NATIONAL REPORT OF UKRAINE

ON COMPLIANCE WITH OBLIGATIONS
OF THE CONVENTION ON NUCLEAR SAFETY

KYIV 2004

FOREWORD

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

By implementing the Convention and taking appropriate measures, Ukraine completely fulfils its obligations as set forth in Article 4 of the Convention.

Ukraine took active part in reviewing National Reports of the Parties, exchanging written questions and comments, as well as discussions at the Second Review Meeting.

This Third 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" (IAEA, Information Circular, INFCIRC/572/Rev.1, 21 October 1999), and also taking into consideration recommendations of the Summary Report on the Second Review Meeting of Contracting Parties dated 26 April 2002 (CNS-RM-2002/02) and Report of the IAEA Secretariat to the Third Review Meeting dated 11 March 2004.

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

This Report results from joint efforts of state bodies of Ukraine responsible for carrying out the state policy in nuclear energy use:

- State Nuclear Regulatory Committee;
- Ministry of Health;
- Ministry for Emergency Situations and on Affairs of Population Protection Against Consequences of the Chernobyl Catastrophe;
- Ministry for Environment and Natural Resources;
- Ministry for Fuel and Energy;
- Ministry for Foreign Affairs,

as well as the Licensees:

- National Atomic Energy Generating Company – NAEK "Energoatom";
- State Specialised Enterprise "Chornobyl NPP".

The Report is based upon legislative and regulatory documents in force in Ukraine and official reports of central executive bodies that supervise and regulate the safety in the use of nuclear energy.

The main objective of the Report is to provide objective and unbiased information on the safety of nuclear installations and on measures taken to upgrade its level and protect the public and the environment of Ukraine, as well as to highlight changes and progress in the legislative and regulatory framework, and in nuclear energy branch of Ukraine for the last three years.

Based on the material presented in the National Report and according to the authority delegated by the President of Ukraine, the Chairman of the State Nuclear Regulatory Committee of Ukraine states that Ukraine has established the priority to safety of the human and environment in the use of nuclear energy. In this context, *Ukraine completely fulfils its obligations in compliance with the requirements of the Convention on Nuclear Safety*, as confirmed by:

- establishment and development of legislative and regulatory provisions for safety assurance of the practices;
- development of safety culture;
- establishment of the state regulatory body for nuclear and radiation safety with appropriate authority, which regulates the safety requirements, criteria and indicators and undertakes licensing and supervision independently of the licensees and other state bodies;
- comprehensive safety assessments of existing nuclear installations and measures intended to upgrade the safety;
- development of the emergency preparedness and crisis response system;
- full responsibility imposed on the licensee for ensuring the safety and taking measures to protect the human and the environment.

The actual data provided in the Report are of 1 July 2004. The Ukrainian Delegation will additionally report on changes that will take place by April 2005 at the Third Review Meeting.

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

Kyiv – 7 September 2004

Vadym Gryschenko

Chairman of the State Nuclear Regulatory Committee of Ukraine

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INTRODUCTION

Nuclear energy remains the most important component in the fuel energy system of Ukraine.

According to 2003 data, nuclear power plants produced 45.3% of the total amount of electricity, thermal power plants – 47.5% and hydroelectric power plants – 5.2%. The total installed capacity of operating nuclear power units remains unchanged and constitutes 11,835 MW.

As of 2004, there are 13 power units with water-cooled water-moderated reactors operating at four nuclear power plants (NPPs) in Ukraine. Two power units are at their commissioning stage – Khmelnitsky unit 2 and Rivne unit 4; three power units of the Chornobyl NPP are being decommissioned. The Shelter facility of this plant is in the process of its conversion into an ecologically safe system. A list of power units and their basic characteristics are provided in Annex 1.

During the last three years, operation of the nuclear power units have been more stable, the number of operating events decreased, and the number of power unit emergency shutdowns with scram decreased owing to safety upgrading measures, repair and maintenance quality enhancement, and personnel training. The amount of electricity produced by nuclear power plants increased and reached 81.4 milliard kW/h in 2003 (77.99 in 2002, 76.169 in 2001). The capacity factor of nuclear power units steadily continued to increase and reached 78.5% in 2003 versus 75.2% in 2002 and 73.5% in 2001.

In order to fulfil the Presidential Decree No. 42/2001 dated 27 February 2001 “On Development of Ukrainian Energy Strategy for the Period till 2030 and Future Prospects”, strategic areas for developing the nuclear branch were developed and are currently considered and discussed by scientific communities, expert organisations, and the general public. These areas take into account the current status of energy supply and energy safety of the State, as well as the priority to safety of population and the environment determined by Ukraine’s national policy in the use of nuclear energy.

Near-term tasks of the nuclear energy branch are to:

- upgrade the operational safety of nuclear power plants in service;
- commission two new power units K2/R4;
- extend the designed lifetime of operating power units based on safety reassessments, determine the residual service life and take measures to upgrade the safety and manage the ageing processes at safety-significant systems and equipment;
- manage spent nuclear fuel;
- decommission three ChNPP power units and convert the Shelter facility into an ecologically safe system.

Implementation of Ukraine’s national nuclear energy programme is supported by a number of programme documents.

One of the main tasks in implementing the national nuclear energy programme is to upgrade the operational safety of power units in service. During the reporting period,

measures to upgrade the safety have been taken on the basis of a comprehensive analysis of existing safety issues as identified and ranked in compliance with the International Atomic Energy Agency (IAEA) recommendations, taking into account operational experience of similar Ukrainian and foreign units and according to the established priorities. In 2002 the Cabinet of Ministers of Ukraine approved the «Comprehensive Programme for Modernisation and Safety Enhancement of Ukrainian Nuclear Power Plant Units», which is to be completed in 2006.

