NATIONAL REPORT OF UKRAINE

ON COMPLIANCE WITH THE OBLIGATIONS OF THE CONVENTION ON NUCLEAR SAFETY

KYIV 2007

FOREWORD

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

Ukraine took active part in the review of the National Reports of the Contracting Parties, exchanging written questions, comments as well as discussions at the three Review Meetings.

This Fourth National report has been developed in full compliance with the requirements of the Convention on Nuclear Safety, "Guidelines Regarding National Reports under the Convention on Nuclear Safety" (International Atomic Energy Agency, Information circular, INFCIRC/572/Rev.2, 9 September 2002), and also taking into consideration the recommendations of the Summary Report of the Third Review Meeting of the Contracting Parties (CNS-RM-2005/08) dated 21 February 2007, the Report of the IAEA Secretariat to the Contracting Parties to the Convention on Nuclear Safety "Synopsis of the Relevant IAEA Requirement Statements Reflecting the Issues Addressed by Articles 6 to 9 of the Convention on Nuclear Safety" (hereinafter referred to as the "Synopsis").

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

This Report, like the previous ones, is the result of the joint efforts of the state bodies of Ukraine responsible for implementation of the state policy in the field of nuclear energy utilization and also of the state enterprises (the Operators):

- The State Enterprise National Nuclear Energy Generating Company (NAEK "Energoatom");
- The State Specialized Enterprise "Chornobyl Nuclear Power Plant" (SSE "Chornobyl NPP").

This Report is based upon the legislative and regulatory documents in force in Ukraine and official reports of the central executive bodies, which pursue the state policy in the field of nuclear energy utilization.

The main objective of this Report is to provide objective and unbiased information on the safety of nuclear installations and on measures taken 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 nuclear energy branch of Ukraine for the last three years.

Based on the materials presented in the National Report and according to the authorities delegated by the Cabinet of Ministers of Ukraine, the Chairperson of SNRCU (SNRCU) declares:

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

In this context, *Ukraine completely fulfils its obligations in accordance with the requirements of the Convention on Nuclear Safety as confirmed by:*

- Determination and development of the legislative and regulatory framework of safety assurance in the field of the nuclear energy utilization;
- Availability of the duly authorized state regulatory body for nuclear and radiation safety, which establishes safety criteria and requirements, develops and approves codes, regulations and standards on nuclear and radiation safety, and performs licensing and state supervision independently of the licensees and other state bodies;
- Independence of state nuclear and radiation safety regulatory authority from any governmental bodies, institutions and officials, whose activities are connected with the nuclear energy utilization, by the independence from the local authorities and self-administrations, associations of citizens;
- Performance of comprehensive safety assessments of existing nuclear installations and by taking measures to improve safety level;
- Development of the emergency preparedness and response system;
- Empowerment of the licensee with full responsibility for ensuring the safety, and taking measures to protect the human and the environment;
- Development of safety culture and implementation of the safety self-assessment practice.

The actual data provided in this Report, except for those stipulated specially, are given as of September 2007. The changes that may take place till April 2008 will be reported in addition by the delegation of Ukraine at the Fourth Review Meeting.

Conclusions on implementing the obligations identified by an appropriate article of the Convention are italicized hereinafter in the text.

Kyiv, September 2007

Olena Mykolaichuk
Chairperson
State Nuclear Regulatory Committee of Ukraine

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INTRODUCTION

Nuclear power remains the most important component of the fuel and energy branch in Ukraine.

As of 2007 there are 15 power units with water-cooled water-moderated reactors in operation at four nuclear power plants in Ukraine. These 15 units also include Khmelnytsky NPP Unit 2, and Rivne NPP Unit 4 that have been commissioned. Three power units of SSE "Chornobyl NPP" are being decommissioned. The Shelter Object of this plant is in the process of its transformation into an environmentally safe system. A list of nuclear power units and their main characteristics are provided in Annex 1.

In 2006 nuclear power plants produced 46.9% of the total amount of electricity produced in Ukraine. Installed capacity of nuclear power units in operation during the reported period increased and reached 13 835 MW total.

In the last three years, implementation of safety enhancement measures, improvement of repairs and maintenance quality, replacement of the equipment, training and qualification upgrading resulted in more stable operation of nuclear power plants: the number of operating events decreased, and the number of emergency shutdowns with scrams reduced. In 2006 nuclear power plants generated 90 225 million kW/h(e). The capacity factor of nuclear power units constitutes 74.4% in 2006, 73.2% in 2005 (taking into account Unit 2 of Khmelnytsky and Unit 4 of Rivne NPP), 81.4% in 2004, 78.5% in 2003.

Aimed at setting the strategic areas for the short-term development of the energy branch in Ukraine, the Energy Strategy of Ukraine till 2030 was developed and approved (Resolution N145-r of the Cabinet of Ministers of Ukraine of 15 March 2006). Its main goals in the nuclear energy branch are as follows:

- to determine the ways and conditions for safe, reliable and sustainable functioning of the nuclear power industry and for its most effective development;
- to ensure energy security of the country;
- to mitigate man-caused pressure on the environment and to ensure protection of the public in the field of industrial safety of the fuel and energy branch;
- to integrate the United Energy System of Ukraine into the European energy system (the Union for the Coordination of Transmission of Electricity (UCTE)) to be followed by consistent increase in the electricity export;

Achievement of these goals will allow creating conditions for the intensive development of the Ukraine's economy and improvement of population life conditions.

The Action plan for 2006 - 2010 regarding implementation of the Energy Strategy of Ukraine till 2030 is being implemented according to the resolution of the Cabinet of Ministers of Ukraine N 436 –r of 27 July, 2006.

Among the comprehensive national-wide tasks for the development of the nuclear power branch as envisaged by the mentioned governmental program documents are:

- Legislative and regulatory framework:
  - Improvement of the system of regulatory documents, which regulate activities on design and construction of new nuclear installations and facilities intended for radwaste management, and for making decisions at all levels for expansion of the existing nuclear installations and radwaste management facilities;

- Improvement of the regulatory documents in the part of construction site selection and determination of the decision making procedure for siting new construction facilities;
- Development of the draft Strategy for spent fuel and radwaste management till 2030 and subsequent period;
- Development and approval of the State Program on radwaste management;
- Systematization and improvements of nuclear legislation;
- Development and adoption of the regulatory legal act on determination of the safety criteria for new nuclear installations;
- Enhancement of safety and continuation of nuclear power plant operation performing the following State programs:
- "Comprehensive Program of Lifetime Extension of Nuclear Power Plants in Operation" (approved by Resolution of the Cabinet of Ministers of Ukraine N 263-r of 29 April, 2004), *which was adopted with the purpose of development and implementation of measures aimed at retaining the level of power generation at the nuclear power plants achieved in 2006 until the new capacities are commissioned, and of the most effective use of nuclear power plants;*
- "Concepts of Safety Improvement of Nuclear Power Plants in Operation" (approved by Resolution of the Cabinet of Ministers of Ukraine N 515-r of 13 December, 2005), *which was adopted with the purpose of the development and implementation of measures aimed at NPP safety improvement, creation of conditions for NPP operation lifetime extension, and fulfilment of the international obligations undertaken by Ukraine under the Convention on Nuclear Safety;*

– Construction of new power units:
- Development and fulfilment of the plan of the preparatory activities prior of the beginning of construction of Khmelnytsky NPP Units 3 and 4;
- Preparing and holding the tenders to determine a supplier of the reactor installation;
- Preparing and holding the tenders to determine suppliers of the turbine and auxiliary equipment;
- Development and regulatory review of the feasibility study documents for the nuclear power units construction (including their environmental impact assessment report);
- Carrying out la consultative referendum;
- Development and support of the Draft Law of Ukraine "On Siting, Designing and Construction of Units 3 and 4 of Khmelnytsky NPP" in the Verkhovna Rada of Ukraine;
- Development of the cadastral register of construction sites for future nuclear power plants;

– Construction of a dry storage facility for the long term storage of spent nuclear fuel for Khmelnytsky, Rivne and South-Ukraine nuclear power plants;

– Implementation of the procedure on the decommissioning fund management;

– Industrial and technological support to the nuclear power branch;

– Scientific, engineering, and design support of the nuclear power branch;

– Human resources related issues of the nuclear power branch development;

– Social and economic development of the regions where nuclear power facilities are located.

To determine the areas for future development of nuclear energy branch, Ukraine takes part in the international project on innovative nuclear power reactors and fuel cycles (INPRO) under the aegis of the International Atomic Energy Agency. In the framework of this project Ukraine carries out R&D efforts.

Currently, Ukraine makes considerable efforts to solve the country's most topical issues:

- safety enhancement of nuclear power plants in operation;
- operating lifetime extension on the basis of safety reassessment, determination of residual lifetime and implementation of measures on safety improvement of ageing process management of safety important systems and equipment;
- spent fuel management;
- decommissioning of three power units of SSE "Chornobyl NPP" and transformation of the Shelter Object into an ecologically safe system.

The state programs in the field of nuclear energy utilization are implemented in compliance with the legislative and regulatory documents adopted by the government, which are aimed, in particular, at ensuring the nuclear and radiation safety.

Safety enhancement of the nuclear power units in operation is one of the major tasks of the state policy in the sphere of nuclear energy utilization. During the reported period safety enhancement measures have been implemented based on the comprehensive analysis results of the existing safety issues, identified and categorized in accordance with the IAEA recommendations, with due regard to the operating experience of Ukrainian and similar foreign plants, and in accordance with the established priorities.

Safety improvement measures are implemented in accordance with "The Concept of Safety Enhancement of NPPs in Operation" approved by Resolution N 515-r of 13 December, 2005 of the Cabinet of Ministers of Ukraine, with its scheduled completion in 2010.

Considerable part of Ukrainian power units is coming to the end of their designed operating lifetime. Taking into account the positive international experience on NPP lifetime extension Ukraine undertakes measures on long-term operation of NPP power units.

To solve these issues on the systematic basis "The Comprehensive Program on Lifetime Extension of NPPs in Operation" was approved by the Cabinet of Ministers of Ukraine in April, 2004. The Program specifies necessary measures, prioritizes activities, provides estimates of resources required for its implementation, in particular, scopes, sequence and time frames for implementation of measures which are needed to ensure NPP operation beyond the designed operating lifetime, sources of funding, and responsibility of central executive bodies and other organizations.

NAEK "Energoatom" surveys the condition of the building structures, and equipment of Khmelnytsky NPP Units 3 and 4, which construction was suspended after Chornobyl accident. The results of such surveys will be used to determine possibility for completion of these two power units construction.

Activities implemented in the field of spent fuel management are as follows:

- Construction of the on-site and centralized spent fuel storage facilities;

- R&D support in the field of spent fuel management.

At the moment, wet spent fuel storage facility is operated at the SSE “Chornobyl NPP”, dry spent fuel storage facility is operated at Zaporizhzhya NPP, and a dry storage facility for spent fuel is under construction at the Chornobyl NPP site.

NAEK “Energoatom” plans to build a centralized dry storage facility for the spent nuclear fuel from Rivne, Khmelnytsky and South Ukraine NPPs. In accordance with the Law of Ukraine “On Decision Making Procedure for Siting, Design and Construction of Nuclear Installations and Radwaste Management Facilities of National Importance” NAEK “Energoatom” developed a feasibility study for construction of this storage facility.

Chornobyl NPP Units 1-3 are at the final closure stage, Chornobyl NPP Unit 4 (Shelter Object) destroyed as a result of the accident in April, 1986.

Taking into account the questions of the Contracting Parties on the Third National Report of Ukraine on nuclear safety, Annexes 6 and 7 of this Report provide information on the activity at Units 1-3 of Chornobyl NPP and Shelter Object.

Ukraine submitted detailed information on SSE “Chornobyl NPP” and Shelter Object to the Second Review Meeting on the “Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management”. The information was provided in the Ukraine’s National Report “On compliance with obligations of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste”.

In compliance with the Law of Ukraine “On Ratification of the Convention on Nuclear Safety”, this Report does not cover any specific problems related to the safety of Shelter Object.

PART I. BASIC CONCLUSIONS ON RESULTS OF THE THIRD REVIEW MEETING

Among the main issues identified in the previous National Report of Ukraine and which required further investigation, this Report covers the following ones:

- implementation of the modernization programs (See Part II. para. 2.1, Part III, para. 3.2);
- development of the quality management system of the state nuclear and radiation safety regulatory authority (See Part III, para. 3.2).

Besides, this Report takes into consideration the recommendations of the Third Review Meeting of the Contracting Parties with regard to the further provision of the information on the issues of interest for all Parties of “The Convention on Nuclear Safety” taking into account the Report of the IAEA Secretariat to the Contracting Parties of the Convention on Nuclear Safety, “Synopsis of the Relevant IAEA Requirement Statements Reflecting the Issues Addressed by Articles 6 to 9 of the Convention on Nuclear Safety” (the “Synopsis”).

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

PART II. GENERAL PROVISIONS

2.1. Existing nuclear installations (Convention Article 6)

Each Contracting Party shall 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 shall 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 Chornobyl NPP, Ukraine now operates only WWER–type nuclear power plants.

The overwhelming majority of reactor installations in operation in Ukraine are WWER-1000 (V-320 design). There are 11 units of such installations in operation, two of them were put into commercial operation at Khmelnytsky and Rivne NPPs in 2005 and 2006.

Besides, there are two power units with WWER-440 (V-213 design) and one unit with WWER-1000 (V-302 design) at Rivne NPP, and one unit with WWER-1000 (V-338 design) at South Ukraine NPP (the list of the nuclear installations is given in Annex 1).

NAEK "Energoatom", as the operator, performed significant scope of work on NPP safety assessment (the detailed information is given in para.4.5 of this Report) which was carried out in the framework of the Safety Analysis Reports (SAR) development with application of the state-of-the-art methods of analysis, namely:

- Probabilistic safety analysis;
- Analysis of design basis accidents and beyond design basis accidents.

SAR review and assessment performed by SNRCU allows one to make the statement that:

– design documentation has been updated with due regard to the amendments and additions, resulting from upgrading and implementation of technical solutions, actual condition of safety important systems, and parameters and characteristics that have impact on safety;

– operating experience confirms that all safety parameters, first of all, parameters of the safety system availability, state of defence-in-depth barriers, NPP impact on the personnel, population, environment, etc. are at the acceptable level and do not tend to deteriorate; due to safety enhancement measures taken at NPPs a number of events considerably reduced;

– the quantitative safety assessments (core damage frequency, large radioactive release frequency) have been obtained based on PSA results meet PSA results for European WWER-type NPP;

– dominant accident sequences and spectra of the minimum sections with regard to the main contributors to core damage frequency and large radioactive release frequency have been determined;

– the instrument for determination of priority of measures on safety enhancement has been obtained that will help to define specific measures and their implementation sequence in the framework of SAR;

– design basis accident analyses proved the power unit design basis;

– potential beyond design basis accidents sequences have been analyzed to identify accident management measures.

These positive conclusions conform to the conclusions of experts of the international missions on safety assessment at Ukrainian NPPs.

According to the results of these missions, the level of the operational safety of Ukrainian NPPs is acceptable and in the key areas it corresponds to the international experience, in particular:

- in all areas which were assessed, there are significant positive trends as compared with the situation observed during similar missions in the mid- and second half of the 1990s;
- NAEK "Energoatom" uses the existing international experience widely for identification and solution of safety issues;
- considerable improvements are observed in the field of personnel training, including use of full-scope simulators in training process;
- both NAEK "Energoatom" and SNRCU pay special attention to promotion of safety culture among NPP managers and personnel, safety self-assessment, feedback from the operating experience, and improvement of quality assurance;
- advanced technologies and methods have been successfully implemented in the in-depth safety assessment of Ukraine's NPPs; in particular, the applied PSA methodology that was used during the in-depth safety analysis of Ukraine's NPPs was considered adequate by review of IAEA experts;
- NPP staff is involved in safety assessments.

Planning and implementation of safety enhancement measures is carried out on the basis of the long-term programs, perspective and current plans.

At the operating NPPs of Ukraine (except Khmelnytsky NPP-2, Rivne NPP-4) safety improvement measures are implemented in accordance with the "Concepts of Safety Improvement of Nuclear Power Plants in Operation" by 9 main areas:

1. Management of primary to secondary coolant leakages with equivalent diameter up to 100 mm.
2. Limitation of the dependent equipment failures and common cause failures as a result of internal events.
3. Improvement of reliability of reactor heat removal via secondary circuit.
4. Improvement of reliability of primary circuit overpressure protection under cold condition and thermal shock.
5. Improvement of reliability of primary heat removal and pressure control.
6. Improvement of reliability of radioactive substances confinement in the containment.
7. Improvement of reliability of emergency power supply.
8. Improvement of emergency processes management.
9. NPP analysis deepening and safety substantiation.

It is planned to carry out 275 pilot projects in these areas by the end of 2008.

Implementation of the Concept on safety enhancement of NPPs in operation is under permanent attention of the Government and under the close supervision of SNRCU.

Implementation of particular measures on safety enhancement is carried out in the framework of TACIS projects with safety assessment implemented jointly by SNRCU experts and international experts (RISKAUDIT).

Safety improvement measures are implemented at Khmelnytsky NPP-2 and Rivne NPP-4 according to the "Program of Modernization of WWER-1000 V-320 NPPs in Ukraine".

In accordance with the RISKAUDIT experts' conclusions the implementation of this program will ensure the compliance of these units safety with the international standards.

At the post-start-up stage 80 measures are to be implemented at Khmelnytsky NPP-2 and 81 measures are to be implemented at Rivne NPP-4. According to the Law of Ukraine on Ratification of the Grant Agreement between Ukraine and EURATOM (Law N 2818-IV of 7 September 2005), the post-start-up measures for safety enhancement and reliability improvement of Khmelnytsky NPP-2 and Rivne NPP-4 is to be completed during three fuel campaigns.

At the moment 41 measures are implemented at each of these power units.

SNRCU together with the international experts of RISKAUDIT performs periodic assessment of status and completeness of implementation of the post-start-up measures at these units.

In general 32 branch programs were in force in 2006. Taking into account that the implementation time of some of the programs expired, some of the activities were not relevant anymore or were fulfilled, certain programs were not related to safety, NAEK "Energoatom" reviewed them in 2006 and, as a result, developed "The Integrated Program on Safety Enhancement" (hereinafter - the "Integrated Program").

To concentrate efforts and resources towards safety enhancement, the following approaches were applied in development of the Integrated Program:

- The Integrated Program included only the measures that are directly connected with enhancement of the design safety;
- The Integrated Program contains the measures aimed at implementation of all recommendations, presented in the IAEA reports:

"Safety issues and their ranking for WWER-1000 model 320 nuclear power plants, IAEA-EBP-WWER-05";

"Safety issues and their ranking for WWER-1000 (small series) nuclear power plants, IAEA-EBP-WWER-14";

"Safety issues and their ranking for WWER-440/213 nuclear power plants, IAEA-EBP-WWER-03", and also recommendations of RISKAUDIT international expert team.

All measures of the "Concept on Safety Enhancement of NPPs in Operation" and "Program of Modernization of WWER-1000 V-320 NPPs in Ukraine" part 2 (Khmelnytsky NPP-2) and part 3 (Rivne NPP-4) have been included in the Integrated Program.

Annex 2 gives the Summary Report "Analysis of Implementing Status of the IAEA Recommendations within the Safety Enhancement Programs at NPPs in Ukraine", that contains the information as for the measures inventory and their implementation status.

To substantiate the possibility of the life time extension of some power units, the special attention is paid to plant life management. The most essential tasks of lifetime management are related to buildings, structures, and equipment, which replacement is

impossible or extremely expensive. Reactor pressure vessel (RPV) lifetime extension is the most important of these tasks. That is why, there is continuous in-service monitoring conducted for:

- Physical and mechanical properties of RPV materials by employing periodic inspections of surveillance test specimens;
- Accumulation of fast neutron fluence at the RPV walls against the core using calculation and experimental methods;
- Influence of operating factors on the flaw occurrence in the most stressed areas of RPV by conducting periodic (once in 4 years) non–destructive examination (NDE) of the base metal, welded joints and anticorrosive plating.

Based on the monitoring results the predictive assessment of RPV safe operation is carried out during the whole design operating lifetime. For the most «problematic» RPVs, which materials revealed increased embrittlement propensity as a result of increased nickel, copper and phosphorus contents, the full scaled calculations are conducted of integrity substantiation and brittle fracture taking into account the NDE results, sample tests, fast neutron fluence accumulated by RPV wall, and of the IAEA recommendations on the thermal shock analysis for different accident situations. At present, the chief designer – "Hydropress" (Russian Federation) has performed design substantiation of RPV brittle strength of Unit 1 of Khmelnytsky NPP. "Hydropress" performs similar work for RPVs of Khmelnytsky NPP-2, Rivne NPP-4, and South-Ukraine NPP-2.

Following the principles of safety culture and taking into consideration certain design deficiencies of the surveillance test specimens program for WWER-1000 RPVs, the Czech Institute of Nuclear Research (Řez) upon the request of the Ukrainian operator carries out research and analysis of test results of samples made of the materials of Ukrainian RPVs of Khmelnytsky NPP-2, Rivne NPP-3,4 and Zaporizhzhya NPP-6, exposed at the Temelin NPP by sample located in front of the core. It will allow for comparative analysis and estimation of the change in properties of RPV materials depending on irradiation conditions according to the regular and "integral" programs.

Within the framework of TACIS international regional project (TAREG) "Verification of patterns of radiation embrittlement of WWER-1000 and WWER-440/213 RPVs with the purpose of the integrity assessment" with participation of the foreign experts a significant scope of work was carried out in refinement of fast neutron fluence accumulated by surveillance test specimens during operation of Ukrainian and Russian nuclear power plants.

The results of such RPV monitoring, and planned measures permits one to make reliable prediction of their safe operation during the design lifetime, and enable the planning of beyond design operating lifetime extension of Ukrainian NPP RPVs.

Thus, the measures implemented by the Operator during the reported period will assure complete implementation of the international obligations of Ukraine on safety improvements of NPPs in operation in Ukraine.

The work performed gives confidence in safe work of NPPs in operation in Ukraine during their design lifetime, and allows planning measures aimed at their lifetime extension.

PART III. LEGISLATION AND REGULATION

According to the requirements of the Convention on Nuclear Safety, Ukraine has established and supports the state nuclear and radiation safety system.

3.1. Legislative and Regulatory Framework (Convention Article l7)

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.

During three years after the Third Review Meeting, the legislative and regulatory framework of nuclear energy utilization that covers all safety assurance aspects has been further developed in Ukraine.

In Ukraine, nuclear safety requirements and regulatory provisions are set in a number of the laws of Ukraine, legal acts of the Cabinet of Ministers of Ukraine and legal acts of the central executive authorities, including norms, codes, and standards on nuclear and radiation safety. The Law of Ukraine "On Nuclear Energy Use and Radiation Safety" adopted on 8 February 1995 is the basis law in the field of nuclear energy utilization. The law determines fundamentals of the state regulation of nuclear energy utilization and principles of the state policy in the field of nuclear energy utilization and radiation protection, namely: priority of the human protection, prohibition of performance without a license of certain types of activities in the field of nuclear energy utilization, the state supervision in the field of nuclear energy utilization, separation of state administration and state regulatory functions of the safety of nuclear energy utilization. The system of the nuclear legislation includes those international treaties of Ukraine, which mandatory character was agreed as appropriate, and which became a part of the national legislation. As it was mentioned in the previous National Reports, the legislative and regulatory system in the field of nuclear energy utilization that has been established in Ukraine, by now covers all safety principles and provisions of the Convention. The list of main legislative and regulatory acts in the field of nuclear energy utilization, which came into force in the period from 2005 to 2007 is given in Annex 3.

To improve efficiency of the regulatory activity, the work on nuclear legislation improvement continued since the Third Review Meeting.

Subsequent updating of the existing regulatory and legislative framework in the field of nuclear energy utilization was aimed at solution of the following topical issues:

1. Nuclear power plants safety.
2. Beyond the design lifetime extension of nuclear installations.
3. Decommissioning and construction of new nuclear installations, commissioning of the centralized spent fuel storage facility.
4. Implementation of the Comprehensive Program on Radwaste Management.
   - high level waste treatment;
   - disposal of radwaste in geological repositories.

5. Ensuring the State regulatory influence on the order of shaping, establishment and support of sustainable performance of the systems of physical security of nuclear installations, nuclear materials, radwaste, other sources of ionizing radiation in Ukraine.

6. Development and implementation of the quality management system of regulatory activity.

The lawmaking activities resulted in passing very important laws. The Law of Ukraine adopted by the Verkhovna Rada on 8 September 2005 "On Decision Making Procedure for Siting, Designing and Construction of Nuclear Installations and Radwaste Management Facilities of National Importance" determines the legal mechanism for making decisions by the Verkhovna Rada of Ukraine with regard to siting, designing, and construction of the nationally important nuclear installations. Adoption of this Law became an essential step towards application of the best world practice in relation to public participation in making decisions on construction of nuclear power facilities of national importance.

For the reported period the following international agreements have been ratified and become a part of the national nuclear legislation:

– Additional protocol to NPT Safeguards Agreement between Ukraine and the International Atomic Energy Agency was ratified by the Law of Ukraine on 16 November 2005;

– The Agreement between the Government of the Republic of Bulgaria, Government of the Russian Federation and the Cabinet of Ministers of Ukraine about transportation of nuclear materials between the Russian Federation and the Republic of Bulgaria via territory of Ukraine was ratified by the Law of Ukraine on 27 July 2006.

On l8 July 2005 Ukraine jointly with the other states signed the Amendment to the Convention on Physical Protection of the nuclear materials. With the purpose of the Amendment's ratification and implementation in Ukraine, SNRCU developed respective draft laws, by which the changes will be brought to the laws of Ukraine "On Nuclear Energy Use and Radiation Safety" and "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionizing Radiation". The draft laws are under review at the moment.

In addition, during the reported period 5 laws of Ukraine have been adopted, which introduced some changes into legislative acts:

- for organizing the simplified access to the restricted areas for foreigners who received permissions for special works;

– for financial security of civil liability for nuclear damage for research nuclear reactors;

– for nuclear installation shutdown and decommissioning funds.

