and recommendations made by the State Regulatory and Radiation Safety Authorities, the reports on Shelter safety state are prepared two times per year.

The Shelter transformation into an ecologically safe system requires involvement of significant financial and material resources as well as international support to solve this comprehensive problem as soon as possible.

For reference: in compliance with the Memorandum of Understanding between the

Government of Ukraine and G 7 Governments and European Commission on Chornobyl NPP shutdown signed in December 1995, the Recommended Actions Course was developed, envisaging the following three action phases to transform the Shelter into an ecologically safe system:

Phase 1 - stabilisation and other short-term measures.

Phase 2 - preparation for transformation into an ecologically safe state.

Phase 3 – transformation into an ecologically safe state.

The main task of Shelter Implementation Plan (SIP) is New Safe Confinement construction – protective facility enclosing a complex processing equipment for removal of materials containing nuclear fuel from the destroyed Unit 4 of Chornobyl NPP, the radioactive waste management and other systems designed for transforming this Unit into an ecologically safe system and ensuring personnel, public and environment safety. With regard to removal of the fuel containing materials and other high-level waste from the Shelter, currently there are only conceptual solutions and preliminary evaluation of costs and time required for implementation of the solutions.

The SIP Project envisaged implementation of 22 tasks in total and overall Project management. It was foreseen to complete the Confinement construction in 2004 and to dismantle the unstable structures of the Shelter and finalise the Project implementation in 2007.

At the moment out of 22 tasks 17 tasks have been completed, 4 are on-going and 1 task is postponed to the later period (beyond the timeframes of SIP implementation).

Activities on implementation of top-priority measures to stabilise the Shelter structures were completed in full scope in 2008 the. As a result of the performed stabilising measures the achieved stability level of Shelter localising structure (as intermediate level of the Shelter safety gradual improvement) can be considered as acceptable for 15 years (approximately till 2023). Henceforth the issue of the Shelter unstable structures shall be solved by their dismantling or reinforcement inside the localising cover of the New Safe Confinement (NSC). The development of the detailed design for Shelter unstable structures dismantling within NSC Commissioning Stage 2 commenced in 2012.

The following main infrastructure facilities were commissioned in the framework of SIP implementation: training Centre for the Shelter personnel, construction base to implement the Shelter Stabilisation Project, Facility for Decontamination of Small-Size Equipment and Tools, Change Facility for 1430 persons, sanitary lock at elevation +5.800, off-site utilities for the SIP facilities infrastructure. The Modernised Dust Suppression System and Integrated Shelter Database were commissioned.

The Measuring Unit for Shelter radwaste characterisation was constructed, Shelter Fire Protection System and Physical Protection and Access Control System were commissioned, construction of the New Ventilation Stack of ChNPP 2nd stage (NVS) was completed in the period from 2010 to 2012.

In 2013 the Integrated Automated System for nuclear, radiation, seismic and Shelter

structural monitoring (IAMS) was accepted into trial-industrial operation.

Upon completion of tender process and in compliance with the Chornobyl Shelter Fund Donors Assembly decisions and EBRD "non-objection" to sign the Contract, the Contract between *Chornobyl NPP* and the tender winner – Joint Venture (JV) "NOVARKA" (France) for the New Safe Confinement (NSC) design and construction was signed on 23 August 2007.

The Safe Confinement representing a multi-functional facility with a 100-year lifetime will allow the future removal of the fuel containing materials and high-level radwaste from the Shelter and their conditioning for the subsequent safe storage.

At the beginning of 2013 the state expert review of the Project for NSC Commissioning Stage One (NSC CS-1) was completed and the Individual Authorisation of SNRIU for NSC CS-1 construction and installation was obtained on 22 April 2013.

At present, the activities on the NSC East Arch side erection, arrangement of the Arch permanent foundations and NSC Technological Building construction are being implemented under the New Safe Confinement Project.

It is planned to commence dismantling the "old" ventilation stack of ChNPP 2nd stage (VS-2) in 2013 to support implementation of the NSC Project.