Taking into account favourable international experience in extending the lifetime of water-cooled reactors and results of safety analysis and safety enhancement measures, Ukraine implements measures to manage the ageing processes and extend the service life of power units beyond the designed period.

In order to settle these issues on a systematic basis, the Cabinet of Ministers of Ukraine by its Resolution approved the “Comprehensive Work Programme for Extending the Service Life of Operating Nuclear Power Units” in May 2004. The Programme identifies the required measures, establishes priorities of activities and contains an estimate of needed resources, in particular: the scope, procedure and timescale for measures required for extending the service life of nuclear power units.

The national energy programme determined the priority development of nuclear energy; therefore, National Nuclear Energy-Generating Company NAEK “Energoatom” currently investigates the status of structures, equipment and facilities at Khmelnitsky 3 power unit, which construction was terminated in 1991. Based on this investigation, a proposal will be submitted to the Government of Ukraine regarding the completion of this power unit.

Spent nuclear fuel (SNF) management is regulated by appropriate state and branch programmes, namely:

- “Comprehensive Programme on Radioactive Waste Management” as approved by Resolution of the Cabinet of Ministers of Ukraine No. 542, dated 5 April 1999, and amended in 2003;
- “Comprehensive Programme on Creation of Nuclear Fuel Cycle in Ukraine. Management of Spent Nuclear Fuel from Nuclear Power Plants” as approved by Ordinance of the Minister for Fuel and Energy No. 7, dated 13 January 2000.

During the reporting period, Ukraine has been pursuing the following strategy of spent nuclear fuel management:

- construction of on-site and centralised SNF storage facilities;
- scientific development and exploration for selecting a site for disposal of radioactive waste in geological repositories;
- development of scientific-technical and design-engineering support to SNF management.

The spent nuclear fuel storage facility at the Zaporizhzhya NPP is currently in operation, and a storage facility at Chornobyl NPP site is under construction.

NAEK “Energoatom” is going to construct a centralised dry storage facility for spent nuclear fuel from Ukrainian WWER reactors. A tender is underway to select contractors for designing and constructing the storage facility.

The Chornobyl power units are currently kept at the termination-of-operation stage. Spent nuclear fuel is stored in reactors and cooling ponds.

There is almost a four-year delay in Chornobyl NPP decommissioning resulting from the failure to comply with the commissioning schedule of the Spent Fuel Storage Facility (SFSF-2). In implementing the SFSF-2 design, the general designer (Engineer Architect) – Framatome Company – completed a considerable amount of construction and installation work and developed and delivered a part of equipment. However, significant errors in the design were revealed in the construction process; as a result, Framatome suspended the construction in the middle of 2003. The construction has not been recommenced.

Power unit 4 of the Chornobyl NPP – which was destroyed by a severe accident in April 1986, and then transformed into the Shelter facility – takes a special place among the nuclear installations of Ukraine. Emergency measures were taken to ensure continuous safety of the facility. Main peculiarity of the Shelter is its potential hazard, which is considerably greater than that permitted by standards and rules for installations containing nuclear fissile hazardous materials.

The Shelter conversion into an ecologically safe system requires significant financial and material resources and innovative scientific and engineering solutions. Therefore, Verkhovna Rada of Ukraine (the Parliament) gave the following warning in the Law "On Ratification of the Convention on Nuclear Safety":

“1. Verkhovna Rada of Ukraine adopted a critical decision to ratify the Convention on Nuclear Safety, thus confirming its adherence to the principles of nuclear safety culture and ensuring their implementation, and based on the fact that the world community and the IAEA member-states recognise the unique nature of the Shelter facility located at the territory of Ukraine, that is conditioned by global consequences of the Chornobyl catastrophe.

At present, there are no technologies for converting the Shelter into an ecologically safe system; a set of measures has not been identified as required to achieve a high safety level at this facility in compliance with the requirements of the Convention.

In this regard, Ukraine is not able to solve this wide-ranging problem on its own and relies upon assistance of the IAEA, international organisations and individual states in settling scientific and engineering issues of the Shelter safety; this will also assist in achieving the objectives of the Convention on Nuclear Safety.

2. Provisions of the Convention’s Article 3 are not applicable to the Shelter facility.”

According to the above Law of Ukraine, this Report does not dwell on specific issues related to the Shelter safety.

At the same time, it should be noted, that certain progress was made in fulfilling the Shelter Implementation Plan during the reporting period.

The following efforts are currently underway in the framework of the Shelter Implementation Plan:

- preparation is in progress for construction and installation work (in compliance with the detailed design) needed to stabilise the most hazardous structures in view of their potential collapse ;
- implementation of the conceptual design of the safe confinement is in progress;
- implementation of the integrated automated monitoring system design is in progress;

- trial commercial operation of the modernised dust-suppression system is in progress.

SECTION I. BASIC CONCLUSIONS ON RESULTS OF THE SECOND MEETING

In addition to safety issues as identified in the previous Report of Ukraine and requiring further development, this Report focuses on the following:

- licensing of nuclear power plants (set forth in Section III, para 3.2, Section V, paras 5.1, 5.2, 5.3);
- implementation of the upgrading programme (set forth in Section II, para 2.1, Section III, para 3.2);
- development of internal quality assurance programme of state safety regulation (set forth in Section III, para 3.2).

This Report also incorporates recommendations of the Second Review Meeting regarding further provision of information on problems being of interest to all Parties to the Convention on Nuclear Safety.

SECTION 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 practical 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 possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environment and economic impact.

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

According to their design features, power units of the Ukrainian NPPs can be divided into three groups (Annex 1):

- power units with WWER-1000 (V-320) – large series;
- power units with WWER-1000 (V-302, V-338) – small series;
- power units with WWER-440 (V-213).