To set the legal and organizational principles for the state nuclear and radiation safety regulation to be implemented by SNRCU in full scope, the Cabinet of Ministers of Ukraine has passed a number of resolutions, in particular:

– "On Approval of the Statute on SNRCU" of 27 December 2006. This resolution was developed in connection with the need to bring the Statement on Committee in compliance with the amendments in the Constitution of Ukraine. The Statute SNRCU authorities as a central executive body having a special status to pursue regulatory activity

and perform function of the competent authority and a point of contact according to the Convention on Early Notification of a Nuclear Accident, on physical protection of nuclear material in line with the Convention on Physical Protection of Nuclear Material, functions of the competent authority on safe transportation of radioactive materials;

– "Issues of SNRCU" of 7 June 2006, which is aimed at provision of SNRCU with financial and human resources for establishment of territorial state inspections on nuclear and radiation safety that allowed SNRCU to fully exercise its powers as for the supervision in the field of the nuclear energy utilization;

– "Issues of Qualification of and Incentives for Employees of the State Nuclear Regulatory Committee Directly Involved in State Regulation of Nuclear and Radiation Safety" of August, 31, 2005, which is aimed at implementation of provisions of Article 23 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" and was adopted to establish the mechanism to increase efficiency of SNRCU in compliance with modern European standards.

To implement the laws of Ukraine and with the aim to improve nuclear and radiation safety regulation, a number of regulatory and prescriptive documents of the Cabinet of Ministers of Ukraine have been enforced, in particular:

– Decree of the Cabinet of Ministers of Ukraine of 21 July, 2005 "On Preparatory Activities on Construction of New Units at Khmelnytsky NPP", according to which the facilities, buildings and equipment of Khmelnytsky NPP-3 and 4 should be inspected, and based on the inspection results the proposals should be provided as for the possibility to construct Units 3 and 4 at the Khmelnytsky site;

– Decree of the Cabinet of Ministers of Ukraine of 13 December 2005 "On Approval of Concept on Safety Improvement of NPPs in Operation";

– Decree of the Cabinet of Ministers of Ukraine of 19 July 2006 on amendments to the Procedure and rules of obligatory insurance of civil liability for nuclear damage, and to the Procedure of tariff calculation at the obligatory insurance of civil liability for nuclear damage;

– Decree of the Cabinet of Ministers of Ukraine of 27 April 2006 "Provisions of Creation, Accumulation and Use of Nuclear Installations' Decommissioning Fund";

– Decree of the Cabinet of Ministers of Ukraine of 15 June 2006 "On Approval of Procedure for Implementation of Requirements of Additional Protocol to NPT Safeguards Agreement between Ukraine and the International Atomic Energy Agency", etc.

In 2005-2007 SNRCU developed and adopted regulatory legal acts, which regulate matters related to creation of the radwaste management infrastructure in Ukraine, determine conditions for use of ionizing radiation sources with regard to the potential safety of their specific use, establish requirements for modifications of the nuclear installations, etc. Altogether, l21 regulatory legal acts were adopted.

Taking into account, that Article 51 of the Agreement on Partnership and Collaboration between Ukraine and the European Community of 14 June 1994 provides for the obligations of Ukraine for gradual harmonization of the national legislation with the Community's legislation in the fields determined in this Agreement, in particular, it concerns "laws and instructions related to nuclear energy", SNRCU carries out work on improvement of the nuclear legislation, including norms, codes, and standards on nuclear and radiation safety taking into account requirements of the European Community's

legislation. In addition, the recommendations of the IAEA and experience of regulatory bodies of the other countries are considered in this work.

3.1.2 Nuclear Installation Licensing System and Prohibition of Nuclear Installation Operation without a License

Legislative principles of licensing, which were provided in para. 3.1.2 of the Third National Report, remained unchanged. Legislative framework of licensing the nuclear installations related practice, remains the laws of Ukraine "On Nuclear Energy Use and Radiation Safety" and "On Licensing Activity in Nuclear Energy Use". In accordance with para. 26 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", both legal entities and natural persons, who do not have an appropriate license, are prohibited to carry our any activities related to utilization of nuclear installations and ionizing radiation sources.

The system of the normative and legal regulation of nuclear and radiation safety, which contains documents that regulate all aspects of the licensing process, is continuously improved. In the reported period a number of regulatory documents, which determine requirements to the procedure of the state nuclear and radiation safety examination, to introduction of changes in licensing conditions of implementation of some activities in the field of nuclear energy utilization, etc., were developed (Annex 3).

Practical application by the state nuclear and radiation safety regulatory body of the state regulations in the field of licensing activity revealed a number of gaps, non-compliances with international legislation, etc. To improve the mentioned regulations, SNRCU developed a bill "On Amendments to the Law of Ukraine "On Licensing Activity in Nuclear Energy Use", which adoption will promote in arranging licensing issues in the field of the nuclear energy utilization, in particular, in the part of assuring predictability and transparency in accomplishment of licensing procedures, simplification of application of the regulatory legal acts related to accomplishment of the licensing procedures.

Operators have licenses for all necessary stages of the life cycle of their nuclear installations according to the Law of Ukraine "On Licensing Activity in Nuclear Energy Use".

In the reported period Khmelnytsky NPP-2 and Rivne NPP-4 were put into commercial operation. On the basis of comprehensive safety analysis of the new power units, after one-year stage of the life cycle (commissioning including trial commercial operation) these units were accepted for operation by the State Acceptance Commission, and SNRCU issued the licenses for their operation to the operator.

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

Legislative principles of the system of regulatory control and assessment of nuclear installations for the reported period remained unchanged.

Supervisory activity in the field of nuclear energy utilization, in accordance with Article 5 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" is considered to be among the fundamental principles of the state policy in the field of nuclear energy utilization and radiation protection. In accordance with article 22 of the Law, the state supervision over the observance of regulatory requirements and conditions of granted

permissions by institutions, enterprises and persons that use nuclear installations is a constituent of the state regulation of nuclear energy utilization.

The functions of the state supervision in SNRCU exercised by all its structural subdivisions, by state inspectorates on the nuclear safety at NPPs and by the state territorial inspectorates on nuclear and radiation safety of SNRCU established in June, 2006. SNRCU coordinates supervisory activity and provides methodological support on legally binding liability for violation of nuclear power utilization laws.

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

During the reporting period, the legal framework of enforcement of applicable regulations ad the licensing conditions has not changed.

According to article 24 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety of Ukraine" the state nuclear regulatory authority is authorized for the state supervision over observance of norms, codes and standards on nuclear and radiation safety and licensing conditions, and in case of violations it applies administrative sanctions to the personnel, officials of enterprises, institutions and organizations. Article 25 of the Law determines rights of inspectors regarding their responsibilities and application of enforcement methods to individuals who fail to comply with applicable legislation, rules, regulations and standards on nuclear and radiation safety and licensing conditions. Article 81 of the Law determines the types of infringements for which the personnel and officials of nuclear installation, sources of ionizing radiation, personnel and officials of enterprises, institutions and organizations which carry out any other activity in the field of nuclear energy utilization, as well as citizens, are brought to the disciplinary, civil (except civil liability for nuclear damage), criminal and administrative responsibility. The Ukrainian Code on Administrative Infractions determines specific types and scopes of punitive sanctions towards individuals who are guilty in violation of nuclear and radiation safety laws. The sanctions can be imposed by the state inspector on nuclear and radiation safety.

Article 82 of the Law provides for liability of enterprises, institutions and organizations that carry out activities in the field of nuclear energy utilization. In case of violation of safety norms, regulations and standards or licensing conditions for certain activities, provided these violations caused damage to public health or environment. This liability can be expressed in the form of fines imposed by the state nuclear and radiation safety regulatory authorities.

Article 16 of Law of Ukraine "On Licensing Activity in Nuclear Energy Use" determined that license violation is one of reasons for suspension and cancellation of the operator's license depending on the stage of the lifetime cycle of the nuclear installation.

Residence State Inspectorates on Nuclear Safety supervise nuclear and radiation safety on the plant sites.

For the reporting period:

- development of national nuclear legislation is underway;

- public participation and consideration of its position in development of nuclear energy of Ukraine is provided by the legislative framework;

- the government of Ukraine pays great attention and takes important decisions on pursuing state policy in the field of nuclear energy utilization, in particular, in safety

improvements of nuclear installations, ensuring state regulation of safety and development of nuclear power branch of the state economy.

3.2. Regulatory Body (Convention Article 8)

3.2.1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in article 7 and provided with adequate authority , competence and financial and human resources to fulfil its assigned responsibilities.

The key role in pursuing state policy in the field of nuclear energy utilization and ensuring observance of nuclear and radiation safety requirements belongs to SNRCU, established by the Decree of the President of Ukraine (3 1303/2000 of 5 December, 2000).

The main SNRCU functions in the field of nuclear and radiation safety regulation are as follows:

- to determine safety criteria, requirements and conditions during use of nuclear energy,
- to issue permissions and licenses for activities in the field of nuclear energy utilization,
- to exercise state supervision over observance of laws, norms, codes and standards.

More detailed description of tasks, functions and authorities of the regulatory body, are determined in the Statute on SNRCU approved by the Cabinet of Ministers of Ukraine (Resolution N 1830, of 27 December, 2006). The new Regulation was developed due to the need to bring it in conformity with the changes in the Constitution of Ukraine. The law of Ukraine "On Amendments to the Constitution of Ukraine" (2222-IV of 8 December, 2004) the authority for establishment, reorganization and liquidation of central executive authorities, approvals of statements thereof, appointment for and dismissal from the positions of the heads of the central executive authorities submitted to the Cabinet of Ministers of Ukraine

In accordance with this Regulation, SNRCU was assigned with the additional functions to those above, as determined in the Convention on Nuclear Safety, The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and the Convention on Physical Protection of Nuclear Materials.

Strategic areas of the state regulation policy were set forth in the Program of Development and Reforming of Nuclear Regulatory System of Ukraine, developed in accordance with the Action Plan between Ukraine and EC and approved by SNRCU at the end of 2005.

The program provides for implementation of the following main tasks:

- to improve legislation on safety of activities in the field of nuclear energy utilization;
- to reform the existing regulatory and legislative framework on nuclear and radiation safety into uniform hierarchical system of national regulations and codes based upon the internationally recognized principles and standards and modern research;

– to reform SNRCU into institutionally stable and effectively independent state authority on nuclear and radiation safety regulation by means of legislative statement of its status, functions and authorities;

– to provide SNRCU with resources, in particular, human resources, to ensure implementation of licensing and supervisory activity in full scope, and effective performance of tasks on notification and emergency response.

For the reporting period certain success was achieved in strengthening of institutional capability and independence of SNRCU. In 2005, the structure of SNRCU was changed, its internal and external co-ordination was considerably increased.

Renewal by the Cabinet of Ministry of Ukraine (Resolution N 796 of June, 2006) of the function of the regulatory control, safety supervision in manufacturing and use of sources of ionizing radiation in medicine, industry, science and education, in radwaste management, transportation of radioactive materials and uranium ore processing became an important step towards reinforcement of the state regulation infrastructure.

For due implementation of this governmental resolution, 8 regional state inspectorates on nuclear and radiation safety were established to carry out their activity on the whole territory of Ukraine. The inspectorates get appropriate legal and technical support, their staffing with qualified inspectors is in progress. At the end of 2006, 23 inspectors worked in the inspectorates. In 2007 the number of inspectors in these state inspectorates will be increased up to 96 inspectors. SNRCU pays special attention to state inspectorates' provision and qualification improvement of their staff.

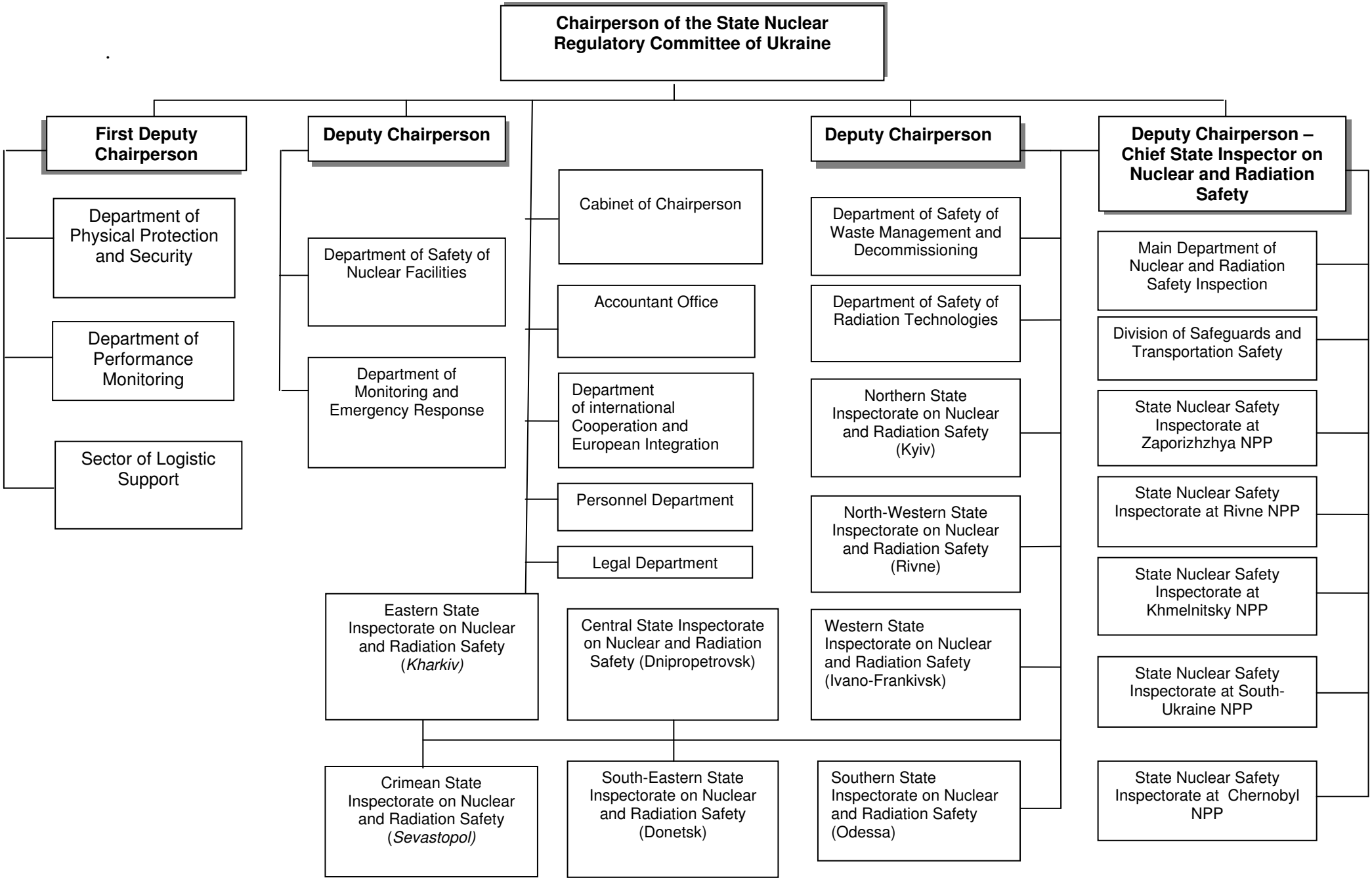
As a result of structure renewal, many employees of SNRCU were granted a higher status of inspectors, the system of qualification upgrading, organization and implementation of qualification of SNRCU's employees directly involved in state nuclear and radiation safety regulation was improved.

Since the end of 2006 a number of key measures were implemented aimed at implementation of quality assurance system in accordance with ISO 9000:2001 and at certification of the system early in 2008. Within the framework of these activities the process approach is being applied, indicators, quantitative and qualitative parameters of regulatory activity quality control are being determined. Development and application of regulatory quality assurance documents is underway. These documents include processes methodologies and secondary level guidelines:

- Guidelines on the supervision quality;
- Guidelines on regulation-making quality;
- Guidelines on licensing quality.

A risk-informed approach is implemented into the regulatory activity as a complementary to the deterministic approach. Risk assessment is a mandatory component to substantiate modification safety, probabilistic safety analysis is an integral component of safety analysis reports, probabilistic methods are used as tools for safety measures prioritization. A risk-informed approach is introduced into the regulatory activity within the interagency program. SNRCU develops relevant regulations.

"Regulatory Issues" is one of the four areas of Ukrainian NPP safety assessment determined in the Memorandum of Understanding between Ukraine and the EC on cooperation in the energy branch signed on 1 December, 2005. The key aspect of this area is conducting the IAEA's IRRS mission. SNRCU takes preparatory measures to hold the IRRS mission in Ukraine in May 2008


Chairperson of the State Nuclear Regulatory Committee of Ukraine
First Deputy Chairperson
Department of Physical Protection and Security
Department of Performance Monitoring
Sector of Logistic Support
Deputy Chairperson
Department of Safety of Nuclear Facilities
Department of Monitoring and Emergency Response
Cabinet of Chairperson
Accountant Office
Department of international Cooperation and European Integration
Personnel Department
Legal Department
Eastern State Inspectorate on Nuclear and Radiation Safety (Kharkiv)
Central State Inspectorate on Nuclear and Radiation Safety (Dnipropetrovsk)
Crimean State Inspectorate on Nuclear and Radiation Safety (Sevastopol)
South-Eastern State Inspectorate on Nuclear and Radiation Safety (Donetsk)
Deputy Chairperson
Department of Safety of Waste Management and Decommissioning
Department of Safety of Radiation Technologies
Northern State Inspectorate on Nuclear and Radiation Safety (Kyiv)
North-Western State Inspectorate on Nuclear and Radiation Safety (Rivne)
Western State Inspectorate on Nuclear and Radiation Safety (Ivano-Frankivsk)
Southern State Inspectorate on Nuclear and Radiation Safety (Odessa)
Deputy Chairperson – Chief State Inspector on Nuclear and Radiation Safety
Main Department of Nuclear and Radiation Safety Inspection
Division of Safeguards and Transportation Safety
State Nuclear Safety Inspectorate at Zaporizhzhya NPP
State Nuclear Safety Inspectorate at Rivne NPP
State Nuclear Safety Inspectorate at Khmelnitsky NPP
State Nuclear Safety Inspectorate at South-Ukraine NPP
State Nuclear Safety Inspectorate at Chernobyl NPP

To implement additional measures with regard to incentives for the individuals for significant achievements in pursuing of the state policy in the field of the nuclear power utilization, SNRCU established departmental official honours:

- SNRCU Merit Certificate;
- SNRCU Certificate of Honour "For Achievements in the Field of Nuclear and Radiation Safety Assurance in Ukraine" and lapel badge.

In September 2007 a draft Concept of the State nuclear regulation of nuclear and radiation safety was developed, which defines the main principles of state regulation in this area, provides for revision of the role and place of the state nuclear regulatory authority in the system of state executive bodies, increase of the level of its responsibilities and re-statement of main principles of its establishment and arrangement of its activity. The concept is to be approved by the Decree of the President of Ukraine.

3.2.2 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 organization concerned with the promotion or utilization of nuclear energy.

The national legislation of Ukraine distinguishes clearly the functions of the state nuclear and radiation safety regulatory body and functions of any other bodies or institutions, which carry out their activity in the field of the nuclear energy utilization. On the legislative level it is regulated by articles 23, and 24 of the Ukrainian law "On Nuclear Energy Use and Radiation Safety". On the law level this issue has been regulated through the determination of the authorities of these bodies and Statute of such bodies.

During the Reported period:

- *the structure of the state nuclear and radiation safety regulatory body was renewed, to ensure fulfilment of the safety regulation functions at carrying out activities on utilization of the sources of lionizing radiation;*
- *the improvement of qualification upgrading system for employees of the State Nuclear Regulatory Committee was continued;*
- *the guidelines for the regulation quality control system were developed;*
- *the honours of the regulatory body for significant contribution and outstanding labour achievements have been introduced that allows increasing prestige of the regulatory body and the safety culture in the field of the nuclear power utilization.*

3.3. Responsibility of the License 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 license and shall take the appropriate steps to ensure that such license holder meets its responsibility.

Legal basis for allocation of responsibility for a nuclear facility safety has been established in Ukraine at a legislative level.

As prescribed in Article 26 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" operation of nuclear facilities in the territory of Ukraine is license-based. License for activities at separate stages of nuclear facilities life is issued to the operator. In accordance with Article 32 of the mentioned Law the licensee takes complete responsibility for radiation protection and safety of a nuclear facility. Specific obligations of the operator are established in Article 33 of this Law.

There are two operators in nuclear energy sector of Ukraine: NAEK "Energoatom" and the State Specialized Enterprise SSE "Chornobyl NPP"

NAEK "Energoatom" has substantially modified its administrative structure. Now it is a unitary organization responsible for the safety of the nuclear facilities, which has delegated specific authority to its separated entities (nuclear power stations).

NAEK "Energoatom" holds SNRCU licenses to:

− operate South Ukraine NPP power units 1-3, Rivne NPP power units 1-3, Khmelnytsky NPP power unit 1, Zaporizhzhya NPP power units 1-6 (including operation of Spent Nuclear Fuel Dry Storage Facility at the ZNPP site);

− operate recently commissioned power units Khmelnytsky NPP – 2 and Rivne NPP - 4.

Within the framework of these licenses for operation of NPP power units the NAEK "Energoatom" gets separate permits annually for launching NPP power units after outages with reactor core refuelling.

SSE "Chornobyl NPP" holds SNRCU licenses for:

- decommissioning of Chornobyl NPP;
- operation of the Shelter Object;
- construction of the spent nuclear fuel storage facility ISF-2.

License for decommissioning of Chornobyl NPP authorizes the operator to perform activities and operations on nuclear facility decommissioning, including those envisaged by the nuclear facility decommissioning stage.

Within the framework of license for decommissioning of Chornobyl NPP the SSE "Chornobyl NPP" must get separate permissions to proceed to the next decommissioning stage as applied to a specific nuclear facility and to perform specific works or operations at decommissioning stages related to design, construction, commissioning or operation of radioactive waste management facilities, as well as to remove spent and fresh nuclear fuel, liquid and solid radioactive waste accumulated during the operation of Chornobyl NPP.

NAEK "Energoatom" and SSE "Chornobyl NPP", as license holders, are fully responsible for radiation protection and the safety of nuclear installations independently of activities and responsibilities of suppliers and state regulatory bodies for nuclear and radiation safety.

According to the responsibilities imposed by the legislation of Ukraine upon the operating organization, NAEK "Energoatom" and SSE "Chornobyl NPP" have to:

- ensure nuclear and radiation safety (see para. 2.1 and 4.2 for description);
- develop and implement safety upgrading measures for the nuclear installation (see introduction to para. 2.1 for more details);
- ensure radiation protection of personnel, public and environment (see para. 4.6 for more details);
- inform about operational events at nuclear installations in a timely and full manner, conduct investigations and take corrective measures (see para. 4.3 for more details);
- provide financial coverage of liability for nuclear damage according to the legislation of Ukraine (see para. 4.2 for more details);
- set requirements on qualification of personnel, depending on their responsibility for the operational safety of a nuclear facility and provide for their training (see para. 4.2 for more details).

SNRCU supervises the licensee's activity compliance with the identified provisions, starting from the review of the licensee's application. In particular, the compliance of the nuclear facility safety with the established requirements, availability of financial, material and other resources, administrative structure, skilled personnel and personnel training scheme are obligatory licensing issues controlled by SNRCU.

Since 2002 SNRCU introduced a practice of inspecting how the safety enhancement measures are implemented at nuclear installations and kept within their schedules. Results of the inspection are necessarily taken into account in making a decision on issuing a license or an individual permit to the applicant. So, within the framework of regulatory inspection, the SNRCU jointly with the operating organization NAEK "Energoatom", and international organizations took inventory of safe enhancement measures at each nuclear power unit as provided for by all programme documents. The approaches have been verified according to the international recommendations presented in the IAEA reports on safety issues as related to NPPs with WWER-1000/320, WWER-1000 (small series) and WWER-440/213 (IAEA-EBP-WWER-05, IAEA-EBP-WWER-14, IAEA-EBP-WWER-03) reactor types. Based on the collection, inventory and analysis of the measures, the Integrated Report "Annual Assessment of Implementing Safety Upgrading Measures at Ukrainian NPP units according to IAEA Recommendations" was developed upon SNRCU request.

The current status of safety upgrading measures and their schedules as well as compliance with the licensing terms are monitored in the framework of periodic inspections and reviews. Thus, inspection subdivisions of SNRCU performed the following inspections (reviews) for the period of 2005-2007:

- 103 inspections performed by the subdivisions of the Central Office;
- 353 inspections performed by the state inspectorates at NPP sites.

During the reporting period Ukrainian operating organizations ensured full compliance with liabilities stipulated by the legislation as related to safe use of nuclear energy.

SECTION IV. GENERAL LSAFETY CONSIDERATIONS

4.1. Priority to Safety (Convention Article 10)

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

Priority to safety in creating and operating nuclear facilities, determined in the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" is the main principle of the state policy in the use of nuclear energy.

During the reporting period adherence to legislative principles of the state policy was ensured by all entities of legal relations in nuclear energy according to assigned authorities. Implementation of the state policy principles regarding issues covered by the Convention on Nuclear Safety is set forth in this and previous reports of Ukraine.

Safety assurance and reliability of nuclear energy and Ukraine's compliance with respective international obligations are the priorities for executive bodies. Continuous attention of government authorities to safety assurance issues is a confirmation hereto. The status of nuclear and radiation safety was regularly reviewed at meetings of Cabinet of Ministers and Council of National Security and Defence of Ukraine. The issues of NPP safety are discussed by the SNRCU Boards and Boards of the ministries involved, at meetings of inter-departmental commissions.

During the reporting period "Energoatom" prepared reports for the SNRCU to hold before the Verkhovna Rada, the President and the Cabinet of Ministers of Ukraine "On Nuclear and Radiation Safety in Ukraine" in accordance with established procedure.

The Statement of NAEK "Energoatom" on Nuclear Safety Policy has been approved and published. It reads:

- NAEK "Energoatom" takes all responsibility for nuclear power plants' safety at all operational life stages and sets its absolute supremacy over other tasks;
- NAEK "Energoatom" activities are aimed to establish the spirit of personnel's commitment to nuclear safety issues, their personal responsibility, and to mold safety culture principles with them.

"Energoatom" has made it customary to host international conferences "Safety Culture at NPPs of Ukraine". These were conducted in 2002, 2004 and 2006.

In order to implement safety culture principles, NPPs arrange two-level Safety Days on a quarterly basis: departmental and all-plant. The all-plant Safety Days are prescribed by the annual "Safety Day Schedule" incorporated into the annual schedule of work with personnel.

The "Safety Day" agenda is revised as needed to incorporate prescriptions of supervisory bodies and according to NPP operational events. The inspection certificate indicates revealed deviations and associated elimination measures, assigns executives and establishes implementation schedule.

The "Safety Day" promotes the principles of safety culture, enhancement of nuclear and process safety, tightening of inspection by department managers and plant administration over compliance with the established safety requirements.

At each NPP there are Statements of the NPP management elaborated and communicated to the personnel specifying NPP priorities in safety and quality assurance issues.

Programmes for Production Culture Assurance and Enhancement, Labour Protection and Fire Safety have been elaborated and enacted at NPPs; long-term planning of activities as related to safety culture is also foreseen.

Job description documents for all-rank managers responsible for nuclear safety specify obligations related to safety culture development with the subordinate personnel.