Since submission of the previous Report, safety analysis reports have been developed in the planned scope, namely: the first stage of the safety analysis has been completed on the pilot (reference) power units covering all WWER designs operating in Ukraine – RNPP-1, SUNPP-1 and ZNPP-5.

Revision of technical safety substantiation (TSS) has been completed for all the NPP units; design documentation has been revised to incorporate changes and additions conditioned by reconstructions and modifications implemented, actual state of safety-significant systems, and parameters and characteristics that have safety impact.

All factors related to changes in environmental conditions, industrial and household activity, and demographic factors have been reassessed for all NPP sites. Appropriate changes have been introduced into design documentation.

The safety analysis focused on additional and/or specified safety parameters, principles and criteria, as compared to those incorporated in the design has been carried out for all NPPs within the additional materials on safety analysis (AMSA). Operating experience for the last 5-10 years has been analysed in terms of NPP safety.

Results of the analysis confirm that all safety indicators, first of all safety indicators of safety systems, status of protective barriers, NPP impact on personnel, the public, the environment, etc., are acceptable and do not tend to deteriorate. As a result of the safety enhancement measures undertaken at NPPs, the number of operational events decreased by half as compared to the early 90's.

In the framework of the in-depth safety analysis employing up-to-date tools (probabilistic safety analysis (PSA), analysis of design-basis accidents (ADBA)), quantitative assessments of the core damage frequency were obtained: comparison of level 1 PSA results with PSA results for the European NPPs with WWERs shows that safety of the Ukrainian power units corresponds to the safety of foreign analogues. Dominant accident

sequences and spectra of minimal cross-sections regarding the main contributors to the core damage frequency have been determined; an instrument has been obtained for identifying the priorities of safety upgrading measures – this tool will be used to identify specific measures and their sequence within the integral SAR.

The first stage of safety assessment permitted determining the safety level of all NPP designs in operation. Findings of this assessment allowed the State Nuclear Regulatory Committee of Ukraine (SNRCU) to make a decision on issuing licences to operate NPPs for each site and determine priorities for further plant safety enhancements.

The in-depth safety analysis of NPPs is currently continued within the second stage. The second stage deals with complementing the level 1 PSA (as regards external events and low power level), analysing transients without scram and revising guidelines on beyond design-basis accident management as regards specific recommendations and assessment of the time for the operator's response. The development of level 2 PSA has been planned.

In parallel with the completion of SARs for pilot power units, the operating organisation adapts results obtained for pilot designs to other power units with similar reactors.

The operating organisation carries out this activity in compliance with the schedules approved by the SNRCU. Measures related to SAR development are taken in compliance with the «Summary (Consolidated) Schedule for Developing SAR Sections for Power Units with WWER-440/V-213, "Small Series" WWER-1000, and WWER-1000/V-320» as approved by the SNRCU.

It should be also noted that the safety analysis was carried out in much greater scope for new units WWER-1000 (V-320) KhNPP-2/RNPP-4 and favourable results were obtained during the reporting period. This analysis covers the location area, site, common-unit structures and systems. More detailed information on the safety analysis of these new units is provided in para. 5.3.1.

Positive conclusions made in the comprehensive safety assessment comply with findings of experts involved in international missions on safety assessment at the Ukrainian NPPs. According to these missions, the level of operational safety is acceptable at the Ukrainian NPPs and complies with the international practices in key areas, namely:

- positive trends are observed in all areas subject to assessment as compared to the situation during similar missions in the middle and late nineties;
- NPP administration and mid-level personnel have started wide application of existing international experience in identifying and solving safety issues;
- substantial improvements are observed in the area of personnel training, efficient use of full-scale simulators permits training at acceptable quality level;
- NPPs undertake a significant number of measures that demonstrate the willingness of plant management and personnel to improve the safety culture; the operating organisation plays an important role in implementing branch measures on safety self-evaluation, systematic feedback from operating experience, and quality assurance improvement;
- advanced technologies and guidelines have been successfully implemented in the in-depth safety assessment of the Ukrainian NPPs; in particular, the applied PSA methodology was considered adequate by review of IAEA experts;

- NPP personnel took an active part in safety assessments: management of the most significant tasks, participation in the development of thermohydraulic calculations, assistance to subcontractors in their work.

Results of the in-depth safety assessment of NPP pilot units and SAR review allow the statement that the scope of the analyses within the SAR is sufficient to confirm that the safety of power units complies with the national and internationally accepted requirements on nuclear and radiation safety. Safety deficiencies, which could cause the need to terminate the operation of pilot power units, were not revealed.

Drawbacks and weak spots of the design as revealed by safety assessment require the implementation of safety enhancement measures. These issues are solved in the framework of the Programme for Modernisation and Safety Enhancement of the Ukrainian Nuclear Power Plant Units, which is based on results of the in-depth safety assessment.

Safety enhancement measures are planned and implemented on the basis of long-term programmes, prospective and current plans that are intended to:

- comply with national legislative requirements and recommendations of the international organisations;
- take into account recommendations of experts within international missions: IAEA, WANO, OSART, European Commission etc.;
- eliminate safety deficiencies revealed from operational experience of the Ukrainian and foreign NPPs;
- eliminate drawbacks of the design;
- carry out the in-depth safety analysis of operating power units with the use of up-to-date methods and approaches based on accepted international practices;
- improve operation (take measures to prevent initiating events, ensure personnel training, maintenance, testing and inspection of process systems and equipment, develop guidelines on operation and maintenance, accident management and mitigation of accident consequences, personnel training in accident management and emergency actions, improvement of safety culture and quality assurance);
- improve radiation protection of personnel and the public;
- improve fire safety.

A list of programme documents on safety improvement is provided in Annex 2.