The Days of Production Culture are organized at all NAEK "Energoatom" NPPs.

The course on "Safety Culture" is an obligatory integral part of both position training programs and proficiency maintaining programs for all NPP operating personnel. The NPP operating personnel, by categories, are engaged in safety issues studies by 100 %.

The training centres have developed complete sets of methodological training materials to cover the following topics:

- "Safety Culture Basic Principles and Properties";
- "Human Factor Share in Safety Culture Assurance";
- "Quality Assurance";
- "Safety Management ".

The safety culture elements are incorporated into the practical training courses at full-scope simulator, in laboratories and workshops.

In order to implement the principles of openness and accessibility of information on nuclear energy use there are special public relations departments and information centres established at the four Ukrainian NPPs and directorate office of NAEK "Energoatom" to deliver comprehensive information on radiation situation of the environment to the public. Nuclear power plants and their information centres arrange visits for the public to get them familiarized with the NPP work. Each NPP issues a stationary newspaper, has radio and television offices and a website.

NPPs prepare annual reports on operating safety level and technical condition of NPP power units and reports on radiation safety and protection of an NPP. "Energoatom" generalizes the NPPs' reports and based thereupon develops a Summary Report on Operation Safety and Technical Condition of NPP Power Units and a Report on NPPs' Radiation Safety and Protection which are subsequently produced to the regulatory and governing authorities of Ukraine.

The priority of nuclear and radiation safety established by the Ukrainian legislation and making it binding (for the operator) promoted adherence to safety principles as a lifestyle.

4.2. Financial and Human Resources (Convention Article 11)

4.2.1. 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.

The share of monetary reimbursement for the electric power produced was 98,2% in 2004, 98,9% in 2005, and 97,0% in 2006. Insignificant increase of non-monetary reimbursement in 2006 as compared to 2005 is explained through application of mechanisms as specified in Law of Ukraine №2711 "On measures aimed at ensuring operation of enterprises of fuel and energy complex of Ukraine" of 23 June 2005.

The electric power produced by the NPPs operated by "Energoatom" and delivered to the SE "Energorynok" is subjected to a fixed tariff rate. A decision on the tariff rate is made by the National Electricity Regulatory Commission of Ukraine (NERC). A tariff rate is fixed by the respective NERC decree. Along with the tariff the NERC also prescribes a structure of costs for electricity production for "Energoatom".

The complete implementation of the "Integrated Program on Safety Improvement of Ukrainian NPPs power units" is estimated at 5,4 billion UAH, including implementation of the Safety Improvement Concept for power units in operation approved by the Cabinet of Ministers of Ukraine, Decree No.515 of 13.12.2005, which is estimated at 1,2 billion UAH.

During the first half of 2004 "Energoatom" placed bonds at the fund market of Ukraine to the total sum of 430 million UAH with the 3-year term of appeal to enable funding of construction accomplishment for new power units, namely, KhNPP-2 and RNPP-4. In December 2006 the NAEK "Energoatom" finally liquidated the issue of bonds in full compliance with the terms of bond offering.

To finance the Program on Safety Improvement and Modernization of KhNPP-2 and RNPP-4 "Energoatom" – once the power units were commissioned – entered into credit agreements with EBRD and EURATOM, these agreements have come into force in 2005 (Law of Ukraine 2818-IV on Ratification of the Guarantee Agreement between Ukraine and the European Atomic Energy Community to improve KhNPP-2 and RNPP-4 safety of 07 September 2005).

Starting with 2005 "Energoatom" has been allocating funds with the special state budget fund as prescribed by Article 7 of the Law of Ukraine "On Nuclear Safety Assurance Issues", the former being used to establish a financial reserve for decommissioning activities at nuclear facilities.

Ukraine is a Contracting Party to the Vienna Convention on Civil Liability for Nuclear Damage (according to the Law of Ukraine "On Ukraine Entering into the Vienna Convention on Civil Liability for Nuclear Damage" of July 12, 1996).

The Law of Ukraine "On Civil Liability for Nuclear Damage and Financial Coverage" establishes that the operator's liability for nuclear damage is limited to the sum equivalent to 150 millions of Special Drawing Rights (SDR) in national currency for every nuclear incident. Resolution of the Cabinet of Ministers of Ukraine №953 "On Obligatory Insurance of Civil Liability for Nuclear Damage" dated 23 June 2003 approved the

procedure and rules for obligatory insurance of civil liability for nuclear damage and provisions on the Nuclear Insurance Pool of Ukraine.

In order to meet the above documents NAEK "Energoatom"s civil liability for nuclear damage has been insured since April 27, 2004. NAEK "Energoatom" entered into a respective agreement with the insurance companies, members of the Nuclear Insurance Pool of Ukraine.

There are further 15 states whose Nuclear Insurance Pools are engaged in reinsurance of Energoatom's civil liability for nuclear damage: the USA, Belgium, Great Britain, Spain, China, Germany, Russia, Slovakia, Slovenia, France Croatia, Czech Republic, Switzerland, Japan, and the Northern Nuclear Insurance Pool.

The Annual Financial Plan of NAEK "Energoatom" and Addendum thereto are approved by the Cabinet of Ministers of Ukraine.

4.2.2. 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 training and qualification upgrading of nuclear personnel, as described in para. 4.2.2 of the Second Report was further improved.

An NPP personnel training system has been created and applied in Ukraine. This system is based on the IAEA-recommended systematic approach to training and refers to the summarized experience in personnel training of the leading IAEA member states.

The personnel training system is implemented in interaction with scientific organizations, enterprises, state management and regulatory bodies, and other educational systems to achieve high-quality training, retraining, qualification improvement and professional development of personnel to acquire knowledge, skills and experience required for NPP safe operation.

SNRCU licenses NPP personnel training in compliance with the requirements of the regulation, namely, "Rules of Licensing for Training the Ukrainian NPPs Personnel".

NAEK "Energoatom" has developed and implemented the branch regulation "Provisions on Work with Personnel of NAEK "Energoatom". The document incorporates the modern international experience in NPP personnel training. It determines declared principles according to which systematic work with personnel inculcates in them safety culture, ensures the required qualification level and continuous readiness for their professional duties. This is very important for NPPs nuclear and radiation safety and, in particular, for protection and security of the system of defence-in-depth barriers.

The effectiveness of the personnel training system is verified by a stable increase in the personnel availability factor, decrease in the NPP operational events, and improvement of other performances.

Further development of NPP training centres, as a basis for the training system, is underway. The structure and staff list of training centres have been developed taking into

account the peculiarities of each NPP. The centres are staffed with qualified instructors. Improvement of training aids and appliances is underway.

NAEK "Energoatom" has training centres at each NPP and the Enterprise "AtomRemontService" – they obtained proper SNRCU licenses and permits to train personnel of different categories.

NPP training centres use 8 full-scale simulators for WWER-1000 units – KhNPP-1, ZNPP-1,3,5 and RNPP-3, SU NPP-1,3; a full-scale simulator for WWER-440 - RNPP-2; simulators for KhNPP-1, ZNPP-3,5, SU NPP-1,3 and RNPP-2,3 emergency control rooms. In addition, there are further multifunctional and local simulators as well as computer training systems resorted to for personnel training.

In training personnel instructors refer to training and methodological materials developed in compliance with NAEK "Energoatom" standard "Requirements on Training and Methodological Materials". The availability of these materials is one of the compulsory requirements to obtain a license for personnel training.

Personnel subject to certification are trained according to individual training programmes developed based on standard programmes approved by SNRCU.

The dynamics in the number of the certified NPP experts and the data on NPP personnel training are provided in Annex 4.

During the reporting period the Ukrainian system of training and professional development of personnel working at nuclear installations, which ensures occupational training of plant employees for activities throughout all life stages, was improved.

All Ukrainian NPPs are completely staffed with trained and qualified personnel.

The efficient system of NPP personnel training promotes improvement of performance indicators and safety upgrade of nuclear facilities.

4.3. Human Factors (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 facility.

To prevent and eliminate the influence of the human factor, as a reason of NPP work deviations and failures, which is pre-conditioned by incompliance of the psychophysical state and qualification of personnel with the established safety requirements, NAEK "Energoatom" employs the operation experience feedback system in personnel training at NPP training centres.

A structure of the efficiency assessment as applied to the NPP personnel training system in Ukraine with due regard to the human factor could be pictured as follows:

- analysis of deviation reports with abnormal events, pre-conditioned by personnel erroneous actions, being described;
- audits of NPP training centres by SNRCU experts to decide on licensing personnel training activities in the categories as specified;
- analysis of accident reports pre-conditioned by training gaps.

To assess operating personnel technical proficiency to perform power unit operation under different operation modes there is an operating personnel availability factor to calculate. Active erroneous actions of the operating personnel entailing a deviation in transient modes, as well as operating personnel incorrect actions or omissions are taken into account.

The licensed personnel (shift supervisors and control room operators) are certified by NPP commissions headed by the NPP Chief Engineer. The rest of the operating personnel are certified by commissions headed by the deputy (deputies) Chief Engineer or engineer in charge. The knowledge assessment is conducted as prescribed in respective Provisions.

If the individual training programme is the case, the instructor checks the level to which the training objectives have been achieved. In addition, there are summary assessments following each training stage.

Upon training completion an exit test is to be performed at NPP training centres. Provided that the test results are positive, the trained specialist shall be examined by the commission for knowledge assessment.

There is further certification procedures applied to personnel, whose training is subjected to licensing:

- preparation for knowledge assessment by NPP central commission, during which the previously gained knowledge are recovered and reinforced, safety requirements and rules are specified as applied to the unit systems and NPP operation administration. Based on the final inspection results the trainee, through self-training and instructor's coaching, gradually reviews the majors of the individual training programme:
  - final training on a full-scale simulator.

The final testing is administered by one of the Chief Engineer deputies. The examination tests trainee's technical skills to manage the process from the unit control room under the following modes:

- normal operation;
- abnormal operation;
- emergency operation.

Besides, suitability for teamwork is tested.

The summary final test is administered by the Deputy Chief Engineer. It tests if the knowledge obtained is sufficient for non-supervised work and preparedness for knowledge assessment.

The test results are incorporated into reports and along with other documents are handed over to the central knowledge assessment commission.

The test results being negative, additional time is provided for preparation.

Knowledge assessment is performed by the commission headed by the Chief Engineer with the state inspector being present – a representative of the State Nuclear Safety Inspectorate at NPP.

As applied to the licensed personnel, following successful knowledge assessment by the commission, duplication and training, there is a package of documents prepared for license application to be forwarded to SNRCU. If the decision is positive SNRCU issues a license for operating a reactor facility with the NPP power units being specified.

The results of personnel training activities and other measures aimed at safety culture upgrading allowed substantial decrease in personnel-error-based NPP events.

The events caused by personnel mistakes constituted 5 events in 2004, 3 in 2005, 1 in 2006, and 0 in the first quarter of 2007. The number of events stably tended to decrease, owing to the task-oriented training of the NPP personnel.

There were no events resulting from personnel training gaps registered in 2006.

Personnel preparedness for accident response, accident management and recurrence prevention is assured through conducting:

- emergency drills as incorporated into the individual training programme;
- emergency drills for operating personnel;
- trainings for operating personnel on a full-scale simulator within proficiency maintaining;
- full-scale training on beyond-design-basis accident liquidation.

Symptom-informed accident procedures are currently implemented at power units to improve the personnel reliability in power unit control when mitigating accidents. The following steps are taken for this purpose:

- a working team responsible for the development of operational documentation, training materials and performance of training on the use of symptom-informed instructions has been created;
- a list of symptom-informed instructions for WWER-440, WWER-1000 has been defined;
- personnel responsible for development of operating documentation and training materials have been trained;
- symptom-informed instructions and educational materials for NPP pilot power units (WWER-440, WWER-1000 reactor facilities) have been developed;
- the operating personnel have been trained, with the symptom-informed instructions being employed.

To minimize the human factor effect there is a set of administrative measures being implemented, namely:

- physical persons are allowed to perform activities at a nuclear facility or with nuclear materials only following a special training;
- the psychophysical state of operating personnel is tested annually;
- the staffing, personnel training and safety culture improvement are controlled on an interdepartmental level;
- there are all-station, power unit emergency response and fire protection trainings for operating personnel, held annually as prescribed in the Schedule of Work with Personnel; these include individual training with administrative and technical personnel;
- instructions on accident liquidation have been developed to enhance personnel reliability when operating a power unit in accident liquidation.

Thus, the Convention Article 12 provisions have been adhered to in Ukraine.

4.4. 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 through the life of a nuclear installation.

Since the previous Report the quality assurance system of NAEK "Energoatom" has been developed and improved.

In 2006 an "Action Plan for preparation of NAEK "Energoatom" to quality assurance system certification" was introduced, and management systems of separated entities of NAEK "Energoatom" (namely, SE "South Ukraine NPP" and SE "AtomRemontService") were certificated for their compliance with the international ISO 9001:2000 standards. In 2007 the separated entity "Rivne NPP" integrated management system was certified for its correspondence to the international ISO 9001:2000, ISO 14001:2004 standards.

In 2006 the self-assessment of adherence to IAEA recommendations and conclusions as related to Operation Safety was performed at each NPP.

Integral parts of the management system are constantly improved:

- strategic and on-line planning and monitoring;
- development and review of the documents;
- improvement of the NAEK "Energoatom" administrative structure;
- introduction of the classification approach and project management practice;
- staff qualification improvement as related to quality;
- scheduled internal assessments of the quality system;
- self-assessment of the results obtained by each subdivision;
- product supplier assessment and selection procedures.

To ensure efficient performance there are training and qualification improvement courses held for personnel, where differential approach is employed with respect to the role and function of employees: management staff, workers of the quality assurance department, quality system auditors.

Once inconsistencies are revealed, namely, deviation of practical results from the objectives set, their reasons are detected. Based on quality management system reviews corrective and preventive actions are developed with the aim to improve production activity.

The operator exercises its right to choose a supplier through tenders as prescribed by the Law of Ukraine "On Purchase of Goods, Works and Services for the State Funds" and evaluates potential suppliers of the products, important to NPP safety as established in NAEK "Energoatom".

Quality system implementation and improvement has permitted:

- *operation safety level increase;*
- *performance indicators improvement;*
- *reduction of average time of power units' scheduled outages;*

- *reduction of number of violations in normal operation;*
- *safety culture improvement as related to operation of nuclear facilities.*

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

4.5.1. 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.

The use of nuclear installations foresees the detailed and comprehensive analysis of their safety taking into account design characteristics and operational practice. Assessment and verification of safety is required by legislative and regulatory documents of Ukraine.

The operating organization's safety assessment of operating power units is aimed at development of a basic safety substantiating document - Safety Analysis Report (SAR) - which presents a comprehensive safety assessment and a system of technical and administrative measures intended for safety assurance.

For power units commissioned since Ukrainian independence (Khmelnytsky NPP-2 and Rivne NPP-4) and for new NPP power units to be constructed it is provided to develop a preliminary safety analysis report (PSAR) and a final safety analysis report (FSAR). PSAR shall be developed based on the analysis of design documentation and shall constitute the main document to apply for a license for nuclear installation construction. FSAR incorporates changes to the design made during construction and results of pre-commissioning activities, initial criticality and power increase at the power unit and shall constitute the main document to apply for a license for operation.

The abovementioned is completely performed for Khmelnytsky NPP-2 and Rivne NPP-4.

Activities on SAR development for 3 pilot power units, namely, ZNPP-5, RNPP-1 and SU NPP-1 – are in their final stage and are scheduled to be accomplished by the end of 2007.

SAR for the remaining 10 power units shall be developed through adaptation. To ensure activities on adaptation the operator has developed a document (enterprise standard) that prescribes careful analysis of peculiarities of power units to be adapted as compared to pilot power units. Individual chapters of SAR shall be developed in full, as may be needed. Activities for all pilot power units shall be accomplished by late 2009.

As prescribed by nuclear legislation and national safety requirements and rules the operator is committed to periodically – as prescribed by the state regulatory authority for nuclear and radiation safety, at least once in 10 years – perform NPP power units' safety review and report on it to the regulatory authority. To enable safety reviews, the Ministry of Fuel and Energy of Ukraine approved the regulatory document "Requirement to the Structure and Content of Safety Review Report" that referred to the IAEA Safety Standard NS-G-2.10 and incorporated IAEA experts' recommendations. As prescribed by the abovementioned regulatory document the reports on power units' safety review shall be executed in order to decide on amending existing licenses for nuclear installation operation and permitting beyond-design basis operation of the former. Such reports on safety review are to be performed for RNPP-1,2 and SU NPP-1 within activities on their lifetime extension.

4.5.2. 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 nuclear installations were verified for their compliance with requirements, standards, criteria and rules on nuclear and radiation safety as described in para. 4.5.2 of the previous Report.

Regulatory inspection is carried out by the Residence State Nuclear Safety Inspectorates, which are regional SNRCU offices and state inspectors of the SNRCU headquarters. Inspectors' activity is governed by applicable regulations, special programmes and inspection schedules. In comprehensive inspections, both the experts of SNRCU relevant divisions and Residence State Nuclear Safety Inspectorate are involved.

In the framework of technical cooperation with IAEA, peer reviews of the operational safety are performed by the OSART mission experts. The reports on these missions, as good practice, point out state surveillance through inspections, examinations, and qualification of NPP personnel and management, as well as analysis of administrative, operational and reporting documentation.

Ukraine has created the legislative and regulatory framework for a comprehensive and systematic safety assessment throughout the life stages of nuclear installations.

The established assessment requirements are strictly followed by operating organization as confirmed by integrating activities on safety assessment and safety review for power units in operation, adherence to the established schedule and introduction of corrective measures based on the safety assessment results.

4.6. Radiation Protection (Convention Article 15)

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public 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 Ionizing Radiation" aimed to protect an individual, his life, health and property against negative effect of ionizing radiation prescribes practical steps to implement the underlying Law "On Nuclear Energy Use and Radiation Safety" and establishes permitted irradiation dose rates for personnel and population. The Law also outlines the scope of authority and obligations of the state bodies responsible for radiation protection.

In 2001 the Law of Ukraine "On Human Protection Against Ionizing Radiation" was amended to bring the requirements of the Law in full compliance with recommendations of the International Commission on Radiological Protection (ICRP).

The regulatory documents in effect, namely, "Radiation Safety Standards of Ukraine NRBU-97" and the Addendum thereto "Radiation Protection Against Sources of Potential Irradiation" (NRBU-97/D-2000)" comply with the key provisions of the Law of Ukraine "On Human Protection Against Ionizing Radiation" and are based on international experience backlog to reflect the modern trends and principle approaches to establish permissible dose levels of and protection against radiation, take into account recommendations of international organizations, like IAEA and ICRP.

NRBU-97 standards determine basic principles of radiation protection as applied to practical activities and intervention situations, introduce a system of radiation and sanitary regulations to ensure established irradiation levels both for an individual and for the public. Namely, they prescribe effective dose limits for A-class personnel (20 mSv/year) and for population (1 mSv/year), as well as external dose equivalent for lens, skin, wrist and foot that comply with ICRP recommendations Publication 60.

NRBU-97/D-2000 standards extend the NRBU-97 application, incorporating sources of potential irradiation into the system of radiation and sanitary regulation. Taking advantage of the most recent achievements in the field of radiation protection against potential exposure, the document introduces a series of new provisions, namely:

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

The basic principles of radiation protection and the ALARA principle in particular (optimization principle), are implemented in Ukraine through development and introduction of regulatory standards, norms and rules, and through development and introduction of proper operational procedures. Among the activities introducing the ALARA principle a series of organizational and technical measures are to name. These are implemented at Ukrainian NPPs with the purpose to reduce individual and collective doses of personnel, minimize releases and discharges and advance the radiological monitoring systems.

Adherence to the radiation protection norms and sanitary regulations at nuclear energy enterprises is monitored by the State Sanitary-Hygienic 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, their dynamics and release/discharge rates of a nuclear installation.

Figure 1 (Annex 5) reflects the dynamics in collective dose for Ukrainian NPP personnel for the period from 1998 to 2006.

Figure 2 (Annex 5), respectively, reflects the dynamics in average annual individual dose for NPP personnel for the same period. As can be seen from the diagrams, in recent years the dose rate for personnel of Ukrainian NPPs tends to reduce.

Figure 3 (Annex 5) shows individual dose distribution for personnel of Ukrainian NPPs for the period of 2004-2006. It can be inferred from the bar charts that individual doses of the majority of those monitored at Ukrainian NPPs are below 2 mSv. For the 2005-2006 period there were no individuals at Ukrainian NPPs registered to have the irradiation dose exceeding 20 mSv/year.

Figure 4 (Annex 5) shows the percentage ratio of individuals among the NPP personnel whose annual effective dose exceeds 15 mSv. The analysis testifies that every year the number of such individuals is decreasing as the personnel exposure doses at Ukrainian NPPs are decreasing.

Figure 5 (Annex 5) shows the percentage ratio of NPP personnel collective dose to the amount of the electric power produced, per.s.Sv/MW.year. The figure shows the stable trend of power generation increase for the last few years with the total collective dose of NPP personnel decreasing. The high collective dose of the SU NPP and RNPP personnel in 2006 is entailed by increase of radiation-dangerous operations performed during the capital repair of power units.

Figures 6, 7 and 8 (Annex 5) show the dynamics in airborne radioactive releases at Ukrainian NPPs for the last nine years.

The values of actual releases as recorded by the regular radiation monitoring systems at Ukrainian NPPs are much below the permissible levels, established taking into account appropriate dose limit quotas for the public.

Total indices (percentage ratio of actual release to the permissible one) of airborne releases to the environment in terms of main nuclides (inert radioactive gases, iodine radionuclides and long-lived radioactive nuclides: 137Cs, 134Cs, 60Co, 54Mn, 90Sr) in 2006 constituted 0,16 % at ZNPP, 0,28 % at RNPP, 0,26 % at SUNPP, 0,09 % at KNPP. Figure 10 shows dynamics in total indices of airborne releases of radioactive substances into the environment at the Company's NPPs for the period from 2000 to 2006.

Total indices (percentage ratio of actual discharges to the permissible one) of registered water discharges to the environment in terms of main nuclides (137 Cs, 134 Cs, 60 Co, 54 Mn, 90 Sr, 3H) in 2006 constituted 0,15% at ZNPP, 2,27% at RNPP, 7,58% at SU NPP, 3,61 % at KhNPP. Figure 10 shows the dynamics in total indices of radioactive substance discharges into the environment at NAEK "Energoatom" NPPs for the period from 2000 to 2006.

As can be seen from Figures 9 and 10, in recent years discharge and emission indices tend to stably reduce, what consequentially reduces population irradiation on the

territories in proximity to NPP sites.

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

There are several thousand samples in the radiation control area selected annually for further inspection and control. These can give the irradiation picture as related to the surface air, surface water and components of terrestrial and aquatic ecosystems. Sample analysis of surface air in the area of NPP location shows the radionuclide composition to be predominantly presented by 137Cs, 60 Co and 90 Sr nuclides.

In 2006 the radioactive substances content in the air in proximity to ZNPP constituted for 137Cs – < 0,4 – 3,2 mBq/m3, for 90Sr – < 0,1 - 0,40 mBq/m3. At RNPP the content of 137Cs radionuclide in atmospheric air varied from 3,2 to 21,6 mBq/m3. At SU NPP the content of radioactive materials in atmospheric air varied for 137Cs from < 1,4 to 1,1 mBq/m3, for 90Sr – from 0,20 to 1,92 mBq/m3. At KhNPP the content of radioactive materials in atmospheric air varied for 137Cs - from 0,4 to 5,5 mBq/m3, for 90Sr – from 0,3 to 2,4 mBq/m3.

Concentrations of radionuclides in the surface layers of atmosphere for all NPPs are essentially lower than the permitted values for these radionuclides and are at the "zero background" level.

Thus, Ukraine is implementing provisions of Convention Article 15.

4.7. Emergency Preparedness (Convention Article 16)

4.7.1. 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.

For the three years passed from preparation of the previous National Report, Ukraine has implemented a number of measures to develop emergency preparedness and response system to radiation accidents and incidents. The emergency preparedness and response system continued to operate within the Unified State System of Prevention and Response to Man-made and Natural Emergencies (USSE), whose description and a list of regulations in the sphere of emergency preparedness were presented in the previous Reports.

In the framework of the USSE SNRCU is responsible for the functional subsystem "Safety of Nuclear Power Facilities" that operates at installation and national levels. The activities of the Information and Crisis Centre (ICC) as an executive division of the USSE functional subsystem have already been presented in previous Reports. The reliable electrical power supply system, telephone conversation recording system and automated telephone dialling system for personnel warning were put into operation at the ICC during the reporting period.

With the aim to strengthen the normative base of the USSE functional subsystem "Safety of Nuclear Power Facilities", two important documents were developed in 2006.

First, in order to implement the Radiation Accident Response Plan (НП-306.5.01/3.083-2004), the Response Plan of the functional subsystem "Safety of Nuclear Power Facilities" was developed, approved by the SNRCU Board and put in force by the SNRCU order No.4 of 10 January 2006. This plan is the SNRCU main internal document that regulates functioning of its emergency preparedness and response system. All other instructions and procedures are to be developed in accordance with this plan. The plan supersedes the out-of-date previous document issued by the former State Committee on Nuclear and Radiation Safety of Ukraine in 1994.

Second, the procedure on information exchange between SNRCU and the Ministry of Emergencies of Ukraine in the case of emergency was updated taking into account the changes in the normative base and accumulated experience of the document application. The procedure was approved by the joint order No. 31/103 of 27 February 2006. Because protection of population and territories in case of emergencies is within the competence of the ministry, and SNRCU is the primary recipient of information on radiation accidents occurred beyond Ukrainian borders, the co-operation of these central executive authorities is an important factor for ensuring public protection in Ukraine.

Implementation of the abovementioned Radiation Accident Response Plan (NP-306.5.01/3.083-2004) is in progress. To meet requirements of this document relating to facilities threat categorization and emergency classification, the NPP Sample Emergency Plan (PNA-.0.20.192-05) was revised in 2005; development of the Reference Radiation Accident Response Plan of the USSE territorial subsystems whose territory falls within NPPs supervision zones, is under way.

In the USSE framework the Ministry of Fuel and Energy of Ukraine is responsible for the functional subsystem "Nuclear Power and Fuel & Energy Complex". The System of Preparedness and Emergency Response (SER) of the NAEK "Energoatom" that provides for preventing accidents at NPPs and mitigating their consequences, is an integral part of this functional subsystem. Information on functions and concept of emergency planning and response of NAEK "Energoatom" is presented in the previous National Reports.

In the period of 24-28 April 2007, the NAEK "Energoatom" hosted the WANO-Moscow Center's technical support mission. Based on the Mission results, an excellent grade was given to state of operating organization's preparedness to prevent and response to radiation accident and mitigate its consequences.