Annex 3 contains the Summary Report “Annual Assessment of Safety Enhancement Measures at the Ukrainian NPP Units in Compliance with IAEA Recommendations” providing data on the inventory of measures and the status of their implementation.

In particular, the “Comprehensive Programme for Modernisation…” alone provides for 388 measures for 2002-2005 at the Ukrainian power units, which are implemented under separate projects. The total number of separate projects and activities constitutes 937. Special attention is paid to the following:

- adequacy of the conservative approach to safety assessment accepted in the design;
- ensuring efficiency of safety barriers and means of their protection;
- improvement of technical and administrative measures intended to prevent initiating events and their development into accidents, as well as to manage beyond design-basis accidents;
- sufficiency of available analyses and safety substantiation for developing safety analysis reports (SAR).

After development of the SAR second stage, revision of the «Comprehensive Programme for Modernisation...» is planned to incorporate measures of categories II and I as set forth in the IAEA documents as regards their nomenclature and priorities, as well as implementation of the programme till 2006. Meanwhile, Ukraine has determined that bringing the safety of operating power units into compliance with the level achieved at new units – RNPP-4 and KhNPP-2 that underwent substantial modernisation and upgrading during construction – is its priority.

The decision on further operation of the Ukrainian power units was based on the assessment of accepted design bases and technical solutions of the reactor, data on operational experience, and study of the possibility to maintain and enhance safety by implementing compensatory measures. The in-depth safety analysis of the “pilot” power units has shown that no safety deficiencies have been revealed either at “pilot” units and those constructed and commissioned, which would require shutdown of these units. This instils confidence that operating power units of the Ukrainian NPPs can operate safely over the designed lifetime and permits planning the measures intended to extend this lifetime.

Since the submission of the previous Report, Ukraine has completed stage I of the safety assessment. Results of the comprehensive assessment confirm that safety of the Ukrainian NPPs is acceptable.

The proposed modernisation measures have permitted enhancing safety of nuclear installations and eliminating the revealed drawbacks.

There are no safety deficiencies that would require terminating the operation of power units.

SECTION III. LEGISLATION AND REGULATION

3.1. Legislative and Regulatory Framework (Convention Article 7)

Each Contracting Party 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.

As noted in the Second National Report, the legislative and regulatory system of Ukraine in nuclear energy use fully covers all safety principles and provisions of the Convention. A list of Ukrainian regulations in this field is provided in Annex 4.

During the three years after the Second Review Meeting, the aforesaid system has been further developing in Ukraine. The main areas in developing nuclear legislation were to create mechanisms for financial coverage of the operating organisation's liability for nuclear damage and decommissioning of nuclear installations. Therefore, as further development of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", the Verkhovna Rada developed and adopted two very important laws:

- "On Civil Liability for Nuclear Damage and Financial Coverage" (dated 13 December 2001);
- "On Settlement of Issues Related to Nuclear Safety" (dated 24 June 2004).

In particular, the Law of Ukraine "On Settlement of Issues Related to Nuclear Safety" determines legal and administrative provisions for financial coverage of termination of the operation and decommissioning of nuclear installations.

During the reporting period, 8 laws of Ukraine were adopted with the purpose of amending some legislative documents with regard to passing the Laws "On Authorising Activity in Nuclear Energy", "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation" and adapting Ukrainian legislation to that of the European Union.

In order to establish and improve functions of the state regulatory body for nuclear and radiation safety of Ukraine, four Presidential Decrees were put in force.

In order to fulfil the Laws of Ukraine and improve the licensing procedure in nuclear energy, regulate safety of nuclear material transportation, emergency response procedures, management of radiation sources, provide for physical protection and interaction regarding appropriate issues at the international level, the Cabinet of Ministers of Ukraine adopted 19 resolutions. In order to fulfil the Laws of Ukraine "On Insurance", "On Nuclear Energy Use and Radiation Safety", "On Civil Liability for Nuclear Damage and Financial Coverage", "On Authorising Activity in Nuclear Energy Use", the Cabinet of Ministers adopted Resolution No. 953 of 22 June 2003 "On Obligatory Insurance of Civil Liability for Nuclear Damage" and Resolution No. 1307 of 20 August 2003 "On Approving the Procedure for Determining Rates in Obligatory Insurance of Civil Liability for Nuclear Damage".

Provisions of these Resolutions fully meet legislative requirements and permit ultimate compliance with the Vienna Convention on Civil Liability for Nuclear Damage, as well as determination and separation of the State and nuclear operator's responsibilities; this should ensure protection of the Ukrainian population in the event of a nuclear incident.

Since the submission of the Second Report, the SNRCU continued improving the national system of standards and rules for nuclear and radiation safety and its harmonising with the European and world safety standards. In 2001-2003, 30 regulations were implemented which compensated for the deficiencies of legal regulation in many areas in the use of nuclear energy.

The SNRCU Board by its Decision of 25 February 2003 adopted the "SNRCU Programme for Development of Regulations on Nuclear and Radiation Safety for 2003-2005" taking into account issues requiring immediate solution, namely: KhNPP-2 and RNPP-4 completion and commissioning, extending the service life of operating power units beyond the designed term, establishing a procedure for review of nuclear and radiation safety, improving safety of all activities in nuclear energy. The objective of implementing this Programme is to improve the regulation by identifying priorities in the rule-making process, applying recognised international approaches, results of scientific research and feedback of gained experience, and establishing implementation timescales.

3.1.2 A system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence.

The Laws of Ukraine "On Nuclear Energy Use and Radiation Safety" and "On Authorising Activity in Nuclear Energy Use", which basic provisions are provided in para. 3.1.2 of the Second Report, remain the basic legislative documents for licensing of nuclear installations.

During the reporting period the licensing system was further developed in Ukraine. The authorising principle in the use of nuclear installations – which is established as the fundamental one by the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" – has been implemented into standards and requirements of other legislative and regulatory documents. A system of legal regulation has been created and it now contains a set of documents governing all aspects of the authorising process, in particular:

- distribution of functions and interaction procedures between entities of legal relationships;
- organisation of and procedure for implementing certain procedures by entities;
- requirements to the structure and content of certain documentation.

Articles 6 and 12 of the Law of Ukraine "On Authorising Activity in Nuclear Energy Use" establish requirements for mandatory inspections and state reviews on nuclear and radiation safety in licensing. In order to implement these provisions of the Law, a number of regulations have been developed to determine requirements on the organisation, procedure, order, programmes and methodologies of inspections and reviews.

In order to comply with the legislation, Ukraine also created a nuclear insurance pool, which entered into a contract for insuring civil liability of NAEK "Energoatom" for nuclear damage in 27 April 2004. Hence, the operating organisation complied with the last legislative requirement to obtain licences for the operation of nuclear installations; this permitted the SNRCU to grant licences for the operation of nuclear power plants. Having issued these licences, Ukraine fully complies with Article 7 of the Convention.

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

The legislative framework for the system of regulatory inspection and assessment of nuclear installations as set forth in para. 3.1.3 of the Second Report of Ukraine remained unchanged during the reporting period.

According to Article 5 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety", the supervisory activity of the SNRCU is related to the main principles of state policy in nuclear energy and radiation protection.

The state supervision is intended to ascertain that the operating organisation ensures the safety and protection of personnel, the public and the environment against adverse radiation impact.

Functions and tasks of state supervision in the SNRCU are assigned to appropriate SNRCU departments: State Inspection Department for Nuclear and Radiation Safety and State Inspectorates for Nuclear Safety on site (regional departments).

In order to improve the state supervision, the SNRCU implemented a series of inspection programmes, each of them constituting guidance for an inspector in a target or comprehensive inspection.

Inspections, which number increases on the annual basis (113 – 2001, 234 – 2002, 338 – 2003), permit Ukraine to maintain nuclear and radiation safety at the level complying with national and international safety standards.

Monitoring of nuclear power plants' operation is based on daily reports of NPP shift supervisors regarding compliance with the established safety indicators. The duty officer of the SNRCU Crisis Centre summarises and submits these reports each morning to SNRCU responsible officials for analysis.

Each nuclear power plant submits quarterly, semi-annual and annual reports on the established safety indicators to the SNRCU for analysis and monitoring in accordance with the established procedure.

The SNRCU in its Headquarters arranges hearing of NAEK "Energoatom" reports after scheduled repairs at each power unit regarding the planned scope of the repair, implementation of safety upgrading programme measures, implementation of in-service inspection programme and compliance with the terms of the operating licence. Comments of the inspectors are also discussed at such a meeting. Based on the meeting results, a decision is made on the possibility to issue an authorization to continue operation of the power unit after repair.

According to this information, it can be concluded, that Ukraine carries out comprehensive regulation inspection and assessment of nuclear installations to ascertain compliance with regulations and licensing conditions.

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

During the reporting period, the state inspection was carried out to verify compliance with applicable regulations and licensing conditions.

The Law of Ukraine "On Nuclear Energy Use and Radiation Safety" (Article 80) lists law infringements in the use of nuclear energy, and Article 25 of this Law identifies the

rights of inspectors regarding their obligations and application of enforcement measures and methods to individuals who fail to comply with applicable legislation, rules, regulations, and standards on nuclear and radiation safety and licensing conditions.

The Law of Ukraine "On Amendments to the Code of Ukraine on Managerial Infringements", as adopted on 18 November 2003, gave the state inspector for nuclear and radiation safety additional authority regarding application of enforcement measures.

The status of nuclear and radiation safety on-site is monitored by the SNRCU State Resident Inspectorate for Nuclear and Radiation Safety. In addition to everyday inspections to verify compliance with standards and rules, special terms and conditions of permits and prescriptions by officials, NPP personnel, and contractors working on-site, the Inspectorate undertakes scheduled, special and on-line inspections, based on which a licensee receives prescriptions to eliminate violations when revealed.

In case of incompliance with regulations or licensing conditions, the SNRCU takes various enforcement measures depending on legislation and the level of incompliance:

- state inspectors make records on cases of incompliance in a special logbook in daily monitoring;
- in case of more serious violations, prescriptions are issued to the director of the nuclear power plant or to the management of operating organisation to eliminate incompliance;
- restriction, suspension or termination of activities or operations, including construction (installation), commissioning or operation of safety-significant structures, systems or equipment;
- suspension of the licence;
- if officials do not perform their duties properly, various measures are applied to them (special examination is arranged, proposal is submitted to the management of NAEK "Energoatom" or the Ministry for Fuel and Energy regarding unconformity to the occupied position, fines are imposed according to the Administrative Code of Ukraine).

During the reporting period, the SNRCU took all the above enforcement measures.

Upon the SNRCU demand, the Directors of Khmelnitsky and Chornobyl NPPs were dismissed from their positions.

The operating licence of SUNPP was suspended because of non-extending of the insurance of civil liability for nuclear damage. During the suspension, a stricter regulatory inspection was carried out at SUNPP. The licence was renewed after the violation had been eliminated in May 2004.

Ukraine has made a significant progress for the three years in developing nuclear legislation and regulatory framework, namely:

- *licensing issues for the operation stage of nuclear installations and issuing individual permits to the operating organisation for certain activities or operations have fully been settled;*
- *legislative framework for funding the decommissioning of nuclear installations has been created;*
- *legislative framework and legal mechanisms for insurance of the operator's liability for nuclear damage have been created;*

- *authority of the state inspectors for nuclear and radiation safety has been expanded as regards enforcement measures in case of incompliance with legislation and standards, rules and regulations.*

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.