During the last three years the operating organization has developed and brought into effect the following main documents which regulate functioning of the SER of the NAEK "Energoatom":

- "Main provisions on organization of the "Energoatom" System of preparedness for and response to accidents and emergencies at Ukrainian NPPs" (PL-D.6.20.089-05);
- "Energoatom" Headquarters' Emergency Response Plan (PN-A.6.20.173-05);
- "Sample procedure of functioning and information exchange of NPPs' crisis centers" (RG-T.0.03.178-07). Based on this document plant-specific procedure were developed for crisis centers of each NPP;
- "Procedure on establishing and usage of NPP reserve resources and an emergency set to be used in case of emergency" (PL-D.0.20.401-06);
- "Program on the development of "Energoatom" SER for the period up to the 2010" (PM-D.0.20.396-06);
- "Provisions of the "Energoatom" Commission on Emergencies (PL-D.0.20.401-06)";
- "Provisions on usage of the backup Crisis Centre in the "Energoatom" SER" (PL-D.0.20.069-06);
- "Procedure for individual internal and external personnel dose control in emergencies. General requirements (STP 0.020.063-2006);
- "Procedure for planning of dose burden of the personnel engaged in accident consequence mitigation. General requirements (STP 0.020.062-2006)";
- "Procedure for assessment of the scale and significance of NPP accidental releases and effluents into the environment. General requirements. (STP 0.020.061-2006);
- and emergency plans of "Energoatom" separated divisions, namely: NPPs, "Atomremontservice", "Emergency Technical Centre".

The main and backup Crisis Centers as well as the "Emergency Technical Centre" are included into the "Energoatom" SER.

The main Crisis Centre of the NAEK "Energoatom" is located at the premises of the operating organization headquarters in Kyiv. In 2005 construction works were completed,

local computer network was established, the NPP parameters transfer system was put into commercial operation enabling to transfer in real time information on NPP status. This system is designed to transfer up to 10-15 thousand parameters from each NPP power unit, except for Khmelnytsky Unit 2. Around 60 parameters are being transferred today from this power unit. Activities were started in 2006 to establish at the premises of "Energoatom" Crisis Centre a library of the normative and technical documentation.

The backup Crisis Centre of the NAEK "Energoatom" was established and operates on the base of the former Off-site Crisis Centre of Chernobyl NPP in the village of Dniprovske of Chernigiv region. During the reporting period the room for the Executive Team of the "Energoatom" Commission for Emergencies that is located in the backup Crisis Centre was reconstructed. One of other rooms was redesigned for work of the engineering support group and equipped with the advanced computers. The Emergency Technical Centre of "Energoatom" is located in the village of Bilogorodka, Kyiv region. In case of emergency at NPP, specialists of the Emergency Technical Centre are to be dispatched to this NPP where they are subordinated to the on-site accident commander. Using, in necessary, robotized and other unique equipment, the Centre helps the NPP personnel to conduct radiological and engineering survey, localization and collection of radioactive wastes, decontamination, and etc.

With the purpose of providing reliable communication in case of emergency the NAEK "Energoatom" established satellite communication system that embraces the main and backup Crisis Centers, Emergency Technical Centre, the Crisis Centers of Rivne, Zaporizhzhya, Khmelnytsky and South-Ukraine NPPs. The System of automatic notification of "Energoatom" Commission on Emergencies was put into operation.

In addition to the above mentioned main and backup Crisis Centers of the NAEK "Energoatom", each NPP has its internal (on-site) and external (located off-site, in the NPP supervision zone).

An NPP on-site Crisis Center's function is to control over actions on accident localization and mitigation of accident consequences at NPP site and in the sanitary-protective zone. An NPP external crisis centre is to be used in cases if work in an internal crisis centre becomes impossible due to severe accident conditions.

Works on bringing NPP Crises Centers in compliance with provisions of the regulatory document "Requirement to NPP On-site and Off-site Crises Centers", which became effective in 2004, are conducted pursuant to the schedule approved by SNRCU and shall be completed by the end of 2007.

To train NPP personnel to perform actions during emergencies, for improving its knowledge and skills related to accidents localization and mitigation of accident consequences, the plant-level, unit-level, shop-level and individual emergency exercises are conducted. More detailed information about exercise preparation and conduct is presented in the previous National Reports.

In September 2005 a full-scale emergency exercise was conducted at South–Ukraine NPP, and in November 2006 - at Zaporizhzhya NPP with involvement of specialists of the Ministry of Fuel and Energy of Ukraine, the Ministry of Ukraine of Emergencies and Affairs of Population Protection from the Consequences of Chernobyl Catastrophe, the Ministry for Health of Ukraine. SNRCU took part in both exercises, activating its ICC. The specialists of SNRCU resident inspectorates participated in the exercises on sites directly. Experts of U.S.NRC, SKI and National Agency of Atomic

Energy of Poland observed the Zaporizhzhya NPP exercise at ICC. Experts from the Russian Federation observed the exercise in headquarters of the operating organization, French experts – at Zaporizhzhya NPP.

In the course of emergency exercises the ICC worked out its interactions with the Crisis Centers of both NAEK "Energoatom" and NPPs, communication with the Ministry of Fuel and Energy of Ukraine and the Ministry of Ukraine of Emergencies and Affairs of Population Protection from the Consequences of Chernobyl Catastrophe was simulated; the internal emergency operating instructions were checked out for adequacy and sufficiency as well as the technical status of equipment and communication means. Emergency notification of the IAEA under the Convention on Early Notification of a Nuclear Accident as well as other countries that have bilateral agreements with Ukraine on mutual notification in case of a nuclear accident was simulated as well.

In accordance with intergovernmental agreements and co-operation plans, specialists of the NAEK "Energoatom" are systematically engaged in emergency exercises at NPPs of the Russian Federation and France.

On May 11-12, 2005 SNRCU jointly with the Ministry of Emergencies of Ukraine and Hydrometeorological Centre took part in international exercise ConvEx-3 that was conducted under the IAEA aegis. During almost two days ICC was activated, interactions with the organizations above as well as information exchange with the IAEA Incident and Emergency centre and competent organizations of other countries were worked out.

With the purpose of improving its emergency preparedness and response system and working out actions in case of radiation incidents with terrorist issues, in December 2005 SNRCU prepared and conducted an internal table-top emergency exercise with participation of observers from the Security Service of Ukraine and the Ministry of Emergencies of Ukraine.

During the reporting period the SNRCU resident inspectorates at NPPs with the purpose of regulatory control took part in the numerous emergency exercises conducted by NPPs. Actions of NPP personnel and state of NPP emergency response system were assessed in the course of exercises.

According to the plan of the Ministry of Emergencies of Ukraine, the annual drills and exercises are conducted on the territories that may fall to the areas of potential radioactive contamination in case of accident. The purpose of such exercise is to verify efficiency of the plans on public protection in case of radiation accidents at NPPs. The last training of such a type with participation of the ministry representatives took place in Khmelnytsky region on May 29 - June 1, 2007. During the exercise in the Netishin (Khmelnytsky NPP`s utility town) response actions of relevant services to simulated accidents, such as chlorine release on municipal purification facilities or release of radioactive materials due to accident at Khmelnytsky NPP were worked out. Operation of the notification system for the town and the NPP supervision zone as well as the provision of public with individual protective means was checked out. During the exercise, the Off-site Crisis Centre of Khmelnytsky NPP was activated.

4.7.2. 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.

In Ukraine, in accordance with the requirements of the "Provisions on Notification and Communications in Emergencies", approved by the Decree of the Cabinet Ministers of Ukraine № 192 of 15 February 1999, the notification system is integrated in the unified national communication system whose arrangement is presented in the previous National Reports.

Taking into account recommendations of IAEA document EPR-ENATOM-2000 in regard to national competent authorities and points of contact in terms of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in case of a Nuclear Accident or Radiological Emergency, the Cabinet of Ministers of Ukraine issued the Decree № 1570 of 2 Octobers 2003, titled "On Appointment of Competent National Authorities for implementation of International Conventions in the sphere of usage of nuclear energy". Pursuant to this decree, SNRCU performs functions both of the single national point of contact maintaining twenty-four-hour duty service and functions of the national competent organization authorized to carry out international information exchange. The Ministry of Emergencies of Ukraine is responsible for exercising functions of the national competent organization authorized to send and receive requests and proposals for assistance.

In addition to the above mentioned international conventions, SNRCU is responsible for implementation of intergovernmental agreements with other countries which envisage prompt mutual notification and follow up information exchange in case of nuclear accident or radiological emergencies. By 1 January 2007, Ukraine concluded 13 such bilateral agreements with Sweden, Turkey, Byelorussia, Slovakia, Hungary, Finland, Norway, Poland, Germany, Austria, Bulgaria, Latvia and Romania, the agreement with the Russian Federation is at the stage of signing.

To implement these agreements, the ICC personnel systematically test communications with competent authorities of the above mentioned countries.

SNRCU took part in the IAEA communication tests ConvEx 1b, ConvEx 2a and in ConvEx 2c exercise that based on the scenario of a simulated accident at the "Embalse" NPP in Argentina. Such exercises are conducted by IAEA periodically to test communications between the agency and national competent organizations.

The emergency response system is being developed and continuously improved in Ukraine.

The emergency planning system foresees verifications of emergency preparedness at the state and facility's levels by conducting emergencies drills and exercises.

Measures are provided on informing of population, public institutions and international organizations.

SECTION V. SAFETY OF INSTALLATION

5.1. Siting (Convention Article 17)

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

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

The requirements on siting are established by Ukrainian legislative and regulatory documents. The decision-making procedure and requirements for materials which justify the need to build a nuclear installation are determined in article 37 of Law of Ukraine "On Nuclear Energy Use and Radiation Safety". In particular, the submittals must necessarily include the following:

- characteristics of the environment in the area of possible location of an installation;
- assessment of impact on the public and the environment (EIA) resulted from the planned civil works, commissioning, operation and decommissioning;
- designed measures to prevent the adverse impact on the environment and to mitigate this impact.

Criteria for evaluating factors that can affect safety of nuclear installation are determined in regulations on nuclear and radiation safety, as well as, by the state civil engineering standards. These documents identify indexes, which characterize natural, economic and demographic situations in the site area, information of the pre-operational monitoring of the environment, and meteorological, whether, geological, seismological, hydrological, hydro geological, engineering-geological and geochemical characteristics.

SNRCU is elaborating a normative document that sets up safety requirements for siting of a nuclear power plant and takes into account the IAEA's recommendations No. NS-R-3.

During the reporting period the "Energy Strategy of Ukraine for the period till 2030 year" was approved in Ukraine pursuant to Order No. 145-p of the Cabinet of Ministers of Ukraine dated March 15, 2006, that provides for building of new power units at NPPs, including new sites.

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

The legislative and regulatory documents of Ukraine regulate the evaluation of potential safety impact of the nuclear installation on individuals, society and the environment.

In accordance with the legislation of Ukraine, the potential safety impact of a nuclear installation is evaluated through a state ecological review.

In accordance with Article 13 of the Law of Ukraine "On Ecological Review", the state ecological review is organized and conducted by ecological expert departments, specialized establishments, organizations or specially set-up committees of the authorized central executive authorities of the Ministry for Environment and Natural Resources of Ukraine.

Pursuant to article 36 of the Law of Ukraine "On Ecological Review" the environmental impact assessment of the planned or on-going activity shall justify its usefulness and ways of implementation, possible alternative solutions, 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 of activity, measures to reduce ecological risk and meet ecological safety requirements.

As a rule, the state ecological review is carried out either as an integral part of the state comprehensive review or as a separate review when it is not aimed at evaluating the construction design but EIA materials developed as individual document not included in the design documentation. EIA materials regarding KhNPP-2 and RNPP-4 completion were subjected to individual state review and were positively evaluated.

SNRCU grants a license provided that there is a positive conclusion of the state ecological review and other reviews required by the legislation.

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

Pursuant to Article 33 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", an Operator must, following the rules, standards and norms on nuclear and radiation safety, periodically re-assess the safety of a nuclear installation or radioactive waste repository and report on its results to SNRCU.

The safety reassessment is also carried upon SNRCU's request in case of substantial changes in the design of repository or installation, and also if operating experience clearly shows deficiencies of the previous re-assessment.

In order to keep the acceptable level of environmental safety and to ensure timely corrective measures, re-assessments of appropriate factors and characteristics of the area where the nuclear installation site is located can be carried out as necessary. Such re-assessments are needed in the following cases:

- decision made on co-location of an additional nuclear installation on site (in Ukraine such re-assessment were carried out through a state ecological review at ZNPP in connection with construction of the spent nuclear fuel storage facility and at KhNPP and RNPP in connection with construction of power units);
- new scientific information that indicate the need to revise the input data of natural factors incorporated in the design (research was carried out at RNPP to predict possible development of internal erosion and karst processes; additional seismic investigations took place at ChNPP and SUNPP – detailed information is provided in para. 5.1.4 of the Second Report);
- negative trends in the dynamics of monitoring data (hydro geological, engineering-geological, etc.), for example, subsidence or sloping of buildings.

In order to prevent negative impacts which can result from the combination of man-made and natural factors with equipment failures, SNRCU, while establishing requirements for the content of safety analysis reports on nuclear installations, emphasized the need for in-depth analysis of the factors.

5.1.4. 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.

In accordance with DBN A.2.2-1-95 "State Civil Engineering Standards of Ukraine", "Structure and Content of Environmental Impact Assessment (EIA) Materials in Design and Construction of Enterprises, Buildings and Structures. Basic Design Provisions", if there is a likely impact of the planned activity on the territory of neighbouring states, transboundary EIA is to be developed in accordance with "Convention on Environmental Impact Assessment in a Transboundary Context" ratified on 19.03.1999 by Law of Ukraine No. 534-XIV "On Ratification of the Convention on Environmental Impact Assessment in a Transboundary Context".

While developing designs for completion of Khmelnytsky NPP Unit 2 and Rivne NPP Unit 4 construction, the following reports were published in mass media:

- Environmental Impact Assessment of Khmelnytsky NPP Unit 2 Completion Designs, Mouchel Consulting Ltd., 1998;
- Environmental Impact Assessment of Rivne NPP Unit 4 Completion Designs, Mouchel Consulting Ltd., 1998;
- Environmental Impact Assessment of Khmelnytsky NPP Unit 2 and Rivne NPP Unit 4 Completion Designs. Environmental Impact Assessments of the alternative non-nuclear power supply sources. Mouchel Consulting Ltd., 1998.

In the framework of public consultations, the materials on power unit completion designs and environmental impact assessments were provided to the national and foreign organizations, international news agencies and other mass media, including official representatives of other states.

In accordance with Law of Ukraine No. 2861-IV "On Decision Making Procedures for Siting, Designing, Construction of Nuclear Installations and Radioactive Wastes Management Facilities of National Importance" of 08 September 2005, the reports on measures aimed at notification of neighbouring states of a potential transboundary impact shall be developed for new nuclear installations and facilities designed for radwaste management of national importance.

Ukraine has developed the legislative and regulatory basis to ensure compliance with the justification principle of the activity related to ionizing radiation.

Scheduled and special evaluations and re-assessments of natural and man-made factors are regularly carried out.

Measures are taken to prevent adverse impacts on safety of nuclear installations.

While siting and building new nuclear installations, the measures imposed by the law must be taken to inform neighbouring states of any potential impact in the transboundary context.

5.2. Design and Construction (Convention Article 18)

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

5.2.1. 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 2000 SNRCU put into force the normative document "General Provisions on Safety Assurance of Nuclear Power Plants" (NP 306.1.02/1.034-2000). This document set up criteria, requirements and conditions of safe operation as well as principles and character of technical and organizational safety measures as described in detail in para. 5.2.1 of the previous Report.

In order to provide the regulatory support for designing new advanced nuclear installations, SNRCU has elaborated a normative document that sets up the basic technical safety requirements for new NPP units and takes into account the IAEA's recommendations (No. NS-R-1).

The designs of all nuclear installations constructed in Ukraine after the implementation of this regulation were subjected to revision regarding their compliance with the established requirements. In particular, considerable changes were made to the designs and implemented in KhNPP-2 and RNPP-4 construction to strengthen protective barriers, upgrade technological processes and equipment.

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

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

The technical and organizational decisions made to upgrade and improve the safety level incorporate scientific and technical achievements and are implemented in accordance with the established requirements, namely: they should be proven by the experience or by trial operation. The upgrading requirements are imposed in SNRCU's regulation "Requirements for nuclear installation modifications and for procedure of their safety evaluation" (NP 306.2.106-2005), which was developed based on IAEA NS-G-2.3.

The licensing procedure provides for the need to introduce at first a technology at a "pilot" power unit and then, after having acquired favourable results of trial operation, to adapt this measure to other power units. This procedure fully complies with the international experience and permits implementation of measures on the basis of the operating experience and proven practice.

Thus, new computer information and safety-related control systems (emergency and preliminary protection, neutron flux monitoring) that were developed with using up-to-date

information technology and new element base, were implemented at ZNPP in pilot operation. These systems were implemented at new power units of RNPP and KhNPP only after results of their trial operation were obtained and analyzed.

The introduction of new nuclear fuel design at KhNPP, and later on the other NPPs, was preceded by its few years' implementation at the Kalinin NPP of the Russian Federation.

Pilot-operated safety devices of steam generators, primary circuit pressurizers, the containment hydrogen afterburning and monitoring system are implemented following the same procedure.

5.2.3 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.

The NPP design provides for measures intended to make personnel errors impossible or to mitigate their consequences including those in maintenance.

The design provides for the operator information support system incorporated in the NPP monitoring and control system, which also provides for a system of on-line display of summarized information for personnel on the current safety status of a reactor and NPP unit as a whole.

The NPP unit control and monitoring system is designed so as to ensure the most favourable conditions for enabling the operating personnel to make correct decisions on NPP control and to minimize erroneous decisions.

The experts of OSART mission that took place at South Ukraine NPP in October 2006 pointed out a significant number of computer systems that facilitate and assist the operators in collecting and processing data during normal operation as well as a high level of skills of the personnel, state-of-the-art programmes and procedures applied in the maintenance area, improvements in the equipment reliability and emergency response planning.

The quality management system was established at SUNPP that got ISO 9001 certificate.

Ukraine has developed and strictly follows the regulatory provisions for a defence-in-depth system in the design and construction. The quality of the design documentation has been essentially improved after implementation of the regulatory licensing of such activity as "design".

Ukraine ensures actual compliance with requirements for the implementation of new technologies based only on favourable experience or trial operation.

5.3. Operation (Convention Article 19)

5.3.1. Each Contracting Party shall take the appropriate steps to ensure that the initial authorization 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.

During the reporting period the legislative provisions for the authorization, as set forth in para. 3.1.2 and 5.3.1 of the previous Report, were actively implemented in practices.

The section provides information on realization of legislation on the example of the permit obtained by the NAEK "Energoatom" for operation of Khmelnytsky NPP - 2. The licensing of Rivne NPP-4 commissioning was carried out in accordance with the established procedure similarly to Khmelnytsky NPP-2. SNRCU issued a license to operate Rivne NPP-4.

In compliance with the Law of Ukraine "On Licensing Activity in the Nuclear Energy" the operating organization "NAEK "Energoatom" submitted an application to SNRCU for a license to operate the nuclear installation at KNPP-2. The content of documents that NAEK "Energoatom" submitted together with the license application was determined by the following:

- Procedure for commissioning and operation licensing of KhNPP-2 and RNPP-4 approved by SNRCU on 02 April 2002;
- Plan of commissioning and operation licensing of KhNPP-2 and RNPP-4.

The terms of the expert assessments and review of submittals have been determined by the documents as follows:

- Plans of measures of SNRCU to ensure implementation of an assignment given by the President of Ukraine in relation to completion and commissioning of KNPP-2;
- Schedule of expert review of SAR materials for KNPP-2 approved by SNRCU.

Review and comprehensive assessment of the application documents by SNRCU was carried out through the state review of nuclear and radiation safety, which is an integral part of the licensing process. The experts of the State Scientific and Technical Centre on Nuclear and Radiation Safety of SNRCU and international experts of RISKAUDIT were involved in the state review of safety substantiation materials and operational documentation.

FSAR is one of the most important licensing documents that passed the state review. Taking into account the great number and volume of documents included in SAR, the findings of the preliminary review were immediately submitted to the operator to incorporate remarks and make necessary corrections. To date the review of all KhNPP-2 SAR sections that were submitted have been completed.

The submitted FSAR was developed according to the requirements of SNRCU's regulation "Requirements for the Content of the Safety Analysis Report for WWER NPPs at the Stage of Issuing a Commissioning Permission" (KND 306.302-96).

General approaches used in the preliminary evaluation of the FSAR materials consisted in assessing the completeness and adequacy of the safety justification information and the compliance of proposed design features with fundamental

safety principles and requirements of standards and rules on nuclear and radiation safety.

In developing the KhNPP-2 FSAR, the research efforts were focused on the following areas:

- analysis of NPP systems and site covering design basis, description of structures and flow charts, information on control, monitoring and testing of systems under normal operation, failures and emergencies;
- analysis of design-basis accidents including a list of initiating events, input data on computer models, description of accident scenarios, determination of potential for keeping safety limits in the event of normal operation violation, emergencies and design-basis accidents;
- level 1 probabilistic safety analysis including analysis of equipment reliability, abnormal events and occurrences, identification and grouping of initiating events, modelling of failure trees, accident sequences, personnel reliability and results of quantitative assessment and their interpretation;
- consideration of results obtained at the unit commissioning stage;
- consideration of changes in the organization structure of the operator.

Expert evaluation of a package of operational documentation and emergency procedures was carried out as well.

The evaluation also dealt with analyzing the incorporation, in the SAR materials, of the safety upgrading measures taken prior to power unit commissioning.

In parallel with the state review on nuclear and radiation safety of the documents required to obtain a license for KhNPP-2 commissioning, SNRCU together with international experts of RISKAUDIT carried out an inspection of the submittals for completeness and reliability. The following was checked:

- administrative quality management;
- preparedness of personnel;
- organization of operation and operational documentation;
- compliance with the license requirements for KhNPP-2 commissioning, safety improvement programmes being in force on NPP site, status of SAR development;
- safe operation of a reactor pressure vessel, safety-related systems (components), buildings and structures;
- availability status of physical protection;
- availability status of fire protection systems;
- emergency response planning and emergency preparedness.

Based on results of the state review and findings of the inspections, SNRCU made a decision to issue licenses for KhNPP-2 and RNPP-4 operation to NAEK "Energoatom" (licenses of EO No. 000289 dated 15.12.2005 and EO No.000313 of 06 April 2006, respectively).

In 2007 these licenses were amended in the part concerning authorized officers responsible for KhNPP-2 and RNPP-4 safe operation.

5.3.2. 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.

Limits and conditions of safety operation established in SAR and reflected in the technical specifications are observed and adjusted on the basis of operational experience, assessment of the current safety level, new scientific and technical information, in connection with equipment upgrading and in accordance with new regulations that have been developed and implemented.

For example, during the reporting period, because of transfer of power units to the 4-years fuel cycle, the operating limit for nuclear fuel burnup was changed. Taking into account this new limit, the analysis of designed-based radiological accident consequences was carried out.

Only after introducing a new type of fuel – TVS-A at Kalinin NPP (Russian Federation) during the 4-years period, developing the respective SAR sections, adjusting the technical specification of unit safe operation and conducting a trial operation of TVS-A at pilot units of Ukrainian NPPs (ZNPP-3 and ZNPP-5) for 3 years, the commercial operation of Russian nuclear fuel new modification TVS-A started at Ukrainian NPPs.

The procedure for modifications at NPPs is set forth in a new normative document of SNRCU "Requirement for Modifications of Nuclear Installations and Procedure for their Safety Assessment" (NP 306.2.106-2005), which takes into account the respective recommendations of IAEA No. NS-G-2.3.

In accordance with the licensing procedure the operating organization – NAEK "Energoatom" developed and submitted to SNRCU a branch technical decision on commercial operation of the modified fuel as well as a package of safety substantiation documents. Based on a positive assessment of the submittals and pilot operation results made by the state nuclear and radiation safety review, SNRCU approved the branch technical decision and issued a permission for commercial operation of nuclear fuel of a new modification at all Ukraine NPPs with WWER-1000.

5.3.3. 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 of safe operation, operating and inspection procedures.

During the reporting period, Ukraine revised and re-approved the technical specifications of safe operation of NPP unit (TSSO) taking into account findings of the comprehensive safety assessment and regulatory requirements that have been implemented.

In order to harmonize requirements the NAEK "Energoatom" developed a standard concerning the type content of TSSO for WWER-1000/V-320 Units that is based on TSSO of pilot ZNPP-5. This standard has been already agreed upon with SNRCU.

In 2008 NPPs with WWER-1000/V-320 as well as other NPPs are expected to start applying the improved technical specifications on safe operation.

In order to maintain the capability of safety-related systems to comply with design requirements, regular maintenance, repair and inspection are carried out. These activities are arranged in compliance with instructions, programmes and schedules and are carefully recorded. The conditions of maintenance, repair and inspection of safety systems are specified in the NPP technical safety substantiation and the respective regulations. The administrative and technical measures are determined to avoid any potential of unauthorized changes in the circuits, instrumentation and algorithms of control safety systems. After maintenance and repair, the systems and equipment are checked for operability and compliance with design characteristics and checking results are documented.

During the reporting period 98 branch technical decisions were developed (40 of them dealt with KhNPP-2 and RNPP-4) to upgrade the NPP safety level.

The operability of safety systems, safety-related systems, monitoring and control means and state of the parent metal and welds of safety-related systems and components are inspected prior to NPP commissioning and in established periods as required by technical specifications and operating instructions. The frequency and scope of periodic inspections are determined in the design and are established by schedules elaborated by NPPs. Unscheduled inspections can be conducted upon demand of the regulatory body.

The tests that are not identified by technical specifications and operating instructions are conducted upon a special permission issued by SNRCU. In order to get such permission, the nuclear and radiation safety of these tests have to be justified.

During the reporting period two OSART Missions were conducted at ZNPP and SUNPP; three WANO peer reviews were conducted at KhNPP-2, RNPP-4 and ZNPP and scheduled inspections were conducted by SNRCU.

NAEK "Energoatom" conducts internal inspections in accordance with the approved programmes, such as: "The Standard Programme of Inspection of NPP Nuclear Safety" (PM-D.0.26.009-05) and "The Programme on Inspection of Safety Culture at NPPs of NAEK "Energoatom" (PM-D.0.26.217-04). As a result of inspections corrective measures have to be developed and realized to eliminate safety deficiencies.

The results of internal inspections performed by the NAEK "Energoatom" for checking the safety status, as well as periodic reports on the current safety level have to be submitted by the operator to the regulatory body. The frequency of submission and requirements for the content of reports are specified by regulatory documents.