During the reporting period, Ukraine ensured the stable and predictable system of nuclear regulation. Functions of the state regulatory body for nuclear and radiation safety were performed by the State Nuclear Regulatory Committee of Ukraine. The tasks, functions, and authority of the regulatory body are established in full by the Statute on the State Nuclear Regulatory Committee of Ukraine approved by Presidential Decree No. 155 dated 6 March 2001 (the whole document was provided in Annex 4 to the Second Report of Ukraine).

Since the previous Review Meeting, the SNRCU has extended its cooperation with the Ministry of Health in regulating radiation protection of the public and personnel, the Ministry for Environmental Protection in establishing radioecology monitoring in the 30-km areas around the nuclear power plants, the Ministry for Emergencies in developing the state system of crisis response and fire protection of nuclear power plants, the State Committee for Occupational Safety in regulating occupational hazards, with the State Committee for Construction and Architecture in applying civil engineering standards to nuclear power plants and Chornobyl facilities.

Protocols on interaction and shared responsibility were signed with all the abovementioned departments.

The Chairman of the SNRCU also appointed a state interagency regulatory task force with the main task of preparing joint decisions related to the Chornobyl NPP and the Shelter.

The SNRCU development focused on the following areas during the three years:

- ensuring internal quality system;
- improving efficiency and effectiveness of regulation.

During the reporting period, the SNRCU took measures to develop a quality system based on the requirements of the Ukrainian state standard DSTU-ISO 9000-2001, and IAEA recommendations IAEA-TECDOC-1090. Since 2002 the measures to develop the quality assurance system have been included in the “Comprehensive Plan of SNRCU Activity”. Procedural documents were analysed and priorities were identified for developing the new ones to regulate unsettled issues. The “Programme for SNRCU Regulatory Legal Activity for 2002-2005” was approved in late 2002; an individual section of the Programme identifies quality system documents to be developed. A number of such documents were implemented within this Programme.

The draft “Guideline on Quality Control at SNRCU” was developed. In September 2004 the draft will be submitted to the West-European experts for review and proposals on its improvement.

In addition, the SNRCU pays a special attention to the implementation and effectiveness of the licensees’ quality system. In order to improve regulatory supervision, the “Methodology for State Supervision over Quality Control System in Operation of

Nuclear Installations" was developed and approved by SNRCU Ordinance No. 113 of 30 June 2004. The Methodology establishes the method of state supervision, its organisation, functions of State Nuclear Inspection departments, requirements on documentation and status analysis of the quality control system.

The following was done to enhance the quality of internal activity:

- automated document management system was created;
- corporate information system was upgraded.

The SNRCU measures the efficacy and effectiveness of its activity with decrease in risks of critical events and potential exposure, as well as with the safety level achieved as a result of the activity.

During the reporting period, the SNRCU took the following measures to pursue the strategy of efficacy and effectiveness.

Based on careful analysis of foreign systems of safety indicators and results of pilot research, a list of indicators for current status of operational safety was developed. These indicators constituted the basis for the draft regulation "System for Assessing Operational Safety and Technical Status of WWER NPPs" developed by the operating organisation. This document is currently being analysed and revised on the basis of results of trial operation following the SNRCU agreement and after implementation will be applied to monitor and regulate the NPP operational safety.

In order to enhance safety, plant schedules for implementing the power unit safety enhancement programme were included in the licensing conditions. A practice of regulatory supervision of their implementation was introduced. Inventory and analysis of measures are carried out annually, and an appropriate report is drawn up.

In order to concentrate the efforts and resources on the areas with safety deficiencies, the SNRCU Board made a fundamental decision to apply the risk-informed approach in nuclear branch and regulatory activity. Implementing the risk-informed approach in national practices along with deterministic methods will allow:

- making a better justified/balanced decisions on NPP safety issues;
- focusing attention on the problems associated with the greatest risk for safety;
- using resources in efficient manner to implement the highest-priority measures on NPP safety enhancement;
- making decisions on safety issues on the basis of quantitative assessments.

In order to fulfil the SNRCU Board decision, a programme for implementing risk-informed approaches in regulation (RIR), which is common for the operating organisation and regulatory body, was developed. The main task of the Programme is to:

- provide regulatory, methodological and technical infrastructure required for the wide application of RIR;
- master needed technologies and gain experience;
- work out interaction between the operating organisation and the regulatory body.

Measures were taken to improve inspections: the number of staff of the State Resident Inspectorate on site was increased, guidelines on inspection procedures and programmes of target inspections were developed, certain documents prepared on the basis of inspection findings were unified, etc.

According to Resolution of the Cabinet of Ministers of Ukraine No. 51 of 3 February 1992, state-owned, specialised scientific and technical enterprise was established – the State Scientific and Technical Centre for Nuclear and Radiation Safety (SSTC NRS), which is entrusted with scientific, analytical, technical, expert, methodological, informational, and advisory support to the state regulatory body to which SSTC NRS is subordinated. The tasks identified in the SSTC NRS Statute are entirely aimed at implementing legal authority of the state regulatory body.

The SNRCU created scientific and technical council and other deliberative and advisory bodies to review scientific recommendations and proposals on developing the main areas of SNRCU activity, discuss significant issues of applying scientific and technical achievements in nuclear energy, ensure compliance with nuclear and radiation safety requirements.

The SNRCU staffing policy is aimed at engaging high-qualified experts, and the problem associated with flowing-out of qualified staff is being resolved.