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

At present the following documents defining actions to be taken in response to events and anticipated accidents at NPPs are in force in Ukraine:

- Instructions on liquidation of accidents and incidences at the reactor facilities (ILA);
- Guideline on Beyond-design Basis Accident Management (GBDBAM);
- Operating organization's plans on emergency and accident response at Ukrainian NPPs;
- Plans on the public protection in case of man-caused and natural emergencies.

Since 2004 Ukraine has been implementing the programme on development of the symptom-informed emergency operating instructions (SOAI) for all operating power units of NPP. SOAI is developed taking into account the international experience acquired in the area of replacement of ILA and GBDBAM and determines actions of personnel during design-based and beyond-design basis accidents that are based on indications of events, reactor state indicators and prediction of anticipated accident conditions. All these actions of personnel are intended to restore safety functions and restrict radiation consequences. To date, SOAI were developed for pilot units RNPP-1, ZNPP-5 and SUNPP-3 and submitted to SNRCU for approval. The implementation of SOAI is being completed at pilot units RNPP-1 and ZNPP-5. SOAI are expected to be implemented at non-pilot power units in 2008-2009.

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

The Scientific and Technical Centre (Separate Entity "STC") of NAEK "Energoatom" together with special subdivisions of NPPs provides engineering and technical support in compliance with the approved instructions that determine obligations, interfaces, organization of activities and contractors. In particular, divisions dealing with engineering and technical support develop regulations and instructions, observe the implementation of programmes related to safety systems, analyze results of tests, as well as visual and nondestructive examinations of metal and welds. The NPP organizational structure covers all types of technical support including individual upgrading activities undertaken by contracted organizations including licensed contractors. In particular, the upgrading of NPP equipment safety valves is being conducted to ensure their compliance with the current safety requirements.

NAEK "Energoatom" maintains permanent communication with the Russian Federation organizations that took part in NPP design and now continue to provide engineering support (for example: the Russian Scientific Centre "Kurchatov Institute", OKB "Gidropress", FSUE "SSC RF RIAR").

5.3.6. Incidents significant to safety are reported in a timely manner by the holder of the relevant license to the regulatory body.

According to the "General Provisions on Safety Assurance of Nuclear Power Plants", the operator bears the responsibility for the completeness and quality of investigations, timely submission of investigation findings to the state regulatory body and the development and implementation of measures to prevent further violation of normal operation and prevent accidents.

Information on all violations of normal operation, incidents and accidents that occur at NPPs is communicated to the state regulatory body.

Investigations are carried out in compliance with SNRCU's document: "Procedures for Investigating and Accounting NPP Operational Events", which determines:

- procedure for investigation of events (establishing an investigation commission, determining direct and route causes, assessing in terms of safety impact, developing corrective measures);
- procedure for events accounting;
- procedure for notification about events occurred in NPP operation.

In case of any operational event occurred at NPP, the following has to be transferred to the regulatory body and other organizations:

- Immediate notification of the event (within an hour);
- Preliminary notification of the event (within 24 hours);
- Additional notification of the event (within 5 days following its occurrence in case of any changes revealed);
- Report on investigation of the event (within 5 days following completion of the investigation commission's work);
- Report on implementation of corrective actions specified upon the findings of investigation of events occurred in NPP operation (quarterly for each NPP).

If necessary, representatives of the state regulatory body and its experts are involved in the event investigation commission.

A report on the event investigation is sent to all Ukraine NPPs and the operating organization. The NPP administration reviews this report, makes it available to the subordinate personnel for familiarization, holds necessary briefings, and, if necessary, supplements or adjusts personnel training programmes.

The operating organization reviews this report (analysis of level 2 events) and, if necessary, requests a NPP to conduct additional investigation or adjust and supplement this report. The operating organization sends a letter-demand to other NPPs to take appropriate corrective measures at these NPPs, if an event is of a general-branch character.

The corrective measures to liquidate the event consequences and avoid re-occurrence of such events must be implemented. All these measures have to be listed in the respective work implementation programmes.

SNRCU analyses all events that occurred during the current year and supervises associated investigations, development of preventive and corrective measures and their

implementation. Based on analysis of investigations, data for the previous years are compared annually with data for the current year. If necessary, appropriate regulatory decisions are made.

In 2006:

- The number of reported events decreased as compared with the number of reported events in 2006 (34 in 2005 against 32 in 2006);

- There were no violations of limits and conditions of safe operation;

- There were no actuations of safety systems for the direct purpose under the mode not related to the assurance of a safety function.

Over the first 6 months of 2007 the number of events occurred at Ukraine NPPs is twice as little than the number of events occurred over the similar period in 2006.

5.3.7. Programmes to collect and analyze 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 organizations and regulatory bodies.

The operating organization provides for collecting, processing, analyzing and storing of the information on equipment failures and personnel erroneous actions, ensures systematization and on-line transfer of the information obtained. The information on equipment failures and personnel errors is included in annual reports on the current safety status.

The safe operation of NPPs is supported by an information database on incidents, which is included in the unified information system of the operating organization – "Information System on Operational Events at Ukrainian NPPs".

The system provides for collection, analytical processing of information and exchange of the information with the similar information system of the state regulatory body.

NAEK "Energoatom" implemented programmes intended for the exchange of information on the operational experience:

- Ukrainian database on reliability (for engineering support of equipment flaw detection system and determination of reliability characteristics of safety-related equipment and systems).
- Information system of operational events (for collecting, processing, analyzing and storing of information on equipment failures and personnel errors).
- System for assessing operational safety and technical state of NPPs with WWER (for preparing reports on NPP performances and current safety state of power units).

The operating experience is thoroughly reviewed. To perform these tasks special departments were established in the operating organization and at NPPs. IAEA and WANO are regularly informed of significant events on the basis of bilateral information exchange.

The appropriate communication is maintained with NPP designers, research institutions and equipment manufacturers to familiarize them with the operating experience and to get their respective recommendations, if necessary.

5.3.8. 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.

The design of each NPP provides for process systems and facilities for the collection and preliminary treatment of solid and liquid radioactive waste directly on-site. NPP administration ensures the account of the amount, movement and location of all fissile and radioactive materials, fresh and spent fuel, dismantled equipment, contaminated tools, clothing, radioactive waste and other radiation sources.

Pursuant to the regulatory requirements, each NPP has its Programme on radwaste management that is implemented under continuous supervision of SNRCU. These programmes provides for organizational and technical measures aimed at minimizing the levels of radioactive waste generation and improving the radwaste management system.

Each NPP has developed and takes measures to minimize the generation of radioactive waste.

Special attention was given to measures on construction and commissioning of Complexes for liquid and solid radwaste treatment that permit to reduce the amount of radwaste that have been already accumulated and those being generated.

In the frameworks of the regulatory monitoring SNRCU has assessed design materials that are related to the commissioning of:

- deep evaporation facilities intended for liquid radwaste at South Ukraine NPP;
- centrifugation facilities at Khmelnytsky NPP;
- solid radwaste processing complex at Rivne NPP.

The detailed information on radioactive waste management at NPPs is provided in Ukraine's National Report on Compliance with the Obligations of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Ukraine consistently pursued the principles of the state policy regarding authorization in the use of nuclear energy. Only completed development of the safety analysis reports permitted licensing of nuclear installations in accordance with the legislatively-established procedure.

The operating organization ensures compliance with the requirements of technical specifications of NPP safe operation developed and approved in accordance with the established procedure, as well as revision and amendment of this document with taking into account the acquired experience and operating practices.

Ukrainian NPPs developed appropriate guidelines and instructions to govern personnel actions in the event of emergencies. A mechanism was created for examining

personnel's knowledge of these documents and verifying the effectiveness of the established requirements and provisions.

A well-developed system of engineering and technical support of the installation-wise and branch level ensures solving safety issues throughout all life cycle of nuclear installations.

Ukraine created and implemented a mechanism of notifying the regulatory body of safety-related incidents, investigating these incidents, taking correcting actions and monitoring their implementation.

Ukrainian NPPs have created and maintain databases within the unified information system intended for the collection, accumulation, processing, analysis and interpretation of results in appropriate areas of knowledge, as well as the information exchange.

Annex 1

List of NPPs Operated In Ukraine

1. Operating Power Units

NPP	Power Unit No.	Power capacity, MW	Reactor Type	Date of Commissioning
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 Ukrainian	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
Khmelnytsky	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)
Khmelnytsky	3	1000	To be determined	Research is underway
	4	1000	To be determined	

3. Shut down Power Units

NPP	Power Unit No.	Reactor Type	Date of Operation Termination
Chornobyl	1	RBMK-1000	30 November 1996
Chornobyl	2	RBMK -1000	11 October 1991
Chornobyl	3	RBMK -1000	15 December 2000
Chornobyl	4 - Shelter Object	Destroyed reactor RBMK -1000	26 April 1986

Annex 2

ASSESSMENT OF THE STATE OF SAFETY IMPROVEMENT MEASURES IMPLEMENTATION AT UKRAINIAN NPP UNITS ACCORDING TO IAEA RECOMMENDATIONS

1. WWER-1000/V-320, V-302, V-338 NPPs

Issue No.	Issue Title	Issue Rank	Status	Comment
AREA: GENERAL (G)				
G1	Classification of components	II	Completed	Classifiers are developed for all types of reactors. Analysis of classifiers, as well as of the list of deviations of pilot unit No. 5 at ZNPP (as a part of SAR (safety analysis report)) was assisted by US NRC experts.
G2	Qualification of equipment	III	Underway	"Lists of Equipment and Components of Safety-significant Systems Subject to Qualification (for design of WWER-1000/V-320)" were developed. All the equipment being installed passes complete qualification in accordance with the licensing procedure.
G3	Reliability analysis of safety class 1 and 2 systems	II	Underway	A system for collecting and assessing data on reliability of components has been implemented at all NPP. Class 1 and 2 safety systems reliability analysis was performed for SUNPP-1, ZNPP-5, KhNPP-2, and RNPP-4. Adaptation of SAR for non-pilot units is being performed.
AREA: REACTOR CORE (RC)				
RC1	Prevention of uncontrolled reduction of boric acid concentration in the primary circuit coolant.	II	Underway	Additional protections and interlocks have been implemented to avoid uncontrolled boron dilution. Work is underway to arrange new places for boron concentration monitoring and boron meter replacement. Within the SAR for SUNPP-1, ZNPP-5, KhNPP-2, and RNPP-4, analysis was made of accidents concerning unpredicted reduction of moderator concentration in the primary circuit. Measures were taken to prevent distillate entering to the primary circuit.

Issue No.	Issue Title	Issue Rank	Status	Comment
RC2	Reliability of inserting CPS (control and protection system) control rods into core. Deformation of fuel assembly.	III	Done	From 1995 to 2001, NPP units took a number of measures intended to improve reliability of control rod insertion in the core: - Perforation of CPS CR (control rod) drives; - Reconstruction of protective tubes assembly elements; - Implementation of new types of fuel "TVZ-M" and "TVZ-A" - CPS CR overloading.
RC3	Subcriticality monitoring during reactor shutdown	II	Underway	Substitution of equipment for neutron flux monitoring is carried out for upgraded one that includes means to monitor subcriticality of a reactor shut down.
AREA: ELEMENTS INTEGRITY (CI)				
CI1	Reactor pressure vessel embrittlement and monitoring	III	Underway	Database is being kept on reactor vessel radiation embrittlement; nondestructive monitoring is being performed through ultrasonic testing methods. At all power units, heating up of boron solution was performed within ECCS hydro-accumulators up to the temperature of +55°C and an integral program of surveillance specimens is being realized. All power units were transferred to the strategy of refuelling with low-level flux of neutrons for KhNPP-2 and RNPP-4, calculation and experimental methodology of the Nuclear Research Institute of the Ukrainian Academy of Sciences was implemented to determine neutron flux at critical elements of reactor vessel. Thermal hydraulic calculations were made as well as substantiation of conditions of thermal shock on the reactor vessel.
CI2	Non-destructive testing	III	Done	Methods of nondestructive monitoring of equipment (visual, ultrasonic, eddy-current) are widely used at NPP. Methods and means of nondestructive control, as well as the staff engaged undergo certification on the basis of normative and technical documentation in force.
CI3	Primary pipe whip restraints.	II	Underway	A system of remote control to monitor the primary circuit conduits transfer had been installed. Also transfer restrainers have been installed. Substantiation is being

Issue No.	Issue Title	Issue Rank	Status	Comment
				carried out of applying the concept 'leak before break' for the reactor coolant piping and connecting tubing of the pressurizer.
CI4	Steam generator collector integrity.	III	Done	Analysis of accidents was conducted considering steam generator collector damages for pilot units (as a part of SAR). Uninterruptible inspection of the collector integrity is carried out by nondestructive monitoring methods. Low temperature annealing of collectors was performed as well as "relaxing" them; modernization of SG internals, modernization of collector cover (leak limiter), and modernization of steam generator bleed system. Also the secondary water chemistry conditions were improved and automated.
CI 5	Steam generator tube integrity.	II	Done	Criteria of pipeline blanking- off were worked out, boundary criteria of permissible leaks were established, non-destructive control (eddy current) methods were used.
CI 6	Steam and feedwater piping integrity	III	Underway	Emergency scenarios for various places of pipeline breakage were investigated when filling with hot water within the SAR for pilot units. A concept "zone without break" is being implemented; water chemistry mode of secondary circuit is being improved.
AREA: SYSTEMS (S)				
S1	Primary circuit cold overpressure protection	II	Underway	Pilot-operated relief valves (PORV) of the pressurizer are being replaced or modernized based on their type.
S2	Mitigation of steam generator primary collector beam	II	Underway	Within the SAR, safety analysis was performed for accidents with SF PGW-1000 collectors damage for pilot units. Emergency procedures were developed based on SAR results. Measures were developed and implemented for replacement of steam generators (SG) PORV, modernization of Steam Dump Valves to Atmosphere (BRU-A); implementation of operative determination of emergency SG and leakage size, HP ECCS, modernization, SOAI are being developed.
S3	MCP seal cooling system	II	Done	MCP sealing testing was carried out at de-energization during 24-hours: results are satisfactory – 2 make-up pumps are fed by standby diesel station (SDS).
S4	Pressurizer PORV	II	Underway	Pilot-operated relief valves of the pressurizer are being replaced or

Issue No.	Issue Title	Issue Rank	Status	Comment
	qualification for water and steam-water mixture discharge			modernized based on their type.
S5	ECCS sump screen filters blocking	III	Underway	Thermal insulation is being replaced. Vulnerability analysis of ECCS in destruction of thermal insulation of various types was made and agreed with the State Nuclear Regulatory Authority.
S6	Integrity of sump-tank and ECCS suction lines	I	Done	Non-destructive control system of sump tank and suction pipes of ECCS is being used.
S7	ECCS heat exchanger integrity	II	Done	The non-destructive control system of elements is used, a radiation and a pressure difference monitoring system at heat exchanger is introduced. Annual tests are held to specify the need in cleaning heat exchange surface. Operational control is carried out of the state of heat exchange surface, of cooling water pressure difference; distillate ingress into the primary circuit using indexes of boron meters; radiation control of service water is performed.
S8	Power operated valves on ECCS injection lines	I	Done (substantiated refusal of performance)	ZNPP-5 PSA results prove that failure of valve with electric drive at ECCS is not a dominating contributor in the reactor core damage.
S9	Qualification of SG PORV and BRU-A (Steam Dump Valve into the Atmosphere) for water and steam-water discharge	III	Underway	Replacement of SG pilot-operated relief valves at RNPP-3 and ZNPP-2, 3 and 4 by the "SEBIM" (France). Replacement is planned of SG pilot-operated relief valves and steam dump valves into the atmosphere at the rest of power units.
S10	Features of steam generator safety valves at low pressure	II	Underway	Replacement of pilot-operated relief valves of SG at RNPP-3 and ZNPP-2, 3 and 4 by "SEBIM" (France). Replacement of SG pilot-operated relief valves and steam dump valves into the atmosphere are scheduled at the rest power units.
S11	Steam generator level regulators	I	Underway	Within project TACIS, control devices were replaced at ZNPP. Analysis of the project was done with support of EC experts. Replacement of regulators at the rest of power units is planned.

Issue No.	Issue Title	Issue Rank	Status	Comment
S12	Emergency feedwater tanks makeup procedures	I	Done	Feeding of the supply line of emergency SG was arranged from emergency fire water supply system under reactor de-energization (at KhNPP-1), from distillate reserve tanks (at KhNPP-2 and RNPP-4), from chemical water treatment system and auxiliary feeding pumps (at ZNPP-5, 6). There is no need in additional make-up of emergency feed-water storage tank for ZNPP 1-6. At SUNPP 1-3, emergency feed-water storage tanks are fed from firewater collector.
S13	Cold emergency feedwater supply to steam generators	I	Done	Power supply of auxiliary feedwater pumps from SDS is provided. Technical decision was developed to eliminate thermo cycling of water supply nozzles to SG from auxiliary feed-water pumps.
S14	MCR ventilation systems	II	Underway	Within the SAR, analysis for both reactor and emergency control rooms was performed, as well as analysis of risk of impact of toxic gases, which are generated during external man-made impact, on MCR and ECR personnel.
S15	Hydrogen removal system	II	Underway	Analysis and calculation of hydrogen concentration during MDBA was carried out for the reactor facility V-320. Systems of hydrogen concentration monitoring in the containment were installed at ZNPP. Installation of hydrogen burning system in containment at the rest of power units is planned.
AREA: INSTRUMENTATION AND CONTROL (I&C)				
I&C1	I&C Reliability	II	Underway	Replacing and adding sensors, converters, and secondary devices that do not meet the up-to date requirements is carried out. New devices meet corresponding requirements of the regulatory documents in force. Modernization of process parameters monitoring system accompanied by implementation of diagnostics tasks is performed within the activities on replacement of the automated technological processes monitoring system.
I&C 2	Safety systems actuation design	I	Done	It has been completed within IAEA recommendations. Within the level 1 PSA for pilot units, I&C systems were analyzed, which monitor ECCS systems, and in the probabilistic model I&C

Issue No.	Issue Title	Issue Rank	Status	Comment
				dependencies from power supply were modelled. Additional modernization measures are being carried out to upgrade operation of safety systems and emergency protection systems.
I&C 3	Automatic reactor protection according to power distribution and departure from nucleate boiling	I	Underway	Underway within modernization of in-core monitoring.
I&C 4	Human factor in MCR designing	II	Done	System of operator information support SPDS Westinghouse was introduced. Within the SAR, analysis of main and emergency control rooms was performed for pilot units.
I&C 5	Control and monitoring of power distribution in load changes	II	Underway	Performed within modernization of in-core monitoring system and includes replacement of in-core measurement channels. Systems of CPS CR position monitoring were improved.
I&C 6	Monitoring of mechanical equipment operating conditions	I	Underway	Alarming on pressurizer pilot-operated relief valves position was displayed at the main control room. MCP vibration diagnostics system was implemented. Implementation of complex diagnostic system is planned.
I&C 7	Primary circuit diagnostic system	II	Underway	Monitoring system of primary to secondary leaks on nitrogen-16 at RNPP-3, and 4 was implemented. Implementation of complex and local diagnostic systems, system of detection of weakly fixed objects, primary leak monitoring system, in-core noise diagnostics system is planned as well as implementation of primary to secondary leak monitoring system on nitrogen-16 at the rest power units.
I&C 8	Monitoring systems of reactor lid leak	III	Done	Monitoring systems of leaks at the upper unit at power release nozzles exist and operate as well as thermal monitoring systems at the main connector. Washers of expanded graphite at CPS nozzles and thermal monitoring were put in operation
I&C 9	Accident monitoring instrumentation	II	Underway	The following measures are planned to be realized: - Installation of monitoring to monitor coolant overheating at the outlet from fuel assembly, under the top unit and on "hot" legs of MCP;

Issue No.	Issue Title	Issue Rank	Status	Comment
				- Development and implementation of monitoring means to monitor coolant level over the core in emergency modes.
I&C 10	Technical support centre	II	Underway	Within modernization of KhNPP-2 and RNNP-4, work is implemented on developing technical support as well as its integration.
I&C 11	Water chemistry control and monitoring equipment (primary and secondary)	I	Underway	Model and programs of calculating the processes of "Hide out" and "Return hide out" type are designed that would allow development of measures reducing effect of reduced quality of SG bleed water and corrosive damage of SG construction materials. Implementation of system of automated permanent chemical monitoring is planned which would solve the tasks of collecting, processing and presenting information, diagnostics and predicting water chemistry, making calculations, as well as documenting and registering.
AREA: POWER SUPPLY (E)				
E 1	External power supply via standby transformers	I	Underway	Necessary calculations of the load balance were made. Development of projects measures implementation is carried out in accordance with the calculation results. Installation of the second group of standby in-house transformers is planned at KhNPP-1 and 2; the third group at ZNPP.
E 2	Emergency diesel generator reliability	I	Underway	Within the SAR (PSA), for pilot units analysis was made of de-energizing all normal power supply sections and diesel generators reliability. To enhance DG reliability, replacement of the standby diesel generators monitoring system is envisaged.
E 3	Emergency protection of safety system diesel generators	I	Done	Protection of diesel generators was performed through the use of three-channel structure with configuration "2" of "3". Measures on changes in schemes of automatic reserve switching as well as that of diesel generators protection in power and frequency drop were developed and implemented.
E 4	On-site power supply for incident and accident management	II	Underway	On–site RDES (reserve diesel electric stations) were installed at SUNPP-3, KhNPP-2, RNPP-4 and ZNPP-5 and 6. Inter-unit main lines of standby power supply were implemented.

Issue No.	Issue Title	Issue Rank	Status	Comment
				Within the SAR, analysis of reliability of emergency power supply of safety systems after loss of external sources is carried out.
E 5	Emergency battery discharge time	III	Done	Batteries and uninterruptible feeding aggregates with expired lifetime were replaced.
E 6	Grounding faults in direct current circuits	II	Underway	Improvement of methods and measures to detect damages of grounding is realized with replacement of direct current panels.
CONTAINMENT (Cont)				
Cont. 1	Containment bypass	II	Underway	Within the SAR, analysis was made of with loss of coolant accidents with possible bypass of containment. Measures are being realized on modernization of set-points of the control safety systems to avoid bypassing of containment, and to replace 'breathing' pipeline of intermediate circuit.
INTERNAL HAZARDS (IH)				
IH 1	Systematic fire hazard analysis	II	Underway	Within the SAR (PSA for fire), for pilot units. Adaptation of results for other power units is planned. Analysis of fire hazard within containment was carried out.
IH 2	Fire prevention	III	Underway	Replacement of fire protection doors, fireproof valves, penetration sealing; cable covering with fire resistant compounds was tested and renewed.
IH 3	Fire detection and extinguishing	II	Underway	Measures are realized to replace automatic fire alarming and equipping of premises with electronic and electro technical equipment by standard gas fire extinguishing installations.
IH 4	Fire consequences mitigation	II	Underway	Fire retention valves are installed in ventilation system. Introduction of smoke removal system is planned.
IH 5	Systematic flooding analysis	I	Underway	Deterministic analysis of flooding at pilot units was made in the frames of SAR. Adaptation for the rest of power units is performed.
IH 6	Protection against flood for emergency power supply distribution boards	II	Underway	Deterministic analysis of flooding at pilot units was made in the frames of SAR. Adaptation is made for the rest of power units.
IH 7	Protection against dynamic effects in main steam and	II	Underway	Risk analysis of the secondary pipes was made for KhNPP-2 and RNPP-4 using the concept of "zone without break" Measures were

Issue No.	Issue Title	Issue Rank	Status	Comment
	feedwater line rupture			developed based on the analysis results.
IH 8	Polar crane interlocking	II	Done	Optimization of heavy loads transportation ways was made, and additional interlocks were introduced to exclude load drop and fuel damage.
AREA: EXTERNAL HAZARDS (EH)				
EH 1	Design seismic resistance	II	Underway	Deterministic analysis for pilot units was performed within the SAR. Adaptation is being made for the rest of the power units as well as calculations on seismic resistance of system elements important for safety within the work on equipment qualification.
EH 2	Analysis of plant specific external natural conditions	I	Underway	Performed in the framework of developing the extended probabilistic safety analysis for KhNPP-2 and RNPP-4.
EH 3	Man-caused external events	II	Underway	Performed in the framework of developing the extended probabilistic safety analysis for KhNPP-2 and RNPP-4. Adaptation of results is planned for other power units.
AREA: ACCIDENT ANALYSIS (AA)				
AA 1	Scope and methodology of accident analysis	II	Underway	Carried out within the SAR for pilot units. Adaptation of results for other power units is planned. Development of detailed methodologies was done under support of US NRC experts.
AA 2	Quality assurance of plant data used in accident analysis	I	Done	In carrying out accident analysis quality procedure was introduced aimed at monitoring of collection, documentation and verification of all the data used.
AA 3	Computer code and plant model certification	I	Underway	Implemented within the SAR.
AA 4	Using accident analysis results for supporting plant operation	I	Underway	Done within the SAR for pilot units. Adaptation of results is planned for other power units.
AA 5	Main steam line break analysis	I	Underway	Done within the SAR for pilot units. Results adaptation is planned for other power units.
AA 6	Overcooling connected transients related to pressurized thermal shock	II	Underway	Done within the SAR for pilot units. Results adaptation is planned for other power units.

Issue No.	Issue Title	Issue Rank	Status	Comment
AA 7	Steam generator collector rupture analysis	II	Underway	Done within the SAR for pilot units. Results adaptation is planned for other reactors. Based on the analysis results, necessary measures were developed.
AA 8	Analysis of accidents at low capacity and in shutdown conditions	II	Underway	Done within the SAR for pilot units. Results adaptation is planned for other power units.
AA 9	Severe accidents	I	Underway	Done within the SAR. PSA-2 was carried out for KhNPP-2 and RNNP-4.
AA 10	Probabilistic safety analysis (PSA)	I	Underway	Done within the SAR. PSA-1 was carried out for internal initial events at pilot units.
AA 11	Accidents with reduced boron concentration in the reactor	I	Underway	Done within the SAR for pilot units. Results adaptation is planned for other power units.
AA 12	Spent fuel cask drop accidents	I	Underway	Accomplished within the SAR for pilot units. Adoption of results is planned for other power units.
AA 13	Transients without emergency protection actuation	II	Underway	Done within the SAR for pilot units. Results adaptation is planned for other power units.
AA 14	Total loss of power supply	II	Underway	Done within the SAR for pilot units. Results adaptation is planned for other power units.
AA 15	Total loss of ultimate heat sink	II	Underway	Done within the SAR for pilot units. Results adaptation is planned for other power units.

2. WWER-440/V-213 (RNNP-1 and 2)

Issue No.	Issue Title	Issue Rank	Status	Comment
AREA: GENERAL (G)				
G 1	Classification of components	II	Done	Classifier developed for both reactors.
G 2	Qualification of equipment	III	Underway	For pilot unit 1 the list of equipment was developed for reactor safe shutdown, as well as the list of postulated initial events, which may result in extreme environmental conditions.
G 3	Reliability analysis of safety class 1 and 2 systems	II	Underway	In SAR materials for pilot unit 1, system reliability analysis was carried out. The process of SAR adaptation for power unit 2 is still continued. A system of data collection and assessment on components equipment reliability (Ukr. – "UBDN") is implemented at RNPP.
AREA: REACTOR CORE (RC)				
RC 1	Prevention of uncontrolled reduction of boric acid concentration in the primary coolant.	II	Underway	(Within the SAR) probabilistic analysis of processes with boron dilution for pilot unit No. 1 was carried out.
AREA: COMPONENT INTEGRITY (CI)				
CI 1	Reactor pressure vessel integrity under pressure	II	Underway	Heating to 55 -70 Cº of the water of the passive ECCS section (ECCS hydro accumulator) supplied to the reactor is performed. Measures were taken to reduce neutron flux at reactor vessel; layouts of the reactor core are used having low loss of neutrons. Modern methods of nondestructive testing were implemented.
CI 2	Non-destructive testing	III	Done	Realized of the basis of equipment of Siemens company (Germany).
CI 3	Primary pipe whip restraints.	II	Underway	Reassessment of adequacy of whipping restrainers was done based on individual approach; supports-limiters were installed which bear the load of reactive forces.
CI 4	Primary steam generator collector integrity.	II	Done	The mechanism of collector damaging was defined and measures were developed and taken to minimize damage. Assessment criteria

Issue No.	Issue Title	Issue Rank	Status	Comment
				of SG collector defects were developed. Eddy current monitoring was introduced and water chemistry monitoring system was improved.
CI 5	Steam generator tube integrity.	II	Done	Criteria were developed concerning pipe dumping, boundary values were reviewed. New methods of nondestructive testing were introduced.
CI 6	SG feedwater distributing header	I	Done	Calculation analysis was made of distributing collector damage consequences; new collectors were installed.
AREA: SYSTEMS (S)				
S 1	Primary circuit cold overpressure protection	II	Underway	Technical measures were taken to exclude cold overpressure. Protection and blocking mechanism was realized. Underway is replacement of pilot-operated relief valves of pressurizer at power unit No. 1.
S 2	Mitigation of steam primary generator collector rupture	II	Underway	Replacement of steam generator lid was made with limitation of primary to secondary leak. Replacement of SG pilot-operated relief valves was made within the TACIS project. Measures are developed to monitor primary to secondary leak and implement SOAI.
S 3	MCP seal cooling system	II	Done	Analysis was made of MCP sealing damage in loss of cooling. Measures were taken on providing MCP cooling in case of containment isolation. Analysis was performed of considering leakage through MCP sealing for water reserve in the primary system.
S 4	Pressurizer PORV qualification for water and steam-water mixture discharge	II	Underway	Pipes were qualified which connect valves with pressurizer for loading which results in leakage through hot water valve. Pressurizer PORVs were replaced at power unit No. 1. Such replacement is planned at power unit 2.
S 5	ECCS sump screen filters blocking	III	Underway	Within the TACIS project, new sump screen filters were installed. Analysis was performed of ECCS vulnerability, sump filters efficiency in containment sump after modernizing.
S 6	ECCS suction line integrity	II	Done	Analysis of the suction lines design from sump was performed and

Issue No.	Issue Title	Issue Rank	Status	Comment
				full radiographic examination of welds at suction lines. Also current state of metal was examined with annual monitoring of welds in metal at suction lines.
S 7	ECCS heat exchanger integrity	II	Done	Measures were taken to prevent blocking of heat exchangers and detection of possible leakage in the ECCS system.
S 8	Power operated valves on ECCS injection lines	I	Done	Valve with pneumatic drive (2 items) was installed at each safety system channel.
S 9	SG PORV and BRU-A qualification for water and steam-water mixture discharge	II	Done	SG PORVs were replaced by SG POR produced by "SEBIM" Company (France) at all SG at power units 1 and 2.
S 10	Features of steam generator safety valves at low pressure	II	Done	SG PORVs were replaced by SG PORV produced by "SEBIM" Company (France) at all SG of power units 1 and 2.
S 11	Steam generator level regulators	I	Done	SG valves and level control system were replaced. Regulators 810-250-EA were replaced by more reliable and modernized regulators 1046-250-EN.
S 12	Emergency feedwater system makeup procedures	I	Underway	Works on implementing additional emergency feedwater system is being conducted.
S 13	Vulnerability of emergency feedwater supply system to steam generators	III	Underway	Emergency feedwater supply system to steam generator is being under reconstruction.
S 14	MCR ventilation system	II	Done	Ventilation system was reconstructed as regards physical separation of MCR and ECR ventilation separation. Analysis of MCR air supply (within the SAR) was performed under support of US NRC experts.
S 15	Hydrogen burnup system	II	Done	Analysis and calculation of hydrogen concentration during MDBA for rector facility V-213 were made. Within TACIS project recombiners were installed.
S 16	Gas removal from the primary circuit under emergencies	II	Done	Gas removal system from under reactor lid and upper notes of SG collector in the primary circuit was mounted. Emergency gas removal system from SG collectors was developed on the basis of design blowers.

Issue No.	Issue Title	Issue Rank	Status	Comment
				Drainage system of hydroseals at reactor coolant piping was implemented.
S 17	Essential service water system	II	Done	Analysis of consequences of possible loss of Essential service water system (as a part of the SAR) was performed under support of US NRC experts.
INSTRUMENTATION AND CONTROL (I&C)				
I&C 1	I&C Reliability	II	Underway	Reliability analysis was made of the 1 and 2 safety class of the power unit No. 1 (as part the SAR), as well as analysis of the database of failures of instrumentation and control system elements. Maintenance of I&C was provided. Safety systems at power units No.1 and 2 were modified.
I&C 2	Safety systems actuation design	I	Done	Reconstruction was carried out of the emergency and preventive protection. Relay scheme of forming reaction protection was replaced by modern AZTP equipment. Feed circuit was implemented to reliable supply section of safety system channels at power unit that switches them off after ECCS signals and seismic detectors.
I&C 3	Analysis of signals for startup of emergency reactor shutdown system	II	Done	Analysis of design basis accidents was performed for power unit No. 1 (as part of the SAR) under support of US NRC experts. Measures were taken to ensure the use of EP-2 and EP-3 as restriction instead of protection. Analysis of ATWS (as part of the SAR) was performed under support of US NRC experts.
I&C 4	Human factor in designing of MCR	II	Done	Safety parameter display systems (SPDS) were installed at RNPP-1,2.
I&C 5	Physical and functional separation of MCR and ECR	II	Underway	Within the SAR, analysis was carried out of impact on safety of connection between MCR and ECR. Analysis of provision of physical and functional separation between MCR and ECR is being carried out within probabilistic safety analysis of fire and flooding.
I&C 6	Monitoring of mechanical equipment state	I	Underway	Diagnostics of mechanisms that rotate (Dimex-2) was performed as well as monitoring of FE sealing (FRAMATOM), etc.
I&C 7	Primary diagnostics system	I	Underway	Diagnostics subsystem of mechanisms that rotate was implemented

Issue No.	Issue Title	Issue Rank	Status	Comment
				(Dimex-2).
I&C 8	Monitoring system of reactor vessel lid leak	I	Done	Performed within the IAEA recommendations. Monitoring system of bolt connector tightness was implemented and is being periodically tested. Coolant leakage monitoring system is being implemented additionally.
I&C 9	Accident monitoring instrumentation	II	Underway	The list of emergency parameters to be monitored was specified. Work is planned concerning post-accident monitoring devices
I&C 10	Technical support centre	II	Done	Internal crisis centre was established.
I&C 11	Water chemistry control and monitoring equipment (primary and secondary)	I	Done	Concept has been developed of automatic chemical control system, monitoring, and diagnostics of water chemistry in the primary circuit. System of automatic chemical control, monitoring and diagnostics of water chemistry in the secondary circuit was developed and implemented at NPP.
AREA: POWER SUPPLY (EL)				
EL 1	Emergency diesel startup logic	I	Done	The diagram of feeding supply to reliable power supply sections of safety system channels at power unit No.1 that excludes their de-energizing after ECCS protection signals and seismic warning.
EL 2	Emergency diesel generator reliability	I	Done	Startup acceleration (less start time) of diesel generators was performed.
EL 3	Emergency protection signals of safety system diesel generators	I	Done	Technical decision was implemented on bringing out internal protection of diesel generators after signals "Accident" and "Planned Cooldown".
EL 4	Internal plant power supply for monitoring under emergencies or failures	I	Underway	Batteries AB-10, 12, 13 and 14 at power unit No.1 and AB-24 at power unit No.2 are replaced by state-of-the art batteries of the VARTA company that provide stored energy sufficient to perform safety function. Analysis is being carried out to define the systems requiring standby power supply after loss of external sources.
EL 5	Discharge time of emergency batteries	II	Done	Batteries AB-10, 12, 13 and 14 at power unit No.1 and AB-24 at power unit No.2 are replaced with new-type batteries of the VARTA

Issue No.	Issue Title	Issue Rank	Status	Comment
				company that provide stored energy sufficient to perform safety functions.
CONTAINMENT (Cont)				
Cont. 1	Strength characteristics of bubbler condenser under maximum pressure difference possible in LOCA.	III	Done	Design of bubbler condenser was reinforced. Design-experimental substantiation was carried out and agreed of the reliability of containment system under the design pressure and discharge.
Cont. 2	Bubble condenser thermodynamic characteristics	II	Done	Additional analysis was done of thermo hydraulic events that take place on the racks of bubble condenser after LOCA.
Cont. 3	Containment leak flow	II	Underway	Substantiation was done of the containment system reliability under design pressure. Technical decision was implemented "On the Use of Repair-Emergency Exhaust Ventilation of VB-4 System as Air Discharge System From Containment in Tightness Tests", as well as the resolution "On Rejection of Testing By Design Depressurization of the Accident Confinement Zone at Rivne NPP Power units No.1 and 2". The methodology of detecting gas leakage from the accident confinement system was developed and implemented; pressure sensors were replaced by more accurate ones that comply the requirements of PNAE G-10-021-90. Elimination of non-tightness in containment is being carried out using the methodology of sealant injection, and welding.
Cont. 4	Maximum pressure differences on walls between pressurized box rooms	II	Done	Performed: design analysis of construction of cover and walls in the containment regarding various load resulting from pressure difference; analysis of wall resistance on the basis of the established loading. Measures were implemented to reduce pressure difference based on analysis results (increase of the area of cross sections of openings between rooms).
Cont. 5	Containment pressure peak and sprinkler system	I	Underway	Comparative analysis of calculation results of correct containment modelling with bubble condenser that were performed using

Issue No.	Issue Title	Issue Rank	Status	Comment
	actuation after coolant leak			alternative codes, showed close coincidence of the results with those ones of GRS. Upper pressure limit was determined, which containment structure is capable to withstand. Bottlenecks were detected (walls, overlays, ceilings, passages, cutoff valves, doors, manholes, etc.). Within the frames of PSA-2 quantitative assessment is planned of the strength properties and types of the containment failures.
INTERNAL HAZARDS (IH)				
IH 1	Systematic analysis of fire hazard	II	Underway	Is being performed within the framework of SAR. Deterministic analysis of fires at power unit 1 (as part of the SAR) had been performed under support of US NRC experts. Probabilistic fire safety analysis is planned.
IH 2	Fire prevention	II	Underway	Based on the results of deterministic analysis of AMSA, the complex of fire protecting measures was implemented at power units 1 and 2. Mechanism of fast reactor shutdown in case of fire in CPS panel was realized. Fireproof doors were replaced, as well as fire protection valves in ventilation systems, fire partitions, automatic devices in control cabinets of relay protection circuits (RPC) assemblies and cable covering with fire resistant material.
IH 3	Fire detection and extinguishing	II	Underway	Replacement of fire-prevention-system equipment was planned, as well as provision of premises containing electrical and electro-technical equipment with standard automatic gas fire fighting installations.
IH 4	Mitigation of fire consequences	II	Underway	Refining cable thermal resistance to comply with standards. Covering of ventilation systems cable rooms of reactor units' 1 and 2 was done with pads of basalt superfine fiber with moisture resistance boundary of 1.5 hour.
IH 5	Systematic flooding analysis	I	Underway	Done within the SAR. Deterministic analysis was performed at power unit No.1 under support of US NRC experts.
IH 6	Turbine missiles	I	Underway	Done within the SAR, deterministic analysis was performed at power unit No.1 under support of US NRC experts.
IH 7	Internal hazards caused by	III	Underway	Done within the SAR, deterministic analysis was performed at power

Issue No.	Issue Title	Issue Rank	Status	Comment
	high-energy piping breaks			unit No.1 under support of US NRC experts.
IH 8	Heavy load drop	I	Underway	Done within the SAR, deterministic analysis was performed at power unit No.1 under support of US NRC experts.
AREA: EXTERNAL HAZARDS (EH)				
EH 1	Design seismic resistance	III	Underway	Reassessment was made of seismic project design bases. Estimation of actual state of constructions, elements, and NPP distribution (in view of seismic resistance) systems and their modernization were made. Replacement of air-conditioning systems by the seismic resistance ones is planned.
EH 2	Analysis of plant-specific extreme natural conditions	I	Done	Supervision over the building and constructions settlement at power units 1 and 2 is performed. Probationary drilling for biolocation of power units No.1 and 2 was performed. Cycle of radio logging of power units No.1 and 2 was performed. Assessment and prediction of deformation of the earth surface and engineering structures at RNPP-1and 2 was carried out. Correction of position of the reactor main cutoff point flange was made (elimination of reactor slope).
EH 3	Man-caused external events	II	Underway	Performed within the SAR, deterministic analysis was made at power unit No.1 under support of US NRC experts.
AREA: ACCIDENT ANALYSIS (AA)				
AA 1	Scope and methodology of accident analysis	II	Done	Analysis was performed at power unit No.1 (as part of the SAR) under support of US NRC experts.
AA 2	Quality assurance of plant data used in accident analysis	I	Done	Detailed methodologies of quality assurance for design basis accidents analysis (under support of US NRC experts) was developed and applied.
AA 3	Computer programs and plant model certification	II	Done	Systematic approach and state-of-the-art methodologies were used in accident analysis.
AA 4	Availability of accident analysis results to support	I	Underway	Measures were developed based on the SAR results.

Issue No.	Issue Title	Issue Rank	Status	Comment
	plant operations			
AA 5	Analysis of accidents with main steam line break	I	Underway	Done for the pilot unit.
AA 6	Overcooling transients related to pressurized thermal shock	II	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts.
AA 7	Steam generator collector ruptures	II	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts.
AA 8	Accidents under low power shutdown conditions	II	Underway	Probabilistic safety analysis and analysis of design basis accidents at shut down reactor are performed.
AA 9	Severe accidents	I	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts.
AA 10	Probabilistic safety assessment (PSA)	I	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts.
AA 11	Boron dilution accidents	I	Underway	Performed for the pilot unit.
AA 12	Spent fuel cask drop accidents	I	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts. Organizational and technical measures for spent fuel container transportation were developed and implemented.
AA 13	Anticipated transients without (in failure of) reactor scram	I	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts.
AA 14	Total loss of power supply	I	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts.
AA 15	Total loss of end heat absorber	I	Underway	Analysis at power unit No.1 (as part of the SAR) was performed under support of US NRC experts.

Annex 3

LIST OF THE MAIN LEGISLATIVE AND REGULATORY DOCUMENTS IN THE AREA OF NUCLEAR ENERGY USE PUT IN FORCE IN 2005-2007

1. Legislative Acts

1.1. Law of Ukraine No. 2637-IV "On Amendments to the Law of Ukraine On Decision Making Procedures for Siting, Designing and Construction of Nuclear Installations and Radwaste Management Facilities of National Importance" dated 02 June 2005: improvement of the decision-making procedure on constructing nuclear and radiation hazardous facilities.

1.2. Law of Ukraine No. 2818-IV "On Ratification of Guarantee Agreement between Ukraine as the Guarantor and the European Nuclear Energy Community as the Creditor Concerning the Agreement on Mechanism of Granting Loan for Safety Improvement at Khmelnytsky NPP Unit 2 and Rivne NPP Unit 4 between the National Nuclear Energy Generating Company "Energoatom" and the European Nuclear Energy Community dated 29 July 2004" of 7 September 2005.

1.3. Law of Ukraine No. 2861-IV "On Decision Making Procedure for Siting, Design and Construction of Nuclear Installations and Radioactive Waste Management Facilities of National Importance" dated 08 September 2005.

1.4. Law of Ukraine No. 3092-IV "On Ratification of Additional Protocol to the Agreement between Ukraine and the International Atomic Energy Agency for the Application of Safeguards as regards the Treaty on Non-Proliferation of Nuclear Weapons" dated 16 November 2005.

1.5. Law of Ukraine No. 3533-IV "On the Ratification of the International Convention for the Suppression of Acts of Nuclear Terrorism" dated 15March 2006.

1.6. Law of Ukraine No. 3581-IV "On Amendments to the Law of Ukraine on Civil Liability for Nuclear Damage and Its Financial Provision in Relation to Research Nuclear Power Reactors" dated 16 March 2006: establishing civil liability for nuclear damage and its funding in relation to research reactors.

1.7. Law of Ukraine No. 47-V "On Ratification of Agreement between the Government of the Republic of Bulgaria, the Government of the Russian Federation and the Cabinet of Ministers of Ukraine on Transportation of Nuclear Materials between the Russian Federation and the Republic of Bulgaria via the Territory of Ukraine" dated 27 July 2006.

1.8. Law of Ukraine No. 70-V "On Amendments to the Law of Ukraine "On Regulatory Issues related to Nuclear Safety Assurance" as for Forming of Financial Reserve" dated August 3, 2006: improvement of the use and investing costs of financial reserve supporting the activity on shutdown and decommissioning of nuclear facilities.

1.9. Law of Ukraine No. 232-V "On Amendments to Some Laws of Ukraine on Social Protection of Population in Exclusion Zone" dated 05 October 2006 –social

protection of the population residing on the territories with possible radiation impact of nuclear power plant and facilities intended for radioactive waste management.

1.10. Law of Ukraine No. 623-V "On Amendments to Article 11 of the Law of Ukraine "On Physical Protection of Nuclear Facilities, Nuclear Materials, Radioactive Waste, other Sources of Ionizing Radiation" dated 08 February 2007 – facilitation of the procedure of access to the places of special work by foreigners and stateless persons who stay in Ukraine on legal grounds and obtained admissions to perform special work and permissions to move to restricted areas.

1.11. Law of Ukraine No. 877-V "On Fundamentals of State Supervision (Control) in Economic Activity" dated April 05, 2007

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

2.1. Resolution of the Cabinet of Ministers of Ukraine No. 845 dated 31 August 2005 "Issues of qualification and Incentives for Employees of the State Nuclear Regulatory Committee of Ukraine Directly involved in State Regulation of Nuclear and Radiation Safety".

2.2. Resolution of the Cabinet of Ministers of Ukraine No. 846 dated 31 August 2005 "On Changes in Resolution of the Cabinet of Ministers of Ukraine No. 847 dated 4 September 1997" – on deferring deadlines of measures of the Action Program on formation of the State Register of ionizing radiation sources.

2.3. Resolution of the Cabinet of Ministers of Ukraine No. 978 dated September 24, 2005 "On approval of Agreement between the Cabinet of Ministers of Ukraine and the Government of Romania on early notification on nuclear accidents and information exchange in the area of nuclear and radiation safety".

2.4. Resolution of the Cabinet of Ministers of Ukraine 25.01.2006 No. 59 "On approval of Agreement between the Cabinet of Ministers of Ukraine and the European Atomic Energy Community on cooperation in the area of peaceful use of nuclear energy".

2.5. Resolution of the Cabinet of Ministers of Ukraine No. 266 dated March 09, 2006 "On changes in resolution of the Cabinet of Ministers of Ukraine No. 444 of 13 June 2005" – allocation of funds of the special state budget fund for the purposes of budgetary program "measures of implementation of the Complex Program of creation of nuclear fuel cycle in Ukraine and bringing objects of the production association "Prydniprovsky Khimichny Zavod" in compliance with requirements of environmentally safe condition".

2.6. Resolution of the Cabinet of Ministers of Ukraine No. 284 of 15 March 2006 " On Changes in Resolution of the Cabinet of Ministers of Ukraine No. 1471 dated 25 December 1997" – conduct of special controls for grant of admissions to individuals for performance of special works at nuclear plants with radioactive waste and other ionizing radiation sources.

2.7. Resolution of the Cabinet of Ministers of Ukraine No. 594 of 27 April 2006 "Issues of formation, accumulation and use of financial reserve for decommissioning of nuclear plants ".

2.8. Resolution of the Cabinet of Ministers of Ukraine No. 772 dated May 31, 2006 "On changes in the procedure of public hearings of issues of use of nuclear energy and radiation safety "- mandatory nature of conduct of public hearings on the matters of building new power units and expansion of list of questions to be discussed during the public hearings.

2.9. Resolution of the Cabinet of Ministers of Ukraine No. 796 of 7 June 2006 "Issues of the State Nuclear Regulatory Committee".

2.10. Resolution of the Cabinet of Ministers of Ukraine No. 834 dated 15 June 2006 "On approval of procedures of meeting requirements of Additional Protocol to the Agreement between Ukraine and International Atomic Energy Agency on use of Safeguards in relation to the Agreement of Non-Proliferation of Nuclear Weapons".

2.11. Resolution of the Cabinet of Ministers of Ukraine No. 937 dated July 05, 2006 "On submission for ratification by the Verhovna Rada of Ukraine of the Agreement between the Government of Republic of Bulgaria, the Government of the Russian Federation and the Cabinet of Ministers of Ukraine on Transportation of Nuclear Materials between the Russian Federation and Republic of Bulgaria via the Territory of Ukraine".

2.12. Resolution of the Cabinet of Ministers of Ukraine No. 996 dated July 19, 2006 "On changes in Resolution of the Cabinet of Ministers of Ukraine No. 953 dated June 23, 2003, and No. 1307 dated September 20, 2003".

2.13. Resolution of the Cabinet of Ministers of Ukraine No. 1022 dated July 26, 2006 "On changes in some acts of the Cabinet of Ministers of Ukraine on state target programs and recognition of invalidity of Resolution of the Cabinet of Ministers of Ukraine No. 1091 dated December 31, 1993" – performance of analysis of state target programs on creation of rating system for regions and branches of the national economy as well as subjects of economic activity.

2.14. Resolution of the Cabinet of Ministers of Ukraine No. 1092 dated August 03, 2006 "On approval of State Program of provision of safekeeping of highly active waste sources of ionizing radiation".

2.15. Resolution of the Cabinet of Ministers of Ukraine No. 1829 dated December 27, 2006 "In changes in Resolutions of the Cabinet of Ministers of Ukraine No.1471 dated December 25, 1997 and No. 625 dated April 26, 2003" – exclusion of effect of the Procedure of conduct of special check for grant of admissions to individuals for performance of special works at power plants with nuclear materials, radioactive wastes, other ionizing radiation sources for inspectors of the International Atomic Energy Agency (IAEA), who in accordance with laws of Ukraine perform inspections at nuclear plants and enterprises, as well as on improvement of the Procedure of identification of level of physical protection of nuclear plants, nuclear materials, radioactive waste, other in accordance with their categories.

2.18. Resolution of the Cabinet of Ministers of Ukraine No. 1830 dated 27 December 2006 "On approval of the Statute on the State Nuclear Regulatory Committee of Ukraine".

2.17. Resolution of the Cabinet of Ministers of Ukraine No. 450 dated March 14, 2007 "On changes in Resolutions of the Cabinet of Ministers of Ukraine No. 1177 dated

September 28, 1996 and No. 36 dated January 20, 1997" – improvement of management of the Chornobyl Centre for Problems of Nuclear Safety, Radioactive Waste and Radioecology.

2.18. Resolution of the Cabinet of Ministers of Ukraine No. 759 dated May 23, 2007 " On changes in Annex 1 to Resolution of the Cabinet of Ministers of Ukraine No.403 dated February 26,2000 " – increase of limiting number of employees of the State Nuclear Regulatory Committee of Ukraine.

2.19. For the purpose of improvement of management of atomic and industrial complex, the state-owned concern "Ukratomprom" was established:

- by Resolution of the Cabinet of Ministers of Ukraine No. 1854 dated December 29, 2006, state-owned concern "Ukratomprom" was established;
- by Resolution of the Cabinet of Ministers of Ukraine No. 456 dated March 14, 2007, Statute of the state-owned concern "Ukratomprom" was approved.

2.20. Order of the Cabinet of Ministers of Ukraine No. 281-r of 21 July, 2005 "On Preparatory Activities on Construction of New Units at the Khmelnytsky NPP ".

2.21. Order of the Cabinet of Ministers of Ukraine No. 515-r of 13 December 2005 "On approval of the Concept on Safety Improvement of NPP's".

2.22. Order of the Cabinet of Ministers of Ukraine No. 17-r dated January 18, 2006 "On approval of act of the State Commission for putting into operation of completed by construction object of start-up complex of Khmelnytsky NPP unit 2".

2.23. Order of the Cabinet of Ministers of Ukraine No. 145-r dated March 15, 2006 "On approval of the Ukraine's Energy Strategy till 2030".

2.24. Order of the Cabinet of Ministers of Ukraine No. 332-r dated June 15, 2006 "On changes in the Order of the Cabinet of Ministers of Ukraine No. 281 dated 21 June 2005" – positioning of requirement as for the necessity of conduct of local community advisory poll on building of new power units.

2.25. Order of the Cabinet of Ministers of Ukraine No. 436-r dated July 27, 2006 "On approval of action plan for 2006 - 2010 for implementation of the 8's Energy Strategy for the period till 2030".

2.26. Order of the Cabinet of Ministers of Ukraine No. 38-r dated February 07, 2007 "On Signing of the Agreement on early notification on nuclear accident and information exchange in the area of nuclear and radiation safety between the Cabinet of Ministers of Ukraine and the Government of the Russian Federation ".

3. Regulatory and Legal Acts of the State Nuclear Regulatory Committee of Ukraine

3.1 NP 306.2.106-2005. Requirements to modifications of nuclear plans and procedure of evaluation of their safety

This document identifies:

- *requirements to modifications of nuclear plans (NPs), undertaken by the operation organization (OE) at individual stages of life cycle of NPs, in particular requirements to stages of modifications requiring coordination with the State Nuclear Regulation Committee of Ukraine,*

list and contents of the documents to be submitted by OE for coordination of the modifications with the State Nuclear Regulation Committee of Ukraine;

- *procedure of evaluation of safety of modifications of nuclear plans and making decisions on coordination of technical solutions developed in the course of modification.*

3.2 NP 306.1.107-2005. Procedure of state expertise of nuclear and radiation safety

This Procedure establishes the purpose, objective, order and procedures of state expertise of nuclear and radiation safety.