Activity of the regulatory body is funded through the state budget. In addition, special funds are allocated for scientific and technical developments in priority areas and used for peer reviews and scientific research in nuclear and radiation safety. Moreover, assistance in such work is rendered under bilateral agreements on cooperation with the European Commission, EBRD, IAEA, USA, and Germany.

Independence of the state regulatory body is established by Article 24 of the Law of Ukraine “On Nuclear Energy Use and Radiation Safety” and determined by its place in the structure of central executive bodies with support and assistance of the Government and the President of Ukraine. At the same time, the SNRCU – as an entity of legal relations in nuclear energy – cooperates with operating organisations, licensees, and executive bodies responsible for nuclear activities. This cooperation covers rule-making, authorising, planning and conducting scientific research, elaborating the development strategy and target programmes intended to ensure safety and accomplish the tasks of national nuclear programme. Beneficial practice of scientific and technical councils, boards, meetings with participation of experts and officials of other departments, operating organisations and licensees was implemented. Joint projects on public relations are underway.

In December 2001, a repeated mission of the International Regulatory Review Team (IRRT) was conducted in Ukraine. The IRRT mission was intended to assist in strengthening regulatory bodies for nuclear and radiation safety and improve their effectiveness by providing advice and preparing recommendations.

The 2001 IRRT mission was aimed at analysing the status of implementation of recommendations made in the previous mission as regards strengthening the regulatory body, its independence, improvement of the organisational structure, clearer determination of its authorities, enhancement of staff and resource potential, organisation of the main duty procedures, and identification of first-priority tasks to enhance the state regulatory regime.

The experts pointed out that Ukraine had made significant progress in developing legislation, strengthening the national regulatory body – first of all, acquiring its independent status – improving its organisational structure and establishing authorities, and procedures for authorisation and supervision and scientific and technical support in safety

regulation. Such conclusions of the authoritative international organisation can be considered a favourable assessment of the state regulatory institution in 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 organisation concerned with the promotion or utilization of nuclear energy.

Division of authorities, obligations and responsibilities between the state regulatory bodies is clearly determined in the legislation. Having due regard to this, the SNRCU builds its activity on close cooperation with other central executive bodies entrusted with regulatory and supervisory functions (detailed information is provided in para. 3.2.1 of this Report).

A clear separation of functions of the state regulatory body for nuclear and radiation safety and those of any other bodies or organisations that promote or utilize nuclear energy is established in Ukraine.

Activity of the State Nuclear Regulatory Committee of Ukraine is independent from other central executive authorities that bear responsibility for the use of nuclear energy. This provision is set forth in Article 23 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety".

Since the submission of the Second Report, this provision has been obeyed at all levels of state power by creating an independent system of funding, and review and appropriate decisions by the SNRCU.

At the same time, the State Nuclear Regulatory Committee of Ukraine does not interpret independence as the isolation. Proposals of all stratums of the public, executive bodies and operating organisations are taken into consideration in regulatory review and regulatory decisions.

During the reporting period the state regulatory system for nuclear and radiation safety of Ukraine remained stable and predictable.

The Government of Ukraine maintained the actual independence of state regulation.

The main efforts of the SNRCU were focused on the following:

- *improvement of the quality system by developing and implementing internal quality guidelines;*
- *implementation of risk-informed principles in regulatory policy;*
- *development and maintenance of public information system;*
- *development of international cooperation.*

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

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

Since submission of the previous Report, the administrative structure of operating organisations has been improved, the quality assurance system has been developed, licensing of personnel and systematic approach to training and qualification improvement have been implemented, funding for safety upgrading measures stably increases, issues of personnel insurance have been settled, and so have been the issues of financial coverage of liability for nuclear damage and creation of special fund for decommissioning of nuclear installations.

The State Specialised Enterprise "Chornobyl NPP" was created by Resolution of the Cabinet of Ministers of Ukraine No. 399 of 25 April 2001 "On Creation of the State Specialised Enterprise "Chornobyl NPP" on the Basis of Separate Entity "Chornobyl NPP" of the State Enterprise "National Atomic Energy Generating Company Energoatom". This Enterprise is entrusted with the following primary tasks:

- decommissioning of units 1, 2, 3 of the Chornobyl NPP and other nuclear power plants;
- the Shelter conversion into an ecologically safe system;
- management of radioactive waste accumulated at the Chornobyl NPP and that generated in the process of plant decommissioning and the Shelter conversion into an ecologically safe system;
- management of spent nuclear fuel of the Chornobyl NPP;
- construction and operation of infrastructure facilities required for Chornobyl NPP decommissioning and conversion of the Shelter into an ecologically safe system.

As distinct from the information in the Second National Report, there are currently two operating organisations in Ukraine's nuclear energy industry: National Atomic Energy Generating Company NAEK "Energoatom" and State Specialised Enterprise "Chornobyl NPP".

The National Atomic Energy Generating Company "Energoatom" has substantially modified its administrative structure. At present, this is a unitary organisation responsible for the safety of nuclear installations that has delegated certain authority to nuclear power plants.

NAEK "Energoatom" holds SNRCU licences to:

- operate SUNPP;
- commission KhNPP-2;
- commission RNPP-4;
- operate ZNPP units;

The operating licences for RNPP and KhNPP are at their final preparation stage.

The operating organisation SSE "Chornobyl NPP" holds SNRCU licences to:

- decommission power units 1, 2, 3;

- operate the Shelter;
- construct the spent nuclear fuel storage facility – SFSF-2.

NAEK "Energoatom" and SSE ChNPP have also licences to:

- train personnel of nuclear installations;
- transport radioactive materials;
- utilize radiation sources.

The licence for Chornobyl NPP decommissioning authorises the operating organisation to undertake a series of activities or operations related to decommissioning of ChNPP nuclear installations, certain decommissioning activities of operations 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.