3.3. NP 306.6.108-2005. Regulation for planning measures and actions in case of emergency during transportation of radioactive materials

This Regulation prescribed requirements to content, procedure of development and approval of emergency actions during transportation of radioactive materials (Class 7 hazardous substances).

3.4. RD 306.7.111-2005. Recommendations on records of small quantities of nuclear materials

These Recommendations provide description of administrative measures, instructions and procedures for assurance of correctness of maintenance and records and control of nuclear materials (hereinafter referred to as NMs) at the enterprises where small quantities of NMs are available, in accordance with established Rules of record and control of nuclear materials" (NP 306.7.122-2006).

3.5. RD 306.7.112-2005. Methodological instructions concerning physical inventory taking and drawing up the balance of nuclear materials

The Methodological instructions prescribe uniformed approaches and methods of identification of actually available quantities of nuclear materials (physical inventory taking and drawing up the balance of nuclear materials in the areas of balance of the material for compliance with requirements of the state system of records and control of nuclear materials.

3.6. NP 306.2.113-2005 Requirements to attestation of the System of operational nondestructive control of equipments and pipelines at NPPs.

The requirements establish basic criteria of attestation of the System of operational nondestructive control of system equipments and pipelines important for safety of nuclear energy plants, and establish procedure of attestation, contents of attestation documents and functions of participants of the attestation process.

3.7. NP 306.7.120-2006. Regulation on the system of measurement of nuclear materials

This Regulation prescribes general requirements to the system of measurement of nuclear materials at the national and object levels, as well as to its components.

3.8. NP 306.7.122-2006. Rules of maintenance of account and control of nuclear materials

These Rules establish requirements to maintenance of account and control of nuclear materials being mandatory for entities engaged in activities in

the area of use of nuclear energy, transportation, safekeeping or manufacture of nuclear materials.

Enforcement of these Rules assures maintenance of state records and control of nuclear materials and fulfilment of Ukraine's international obligations as for non-proliferation of nuclear weapons.

3.9. NP 306.6.124-2006. Rules and nuclear and radiation safety at transportation of radioactive materials (Ukrainian acronym - PBPRM-2006)

These rules comply with the document titled "Regulations for the Safe Transport of Radioactive Material. 2005 Edition. Safety Standards Series N TS-R-1. IAEA").

These Rules establish standards of safety that assure admissible level of control over radiation hazards as well as those related to criticality and heat release for personnel, property and environments at transportation of radioactive materials. These Rules apply the principles set forth in publication "Radiation protection and safe handling radiation sources. – Safety editions series No. 120, IAEA, Vienna (1996)" and in publication "International basic standards of safety for protection against ionizing radiations and safety of radiation sources. - Safety editions series No. 115, IAEA, Vienna (1996)".

3.10. NP 306.8.126-2006. Rules of physical protection of nuclear plants and nuclear materials

The Rules were developed with due regard to recommendations of information circular of IAEA 'Physical Protection of nuclear material and nuclear plants "INFCIRC/225/Rev.4.

The Rules apply to nuclear materials and plants used for peaceful purposes, and are binding upon all executive authorities, legal entities, which:

- *carry out mining, treatment, safekeeping, transportation of nuclear materials and operate nuclear plants;*
- *develop regulatory acts in the area of physical protection, control execution of the acts, carry out checks and testing of technical facilities of physical protection;*
- *ensure realization and implement measures of physical protection.*

Provisions of the Rules do not apply to assurance of physical protection of nuclear materials in quantities lower than lower level of category III of nuclear materials, as well as to assurance of physical protection of products containing depleted uranium.

3.11. NP 306.1.129-2006. Requirements to periodicity and contents of reports submitted by licensees in the area of use of nuclear energy

These Requirements establish list of reports to be submitted to the State Nuclear Regulation Committee of Ukraine by the licensees, their contents and terms of submission. The Requirements apply to the entities that duly obtained their licenses from the Nuclear Regulation Committee of Ukraine in accordance with prescribed order for:

a) treatment, safekeeping and disposal of nuclear waste (hereinafter referred to as RAW), including:

- *activities of operating organization (operator) at the stages of lifecycle of radwaste storage site, namely, at the stages of its operation and shutdown;*
- *operation, decommissioning of objects for radwaste treatment and radwaste storage site;*

- *provision of services to contractors of the operator of the radwaste storage site at the stages of its operation and shutdown;*

b) *treatment uranium ores;*

c) *production of ionizing radiation sources(hereinafter referred to as IRS);*

d) *use of IRS including IRS storage and maintenance;*

e) *transportation of radioactive materials;*

f) *training of personnel to operation of nuclear plant in accordance with staffing list and specialties of the personnel for operation of nuclear plants, training of which is subject to licensing, and staffing list for the personnel directly engaged in management of reactor plant of nuclear power plant, as approved by the Resolution of the Cabinet of Ministers of Ukraine No. 1683 dated November 8, 2000 (as amended);*

g) *activity related to assurance of physical protection of nuclear materials, radioactive waste, other sources of ionizing radiation and nuclear plants (in accordance with the list of activities approved by the Cabinet of Ministers of Ukraine).*

3.12. NP 306.6.127-2006. Requirements to quality assurance programs in transport of radioactive materials

These Requirements establish requirements to structure and content of " Quality assurance program in transport of radioactive materials".

The Requirements are based on standards "Quality management system. Requirements of " DSTU ISO 9001-2001, "Quality management. Directives as for quality programs " DSTU 3815-98 and IAEA recommendations – Quality Assurance for the Safe Transport of Radioactive Material, Safety Series No. 113, IAEA, Vienna, 1994, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material. Safety Guide No. TS-G-1.1 (ST-2). IAEA Appendix IY: Quality assurance in the safe transport of radioactive material.

3.13. Order of the State Nuclear Regulatory Committee of Ukraine No. 91 dated August 26, 2005 "On introduction of changes in Regulatory Act "Safety conditions and requirements (license conditions) of carrying out activity in treatment, storage and disposal of radioactive waste (NP 306.5.04/2.060-2002)".

3.14. Order of the State Nuclear Regulatory Committee of Ukraine No. 97 dated August 31, 2005 "On approval of Changes in safety conditions and requirements (license conditions) of carrying out activity in designing nuclear plant or radioactive waste storage site (NP 306.5.02/2.069-2003)".

3.15. Order of the State Nuclear Regulation Committee of Ukraine No. 39 dated December 29, 2005 "On approval of Program of development and reforming of the Ukrainian nuclear regulation system".

3.16. Order of the State Nuclear Regulatory Committee of Ukraine No. 4 dated January 10, 2006 " On approval of Functional Subsystem Response Plan "Safety of nuclear energy objects USSE".

3.17. Order of the State Nuclear Regulatory Committee of Ukraine No. 9 dated January 23, 2006 "On approval of Regulation on qualification of officials of the State Nuclear Regulatory Committee of Ukraine who are directly engaged in performance of functions of state regulation of nuclear and radiation safety"

This Regulation establishes procedure of conduct of qualification of officials of the State Nuclear Regulatory Committee of Ukraine who are directly engaged in discharge of functions of state regulation of nuclear and radiation safety.

Requirements of this Regulation apply to state inspectors as well as other officials of the State Nuclear Regulatory Committee of Ukraine whose authorities include direct discharge of functions of state regulation of nuclear and radiation safety.

List of the officials whose authorities include direct discharge of functions of state regulation of nuclear and radiation safety and are subject to qualification, is approved by the State Nuclear Regulatory Committee of Ukraine in coordination with the Ministry of Labour and Social Policy of Ukraine and the Ministry of Finance of Ukraine.

3.18. Order of the State Nuclear Regulatory Committee of Ukraine No. 21 dated February 09, 2006 "On approval of List of the officials of the State Nuclear Regulatory Committee of Ukraine whose authorities include direct performance of functions of state regulation of nuclear and radiation safety and are subject to qualification".

3.19. Order of the State Nuclear Regulatory Committee of Ukraine No. 22 dated February 09, 2006 "On approval of List of employees of central administrative office of the State Nuclear Regulatory Committee of Ukraine to whom allowance is paid due to special labour conditions".

3.20. Procedure of personal receipt of individuals and participation in "hot" telephone lines by the Chairman, First Deputy and Deputies of the Chairman of the State Nuclear Regulatory Committee of Ukraine, approved by order of the State Nuclear Regulatory Committee of Ukraine No. 194 dated December 18, 2006.

This Procedure regulates issues of arrangement of personal receipt of individuals and participation in "hot" telephone lines by the Chairman, First Deputy and Deputies of the Chairman of the State Nuclear Regulatory Committee of Ukraine.

3.21. Order of the State Nuclear Regulatory Committee of Ukraine No. 14 dated January 30, 2006 "On establishing departmental motivation differentials within the State Nuclear Regulatory Committee of Ukraine".

3.22. Order of the State Nuclear Regulatory Committee of Ukraine No. 11 dated January 17, 2007 "On approval of changes in some legal acts of the State Nuclear Regulatory Committee of Ukraine".

4. Regulatory support of the area of use of nuclear energy

4.1. DSP 6.177-2005-09-02. Main sanitary rules of assurance of nuclear safety in Ukraine

Effect of Main sanitary rules of assurance of nuclear safety in Ukraine (hereinafter referred to as the Rules) applies to all types of production activity, as well as all situations of interference, in which radiation exposure of people in production and/or household activities

from any sources of natural and/or artificial origin takes or may take place.

Effect of the Rules applies to planning, design and implementation of practical activity, as well as to use of ionizing radiation sources within the framework of practical activity as:

- *production and use of ionizing radiation sources or radioactive substances in medicine, industry, agriculture, education, scientific R&D including any related thereto activity where any radiation exposure of people takes or may take place;*
- *production of nuclear power, including any activity within the framework of the entire or a part of nuclear fuel cycle, where any radiation exposure of personnel and/or population takes or may take place;*
- *practical activity connected with radiation exposure from natural sources as specified in the Rules as requiring controls.*

4.2. GND 95.1.01.03.058-2005. Program on improvement of nuclear safety level and assurance of radiation protection at WWER NPPs reactors. General requirements.

This document applies to procedure of development of "Program of improvement of nuclear safety level and assurance of radiation protection at WWER NPPs " and establishes general requirements to its content.

This document "Program of improvement of nuclear safety level and assurance of radiation protection at WWER NPPs " is a single document for all NPPs improvement of nuclear safety level and assurance of radiation protection and establishes terms of fulfilment of the measures.

4.3. GND 95.1.07.06.059-2005. Lightweight hangar storage site for radioactive waste of groups 1 and 2 in containers at nuclear power plants. General requirements of radiation safety.

This regulatory document establishes General requirements of radiation safety in the course of design, operation and decommissioning of lightweight hangar storage site for radioactive waste of groups 1 and 2 in containers.

4.4. SOU-N YAEK 1.001:2006. Reloading of fuel in WWER-1000. Procedure of obtaining permits, requirements to documentation and calculations of neutron and physical properties of active zone.

These Rules apply to WWER-1000 reactors (types W–302, W–320, W–338) in operation in modes envisioned by RU design in compliance with restrictions by cycles of fuel loading, and establishes requirements to validation of nuclear safety at reloading and operation of the reactor's active zone in parts as follows:

- *calculations of neutron and physical properties of active zone of the reactor,*
- *documentation set,*
- *Procedure of obtaining permits for performance of active zone reloading works and operation of fuel loading.*

4.5. SOU-N YAEK 1.002:2006. Reloading of fuel in WWER-440. Procedure of obtaining permits, requirements to documentation and calculations of neutron and physical properties of active zone.

These Rules apply to WWER-440 reactors in operation in modes envisioned by RU design in compliance with restrictions by cycles of fuel loading, and establishes requirements to validation of nuclear safety at reloading and operation of the reactor's active zone in parts as follows:

- *calculations of neutron and physical properties of active zone of the reactor,*
- *documentation set,*
- *Procedure of obtaining permits for performance of active zone reloading works and operation of fuel loading.*

4.6. SOU-N YAEK 1.002:20061.003:2006. Procedure of development of regulations on blowing heat sink of NPP. Methodological instructions.

4.7. SOU-N YAEK 1.001:2007. Requirements to structure and content of report on periodic reassessment of safety of power units of operating NPPs.

These Requirements identify structure and content of report on periodic re-evaluation of safety of power units of active NPPs submitted to the State Nuclear Regulation Committee of Ukraine as basic document for obtaining permit to keep on operating power units of NPPs beyond the established term of operation, or their operation within the following ten-year period.

Annex 4

Dynamics of the Quantity of Licensed NPP Experts for 2002 – 2006

Dynamics in Numbers of Licensed NPP Experts for 2002 – 2006						
Entity	*2002*	*2003*	*2004*	*2005*	*2006*	*2007 (planned)*
SE ZNPP	162	153	158	163	167	172
SE RNPP	55	66	75	89	94	97
SE SUNPP	52	72	79	80	80	82
SE KhNPP	30	24	31	40	45	48
Total	299	315	343	372	386	399

Data on NPP Personnel Training in 2005-2006

Training type	**NAEK "Energoatom"**			**Including 2006**				
	2005	**2006**		**ZNPP**	**RNPP**	**KhNPP**	**SUNPP**	**Administration /Management**
	actual	**plan**	**actual**	**actual**	**actual**	**actual**	**actual**	**actual**
Initial training	2087	1107	2524	1098	565	235	554	72
Retraining	2696	2793	3260	512	199	294	179	176
Qualification maintenance	16600	13837	19332	10209	6130	2418	5887	88
Special training	8954	7921	8973	1956	1810	2421	1695	1091
Advanced training	6919	5622	6277	881	359	866	354	167
Total, (people/course)	**37256**	**31280**	**40216**	**14656**	**9063**	**6234**	**8669**	**1594**

Annex 5

RADIATION SAFETY AND PROTECTION INDEXES

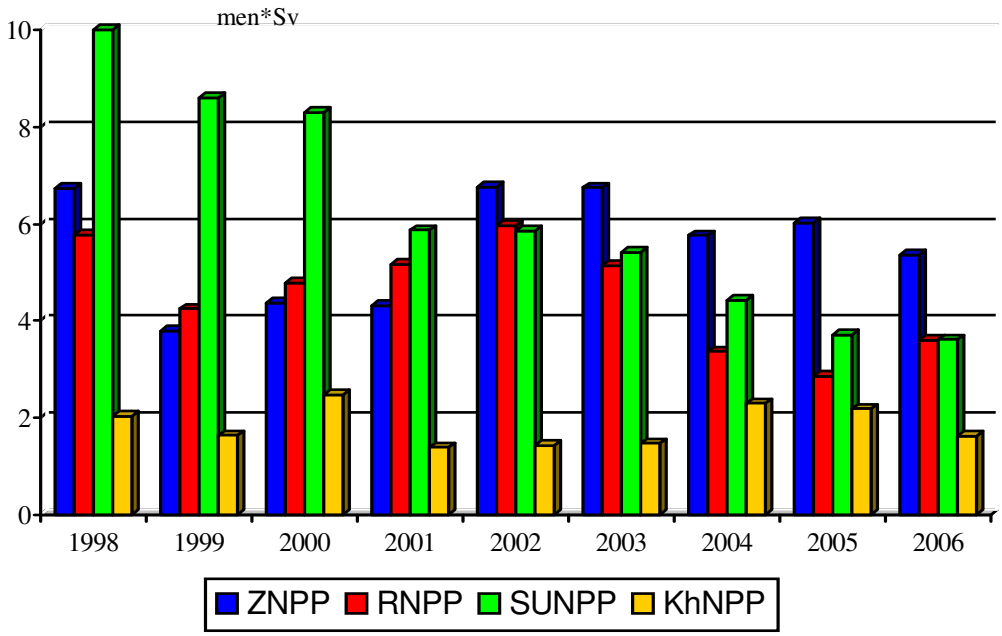


Figure 1. Collective personnel Exposure Dose at NPP with WWER (including personnel on assignment) for 1998 - 2006

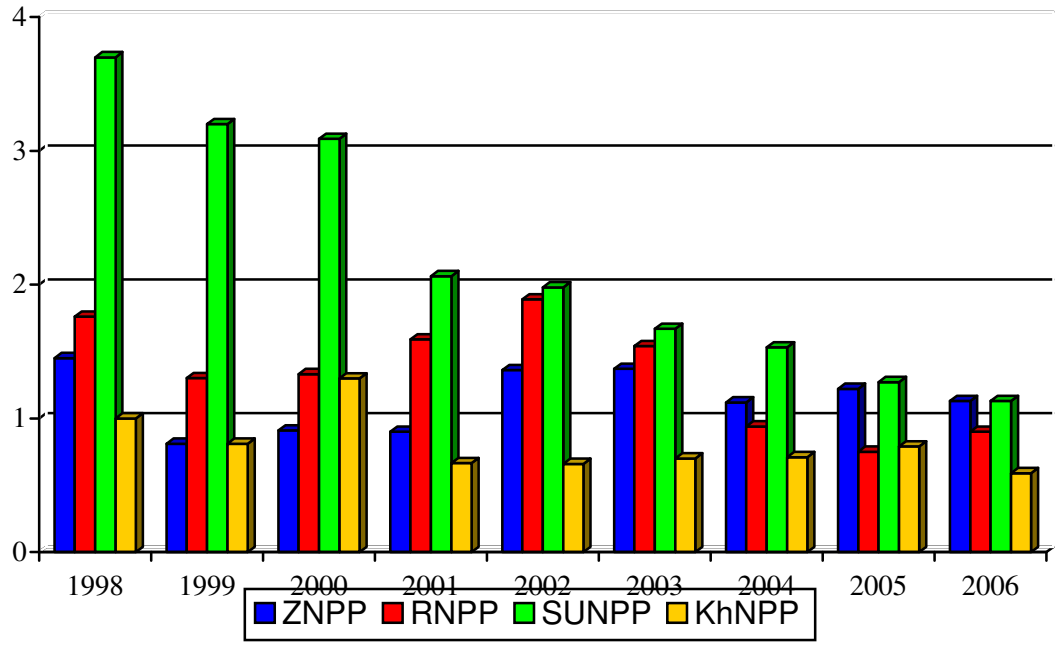


Figure 2. Average Individual Exposure Dose of personnel of NPPs with WWER for 1998-2006

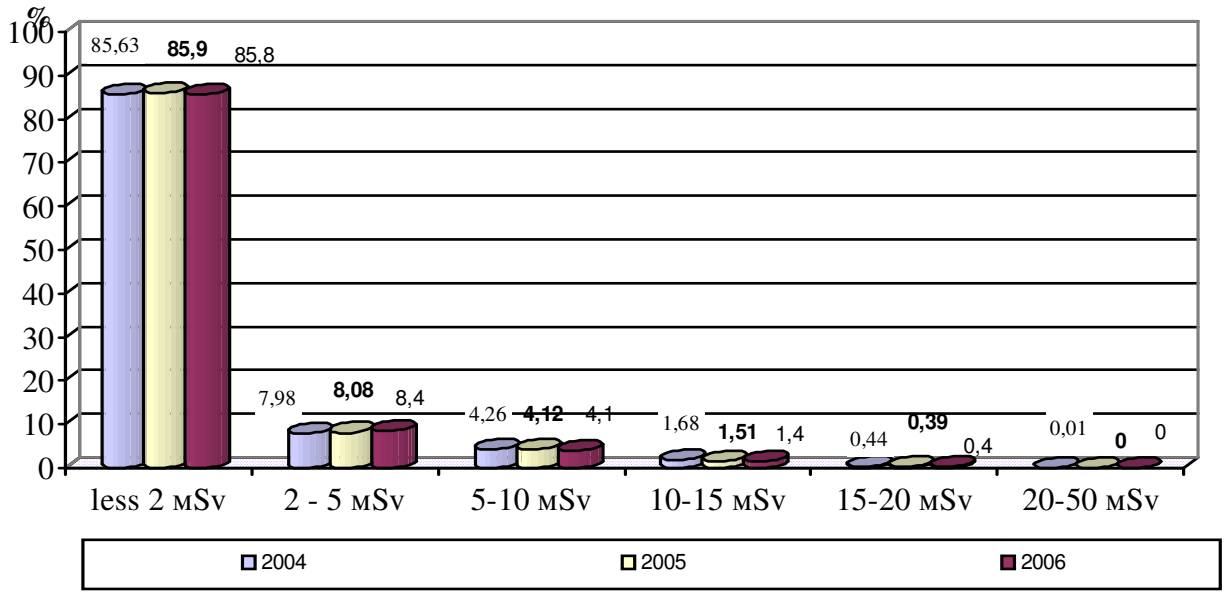


Figure 3. Percentage Distribution of NAEK "Energoatom" NPP Personnel within the Interval of Average Individual Exposure Doses for 2004-2006.

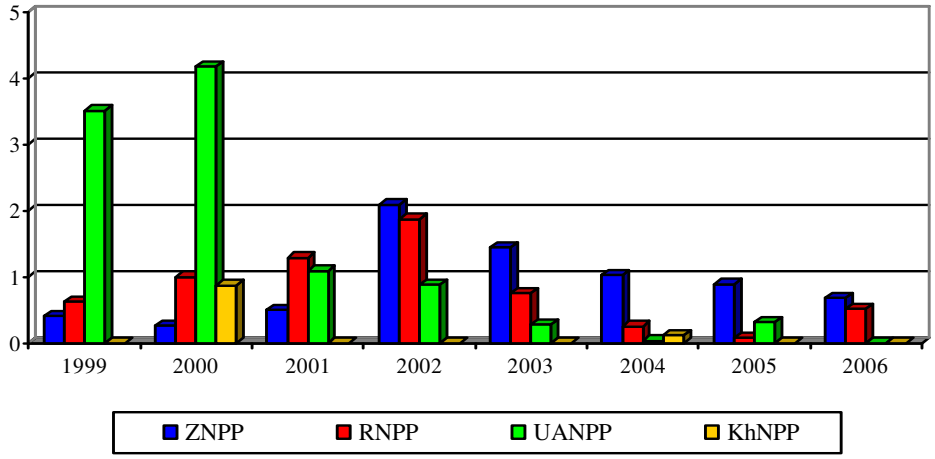


Figure 4. Percentage of Individuals Whose Annual Effective Dose Exceeds 15 mSv for Ukrainian NPPs

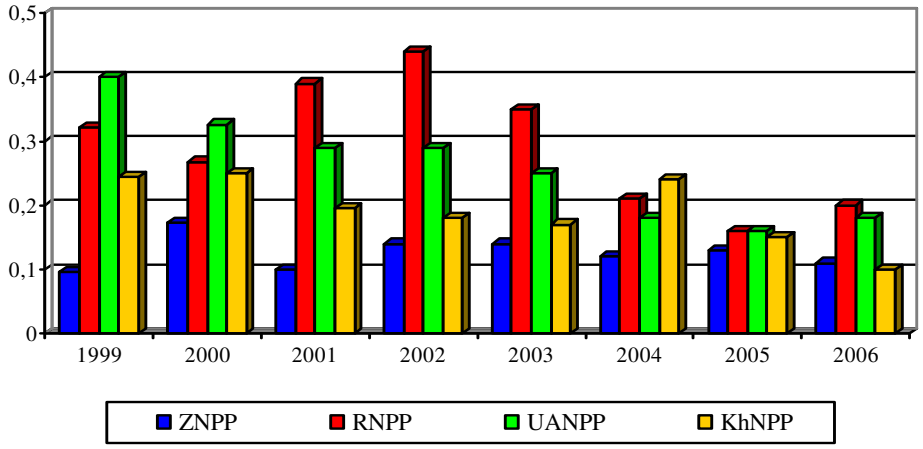


Figure 5. Ratio of Collective Dose to Produced Power Energy, man/mSv/Mw/year for Ukrainian NPPs

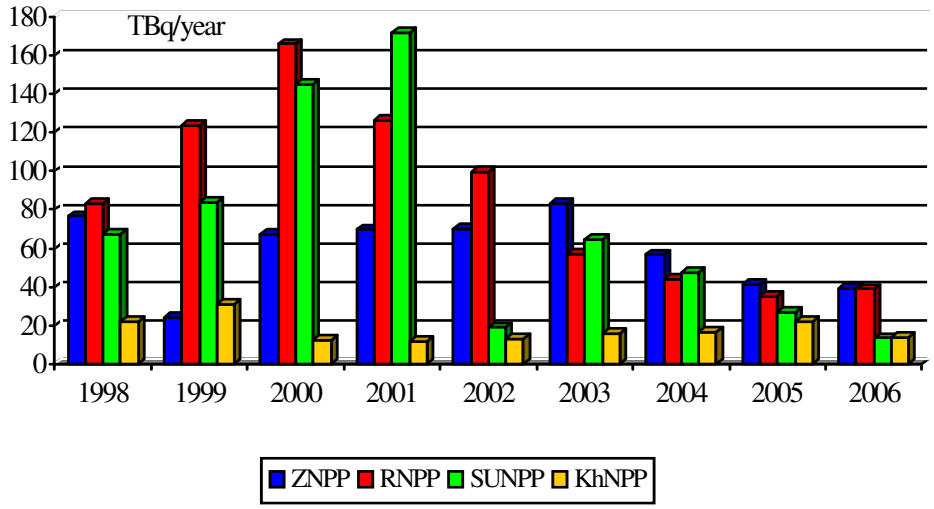


Figure 6. Total Releases of Inert Radioactive Gases from NPPs for 1998-2006.

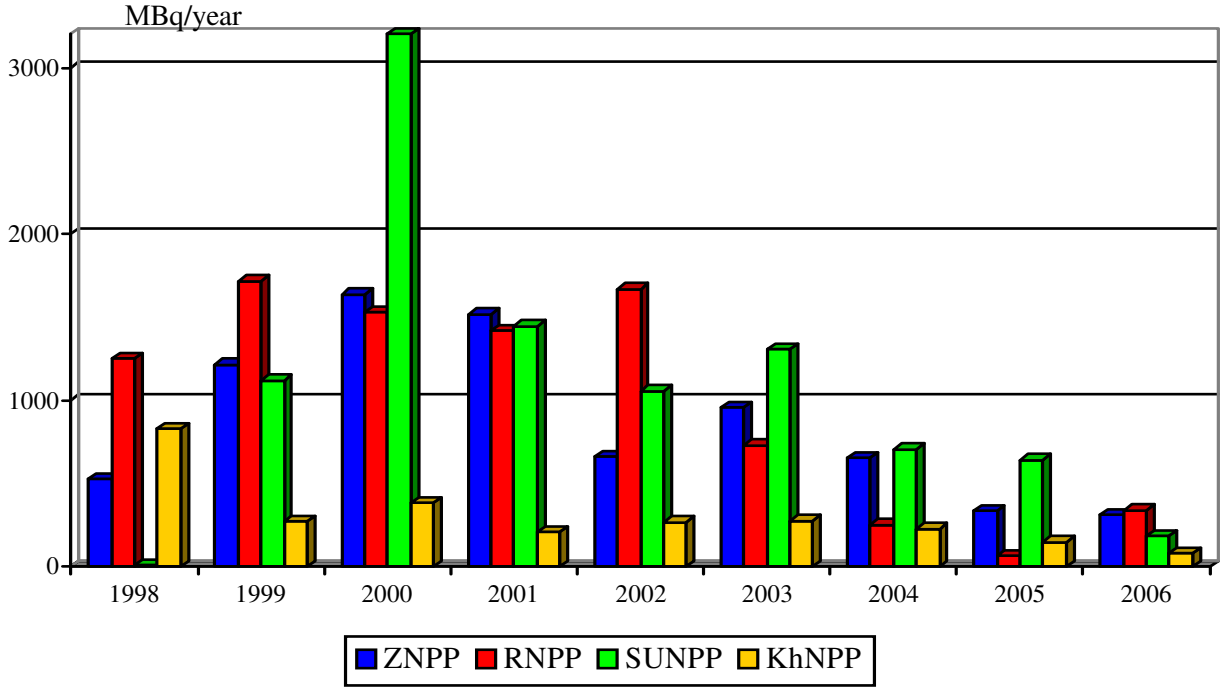


Figure 7. Total Release of Long-Lived Radionuclides from NPPs for 2000-2006

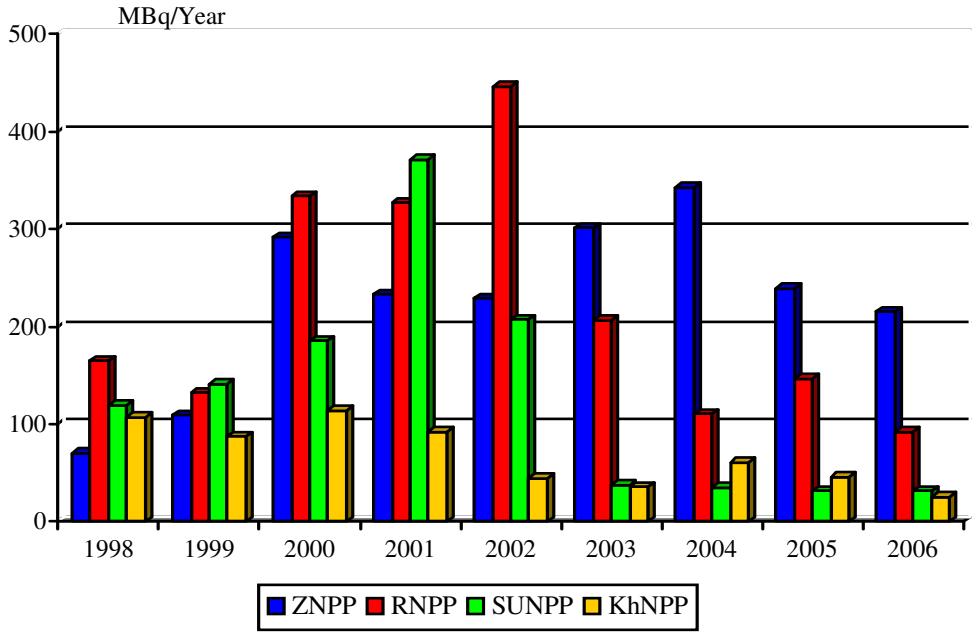


Figure 8. Total Release of Iodine Radionuclides from NPPs for 1998 - 2006

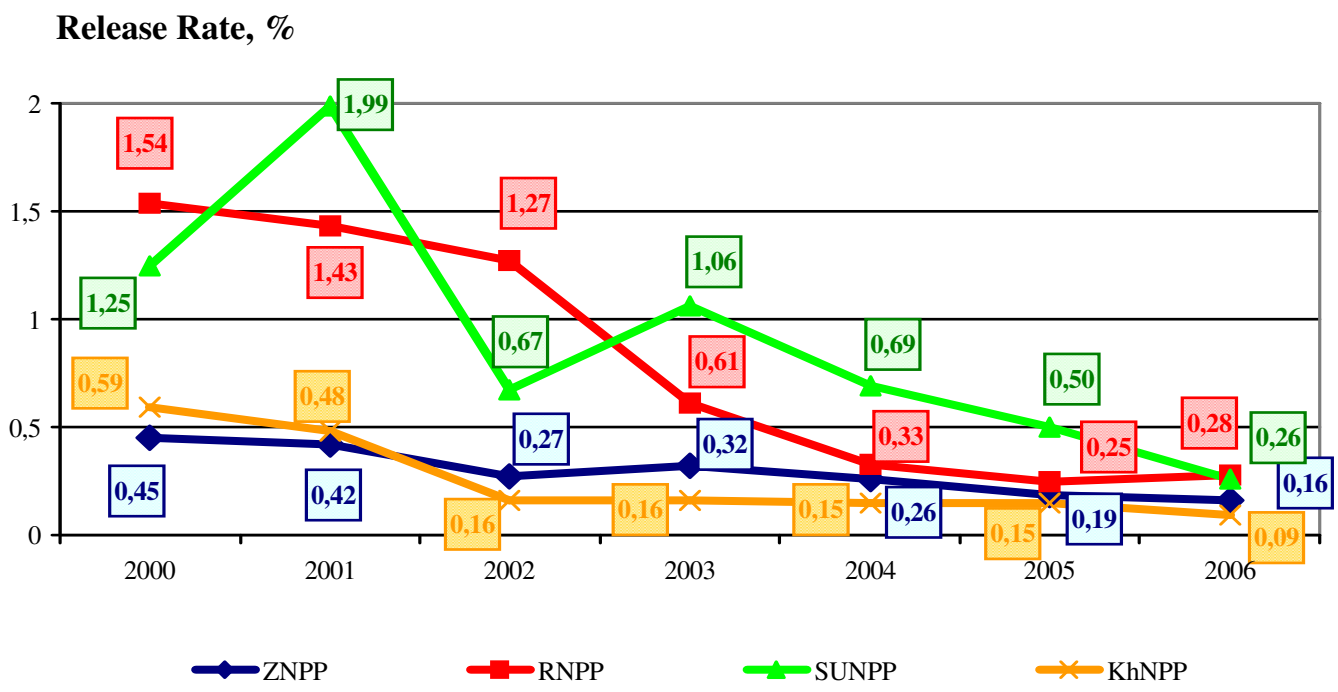


Figure 9. Dynamics in Summary Indexes of Gas-aerosol Radioactive Releases into the Environment from NPPs of the Company in 2000 – 2006

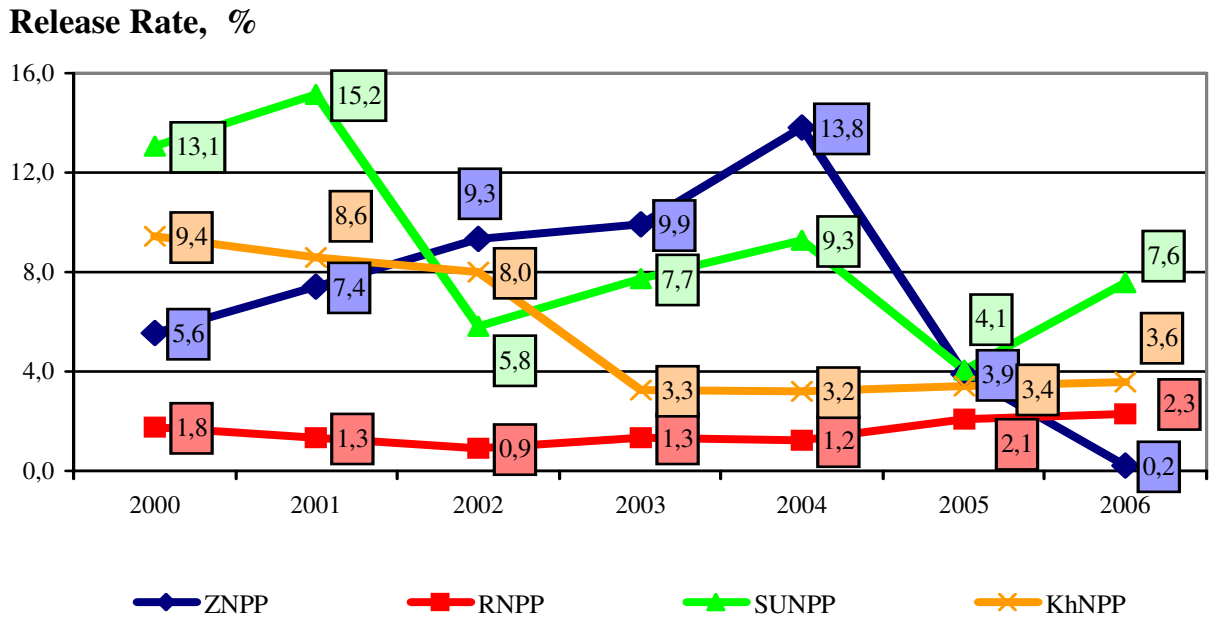


Figure 10. Dynamics of Summary Indexes of Radioactive Releases from NPPs of the Company for 2000 – 2006

Annex 6

INFORMATION ON CHORNOBYL NPP

In accordance with the Law of Ukraine "On the Ratification of Convention on Nuclear Safety", this Convention covers the safety assurance measures of Chornobyl NPP nuclear facilities including nuclear material accounting and control and fulfilment of IAEA safeguards for SSE "Chornobyl NPP".

Chornobyl NPP decommissioning is carried out within the license issued by the SNRCU in 2002. This license provides the operating organization with the right to carry out a complex of work and operations related to decommissioning of nuclear facilities including the work envisaged by the stage of nuclear facilities shutdown.
Currently, SSE "Chornobyl NPP" carries out activities within the decommissioning stage. One of the main priorities of Chornobyl NPP activity at this stage are as follows:

- Maintaining the safe state and ensuring the safe operation of units 1, 2 and 3 in accordance with the requirements of rules, standards and regulations in force;
- Spent fuel reloading (the work determining the duration of the stage) and development of infrastructure for spent nuclear fuel and radioactive waste management;
- Personnel training and qualification;
- Radiation monitoring of ChNPP facilities and natural environment.

At this stage, nuclear fuel removal from power units and its transfer to spent nuclear fuel storage facility designed for long-term storage is performed.

The power units are maintained in the safe state in accordance with the Operational Rules of power units 1, 2 and 3 at the stage of decommissioning. Monitoring of the safety parameters of the power units is ensured in full scope prescribed by the Regulations.

Spent nuclear fuel removal from power units

The work on removing of nuclear fuel from SSE "Chornobyl NPP" units and its transportation to active SFSF -1 started in December 2005, in order to ensure power units decommissioning and safety of work on transformation of the Shelter Object into an environmentally safe system. Procedure of this work is identified in the "Concept of Organization of Work on Spent Nuclear Fuel Management at Chornobyl NPP" agreed with the Ministry of Emergencies of Ukraine.

During this time, over 1\3 of the total fuel that remained in the units after NPP shutdown was transported from ChNPP power units to SFSF-1. This allowed in 2006 to remove completely the nuclear fuel from Unit 1 reactor core and start the work on reactor facility final shutdown at this power unit. Nuclear fuel removal from power unit 3 reactor is planned in 2007.

Therefore, by the end of 2007, nuclear fuel will be stored only in reactor cooling ponds at units 1, 2 and 3.

To fulfil all the tasks of the decommissioning stage in terms of fuel reloading from reactors cooling ponds, the investigations are planned in 2007 to choose the most favourable option of SNF safe interim storage at SSE "Chornobyl NPP" until its allocation for long-term storage at SFSF-2. The following options will be considered:

- SNF storage at units in reactor cooling ponds;
- organization of SNF storage in SFSF-1 in accordance with a compact storage scheme;

- organization of SNF storage in SFSF-1 in cooling pond No.5.

In 2007, it is also planned to start development of the project "Modification of damaged nuclear fuel storage facility at SSE "Chornobyl NPP" that will allow removal of damaged fuel assemblies from power units and SFSF-1.

Taking into consideration possible terms of SFSF-2 commissioning and duration period of fuel transportation, measures are taken to identify the necessity of SFSF-1 operating term extension (approximately, not less than 5 years) with safety reassessment.

As for management of unirradiated (fresh) defective nuclear fuel, currently, the set of documents was submitted to the SNRCU to obtain the license for transportation of nuclear fuel from SSE "Chornobyl NPP" to OJSC "Mashynobudivny Zavod".

In accordance with the Memorandum of Understanding between the Government of Ukraine, the Government of G7 countries, and the European Community Commission concerning Chornobyl NPP shutdown, facilities connected with the development of SNF and radwaste management infrastructure are constructed at Chornobyl NPP industrial site based on the program of international technical assistance:

- construction of spent nuclear fuel storage facility– SFSF-2,
- construction of liquid radioactive waste treatment plant – LRTP,
- construction of industrial complex for solid radioactive waste management - ICSRM

The management of funds under SFSF-2 and LRTP projects is carried out by the European Bank for Reconstruction and Development (Nuclear Safety Account), the management of funds under ICSRM project is carried out by the European Commission.

From 2006 till the beginning of 2007, the decision concerning completion of work on the most critical project - construction of new spent nuclear fuel storage facility SFSF-2 at ChNPP was taken. The issue of engaging new Contractor (American Holtec International Company) capable of solve the main technical issue (SNF drying) was finally resolved in July 2007 at the meeting of the Assembly of Donors of the EBRD Nuclear Safety Account.

Agreement between SSE "Chornobyl NPP" and Holtec International Company on construction of ChNPP SFSF-2 was signed in September 2007 with participation of the President of Ukraine.

A set of consultations with the EBRD was performed during which the issues on construction completion and liquid radioactive waste treatment plant (LRTP) commissioning were solved. At the meeting of the Assembly of Donors of the Nuclear Safety Account in July 2007, "The Strategy of completion of the liquid radioactive waste treatment plant (LRTP)" and "The Plan on completion of LRTP construction" prepared by SSE "Chornobyl NPP" were approved.

Consultations with the European Commission concerning completion of industrial complex for solid radioactive waste management (ICSRM) construction are underway. The joint approach enabling to complete the main work on the project by mid-2008 is being discussed.

Funding of Chornobyl NPP units 1, 2, 3 shutdown is made from the funds of the state budget in the following directions:

- power units maintenance in safe state;
- termination and preparation to decommissioning of units No. 1, 2, 3;
- organization and management of decommissioning;
- Ukraine's contribution to international projects at ChNPP site.

UAH 313,400.00 thousand which make up 110,6 % of 2006 funding is provided for financing the work on maintenance of power units and the Shelter Object at Chornobyl NPP in safe state under budgetary program KPKV 3201520 "Maintenance of power units and the Shelter Object at Chornobyl NPP in safe state". These funds will be allocated to power units No. 1, 2 and 3 maintenance in safe state, their economic support, as well as maintenance of the achieved safety level of the Shelter Object.

Funds of UAH 31,000 thousand equal to the funds in 2006 are provided for preparation to power units decommissioning and spent nuclear fuel and radioactive waste management at Chornobyl NPP under budgetary program KPKV 3201530 "Measures on preparation to power units decommissioning and spent nuclear fuel and radioactive waste management at Chornobyl NPP". These funds will be allocated to preparation and carrying out the Chornobyl NPP decommissioning: purchase of special casks for spent nuclear fuel reloading from power units 1 and 3, development of projects on SFSF-1 modification, solid and liquid radioactive waste collection and treatment.

Fulfilment of international obligations of Ukraine includes:

- obligations to the EBRD Nuclear Safety Account (from which funds are allocated to projects SFSF-2 and LRTP) – from funds of the budgetary program KPKV 3201540 "Ukraine's contribution to the EBRD Nuclear Safety Account" (first contribution of Ukraine to NSA was made in 2006 in the amount of UAH 18,587.9 thousand, and contribution in 2007 equal to UAH 9,852.1 thousand);
- obligations to the European Commission – from funds of budgetary program KPKV 3201530, within which a contribution of Ukraine to project of ICSRM development was made at the amount of EUR 722 thousand (Hryvnia equivalent);
- obligations to the Shelter Chornobyl Fund – from funds of budgetary program 3201180 "Ukraine's contribution to the Shelter Chernobyl Fund for SIP implementation" (expenditures in 2007 were planned at the amount of UAH 11,426.0 thousand).

Human Resources

The document "Rules of work organization with personnel of State Specialized Enterprise "Chornobyl NPP" was developed and put in force at SSE "Chornobyl NPP". This document takes into consideration up-to-date international experience in NPP personnel training. In accordance with this document, required qualification level and constant readiness to fulfil professional duties was provided, which is significant for nuclear and radiation safety assurance at NPPs.

The training centre, which obtained the license from the SNRCU for training of licensed personnel, and the license of the Ministry of Education and Science for training of various personnel categories acts as the basis for personnel training system at SSE "Chornobyl NPP". The Centre is staffed with qualified instructors and equipped with necessary technical means.

SSE "Chornobyl NPP" personnel training is carried out in accordance with individual training programs. Personnel training, which is subject to licensing, is carried out in accordance with individual training programs prepared on the basis of typical programs agreed with the SNRCU.

SSE "Chornobyl NPP" has been fully staffed with well-trained and qualified personnel.

Efficient personnel training of SSE "Chornobyl NPP" ensures improvement of nuclear facilities safety level.

Human Factor

Personnel readiness to eliminate the emergency situations, accident monitoring and prevention of repeated violations of ChNPP operation are achieved by means of:

- emergency training in the course of job training in accordance with individual program;
- emergency training for operating personnel;
- educational and training sessions within qualification maintenance programs;
- full-scale training on accidents elimination.

Based on personnel training results as well as other measures aimed at safety culture improvement from 2004 till the first quarter of 2007, violations of nuclear safety were absent.

Quality Assurance

15 Quality Guides and 9 Quality Programs were developed during the 2004 - 2007 reporting period to form the quality policy at SSE "Chornobyl NPP". Quality Assurance Department was established. Regulatory basis of ChNPP quality system assessment is being continuously upgraded.

Managers of structural units perform evaluation of personnel activities during inspection of workplaces according to the diagram developed in compliance with "Provision on work planning with Chornobyl NPP personnel".

Quality assessment and testing

The Commission for nuclear safety state inspection at power units No. 1, 2, 3, SFSF-1 and the Shelter Object is formed once a year in accordance with the requirements of the regulatory documents and the order of SSE "Chornobyl NPP".

In accordance with "Regulation on nuclear safety state inspection at SSE "Chornobyl NPP", the Commission audits compliance with rules, standards and instructions on nuclear safety in reactor facilities operation, and work with nuclear fuel, safety significant systems maintenance and nuclear materials physical protection assurance in SSE "Chornobyl NPP" structural units.

Based on the inspection results, the "Act of nuclear safety state inspection at power units No. 1, 2, 3, SFSF-1 and the Shelter Object is prepared and measures on of nuclear safety improvement are developed.

Radiation Protection

Monitoring of external exposure doses at ChNPP was carried out with the help of individual dosimetry system, use of which provides the possibility in measuring depth exposure dose Hd; surface dose Hskin (including β-radiation exposure), as well as doses on crystalline lens Hlens (from photons and β-radiation).

Excess of dose limit and reference level of external exposure dose (Hd), reference level of skin exposure dose (H skin) and crystalline lens (Hlens) established for ChNPP personnel was not recorded during the reporting period.

Collective and individual exposure doses of SSE "Chornobyl NPP" personnel during 2004 - 2007 are as follows:

Year	Collective,	Average,

	mSv	mSv
2004	7707,5	2,34
2005	8253,62	2,24
2006	6541,72	1,73

Reference level of individual equivalent personnel exposure doses in 2006 was 14.0 mSv.

Discharge of long-lived radionuclides at ChNPP, kBq/day.

Year	2004	2005	2006
	152	50,3	191,9

None of ChNPP personnel took the annual effective dose over 15 mSv within 2004 - 2007 at SSE "Chornobyl NPP".

Emergency preparedness

Chornobyl NPP personnel training to perform actions under emergency conditions, improvement of their knowledge and skills in accidents conditions and elimination of their consequences is carried out in accordance with the developed "Emergency Response Plan of SSE "Chornobyl NPP".

Account of nuclear material, monitoring and fulfilment of IAEA safeguards

SSE "Chornobyl NPP" fully complies with the requirements of the state safeguards system and assures implementation of IAEA safeguards system.

Te basis of assuring the state safeguards system is to meet the requirements of the state account and monitoring system (SAMS) of nuclear material. In accordance with the requirements of the SAMS, officials of SSE "Chornobyl NPP" were assigned responsible for maintenance of the account and monitoring system of nuclear materials. The procedures for nuclear material account and monitoring were developed.

To achieve the purpose of IAEA safeguards system, the account of nuclear material is a high priority measure in safeguards area in combination with preservation and observations as important additional measures.

In accordance with the Safeguards Agreement, the International Agency undertakes periodic inspections and technical visits.

Currently, to assure functioning of the IAEA preservation and observations systems, such system was installed and is functioning at SSE "Chornobyl NPP" units 1, 2, 3, SFSF-1 and the Shelter Object with the following components:

- video alarming systems SDIS at units 1, 2 and SFSF-1;
- video cameras ALIS in central halls at units 1, 2 and 3;
- detection systems USFM at SFSF-1;
- detection systems GRAND at units 1 and 2;
- mobile systems MMST in container car for spent nuclear fuel transfer;
- video cameras ALIP in container car for spent nuclear fuel transfer;
- integrated detection and video alarming systems CRSM at unit 3;
- fiber-optic seals COBRA and metal seals in cooling ponds at SFSF-1;
- code-changeable seals VACOSS in central halls at units 1, 2 and 3;
- combined monitoring system CSUMS at the Shelter Object.

Decommissioning

During the reported period, the following equipment was dismounted at ChNPP power units:

- evaporator facility of turbine 1;
- generator stator cooling systems at power units 1,2;
- gas cooling system of generator at unit 1;
- main air-nitrogen station with auxiliary systems;
- metal structures in sections 101, 102 of room 138 SRTV;
- electrolysis plant;
- hydrogen concentration monitoring system;
- main system of condensate pump-over.

In 2007, dismounting of turbine-generator set 1 (steam turbine and generator) with auxiliary systems was started.

Annex 7

Information on the Shelter Object

Among all nuclear facilities of Ukraine, special place belongs to a facility unique in the world practice – the Shelter Object – Chornobyl NPP unit 4 destroyed in 1986 as a result of beyond design accident, which has lost all its functionalities and on which the first priority measures were taken in order to decrease accident consequences and assure monitoring of its state and nuclear and radiation safety.

The Shelter Object is not a facility created in accordance with the rules and standards on site selection, designing, construction, commissioning, operation and decommissioning of nuclear plants. The current status of the Shelter Object does not and cannot comply with safety standards and rules in power engineering and requirements of industry-general safety.

In accordance with the Law of Ukraine "On the Ratification of Convention Nuclear Safety", the Shelter Object does not fall under the force of this Convention due to its uniqueness conditioned by global consequences of the Chornobyl accident and impossibility to achieve its high safety level at present in accordance with requirements of the Convention.

The Shelter Object in its current state is qualified as a site for surface storage of unauthorized radwaste (temporary storage of unauthorized radwaste at the stage of stabilization and reconstruction). In other words, all nuclear and radioactive materials at the Shelter Object are the radioactive waste. Regulation of operations at the Shelter Object is carried out in accordance with its qualification specified in NRBU-97/D-2000 based on regulatory and legal acts on nuclear and radiation safety in force.

Radwaste generated as a result of accident, which are the open sources of ionizing radiation and are at the Shelter Object in large scope without any reliable protection barriers, are a serious current and potential hazard for personnel and population including future generations and environment.

In accordance with conditions of the license issued by the SNRCU for the Shelter Object operation, the objective of any activity at the Shelter Object (including the Shelter transformation into environmentally safe system) is protection of personnel, population and environment from impact of radioactive materials available at the Shelter Object or on its site. Any activity pursuing other purposes is prohibited at the Shelter Object.

Transformation of the Shelter Object into an environmentally safe system requires considerable financial and material resources and international support to solve this large problem as soon as possible.

Information: In accordance with the Memorandum of Understanding between the Government of Ukraine, the Governments of G7 states and the Commission of the European Communities on Chornobyl NPP shutdown signed in December 1995, a Recommended Course of Actions was developed providing for three phases of measures on the Shelter Object transformation into environmentally safe system:

Phase 1 – stabilization and other short-term measures.

Phase 2- preparation to transformation into environmentally safe state.

Phase 3- transformation into environmentally safe state.

Within the Shelter Implementation Plan (SIP), measures are being implemented of the first two phases. The main project under SIP is construction of new safe confinement – a protective construction, which includes a set of technological equipment for removal all materials containing nuclear fuel from the destroyed power unit 4 at Chornobyl NPP, radioactive waste management and other systems for the power unit transformation into an ecologically safe system and for safety assurance of personnel, population and environment. The confinement's operation life is 100 years. As regards removal of fuel-containing materials and other high-level waste from the Shelter Object, at present there are only conceptual decisions and preliminary assessment of time and costs required to implement these decisions.

In total SIP has 22 tasks.

It was planned in 2004 to complete the confinement construction, and in 2007 to complete dismantling and the entire project.

Within the Shelter Implementation Plan (SIP), the following main infrastructures were put in operation: personnel training centre at the Shelter Object, rehabilitation centre, construction basis for the Shelter Object stabilization, decontamination unit for small equipment and tools, sanitary inspection post for 1430 persons, sanitary gateway at mark +5.800, analytic centre, external engineering networks for the infrastructure facilities. SIP PMU is located in the new administrative building at ChNPP industrial site, this improved projects management.

An upgraded dust suppression system was put into operation, the integrated database of the Shelter Object was put into research/industrial operation.

Implementation of time-urgent measures on building structures resistance at the Shelter Object is practically completed.

Creation of an integrated automated system of nuclear, radiation, and seismic monitoring, monitoring of building structures state (IACS), system of access and physical protection, as well as preparatory work for new safe confinement (NSC) is being performed.

Selection of Contractor for NSC construction is at the stage of completion. On July 17, 2007, the meeting of the Assembly of Donors to the Shelter Object Chornobyl Fund was conducted. At the meeting, the results of discussions with consortium "NOVARKA" (as a future NSC Contractor) were approved and a decision on concluding a Grant Agreement for NSC implementation was made.

A Contract between SSE Chornobyl NPP and the Consortium "NOVARKA" for NSC construction was signed in September 2007 with the participation of the President of Ukraine.