NAEK "Energoatom" and SSE "ChNPP", as licence holders, bear full responsibility for radiation protection and safety of nuclear installations independently of the activity and responsibility of suppliers and state regulatory bodies for nuclear and radiation safety.

According to the obligations imposed by the Ukrainian legislation on the operating organisation, NAEK "Energoatom" and SSE "ChNPP" have to:

- ensure nuclear and radiation safety (see paras 2.1 and 4.2 for description);
- develop and implement safety upgrading measures for the nuclear installation (see the introduction and para. 2.1 for more details);
- ensure radiation protection of personnel, public and the environment (see para. 4.6 for more details);
- inform of operational events at nuclear installations in a timely and full manner, conduct investigations and take corrective measures (see para. 4.3 for more details);
- ensure financial coverage of liability for nuclear damage according to the Ukrainian legislation (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).

The SNRCU supervises the licensee's compliance with the identified obligations during the licensed activity starting from the review of the licence application. In particular, the SNRCU checks the compliance of the nuclear installation's safety with the established requirements, availability of financial, material and other resources, administrative structure and trained personnel which are mandatory for obtaining a licence.

In 2002 the SNRCU introduced a practice of inspecting how the safety upgrading measures are implemented at nuclear installations and kept within their schedules. Results of the inspection are necessarily considered in making a decision on issuing a licence or individual permit to the applicant. The SNRCU within its regulation inspection jointly with the operating organisation NAEK "Energoatom" and international organisations took inventory of safe upgrading measures at each nuclear power unit as provided for by all programme documents. The measures were verified in accordance with international recommendations provided in the IAEA reports on safety issues for WWER-1000/320, WWER-1000 (small series) and WWER-440/213 nuclear power plants (IAEA-EBP-WWER-05, IAEA-EBP-

WWER-14, IAEA-EBP-WWER-03). Based on the collection, inventory and analysis of the measures, the Integral Report "Annual Assessment of Implementing Safety Upgrading Measures at Ukrainian NPP Units According to IAEA Recommendations" was developed (as provided in Annex 3) upon SNRCU request.

The current status of safety upgrading measures and their schedule, as well as compliance with the terms of the licence, are monitored in the framework of periodic, target and special inspection programmes.

During the reporting period, Ukrainian operating organisations ensured full compliance with liabilities stipulated by the legislation.

Implementation of the quality system and creation of a mechanism of implementing legislative provisions into the regulatory supervisiory activity have improved effectiveness of the regulatory control.

SECTION IV. GENERAL SAFETY CONSIDERATIONS

4.1. Priority to Safety (Convention Article 10)

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

The priority to safety in creating and operating nuclear installations that is set forth 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 the 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.

In 2003 the Law of Ukraine "On National Security of Ukraine" was put in force. This Law identifies nuclear and radiation safety as one of the areas and central components of the national security of the State.

Safety assurance, reliability of nuclear energy, compliance with appropriate international obligations by Ukraine are priority issues for executive bodies. This is confirmed by continuous attention of governmental authorities to ensuring the safety. Since the submission of the previous Report, appropriate officials, including the President and Prime Minister of Ukraine, have been visiting on a permanent basis.

The status of nuclear and radiation safety was regularly reviewed at meetings of the Cabinet of Ministers and Council of National Security and Defence of Ukraine. The President of Ukraine personally pays a special attention to this issue. NPP safety issues are discussed at boards of ministries and meetings of inter-departmental commissions.

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

In order to implement principles of safety culture, reveal violations and deviations from the requirements of applicable rules, standards, regulations, technical specifications, operating instructions, operational documentation, NPPs arrange Safety Days each quarter at two levels: departmental and common-plant. The all-plant Safety Days are indicated in the annual "Safety Day" schedule as included in the annual schedule of work with personnel.

The agenda of the "Safety Day" 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 timescale.

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

In order to implement the principle of openness and accessibility of the information associated with the use of nuclear energy, special departments of public relations and information centres were created at all five NPPs of Ukraine and directorate office of NAEK “Energoatom” where members of the public can receive comprehensive information on radiation condition of the environment. Nuclear power plants and their information centres arrange visits for the public to get familiarised with NPP operation. Each NPP issues its plant newspaper, have radio and television offices and websites.

Public hearing are arranged regarding some aspects, in particular:

- expediency of completion of Khmelnitsky and Rivne NPP in the context of present-day status of power engineering;
- ecological problems in regions of NPP location;
- status of power units in operation and newly constructed units;
- disposal of radioactive waste and construction of storage facilities for nuclear waste;
- problems related to the transportation of radioactive waste through the territory of Ukraine;
- construction of a centre for radioactive waste processing and disposal in the exclusion zone of the Chornobyl NPP;
- problems of the Chornobyl exclusion zone on the population and the environment;
- issues related to conversion of the Shelter into an ecologically safe system, etc.

The priority of nuclear and radiation safety established by the Ukrainian legislation and requirements on compliance with it promoted the adherence to safety as a style of life.

4.2. Financial and Human Resources (Convention Article 11)

4.2.1. Financial resources

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

During the three years after the previous Report, the percentage of payments for the produced electricity of its cost essentially increased. The payments reached 97.5% in 2003 against 39% in 2000, 54.4% in 2001 and 82.8% in 2002. This allowed livening up the implementation of safety upgrading measures. The scope of funding increased in 2003 almost 3 times as much versus 2002 and almost 9 times as much versus 2001.

Based on the structure of costs for electricity production, the tariff is calculated as shown in Annex 5 for 2004. A decision on the tariff rate is made by the National Electric Energy Regulatory Commission.

Modernisation and safety enhancement measures as envisaged by 32 programme documents have been planned and are underway at the Ukrainian NPPs. The implementation of safety upgrading programmes is estimated at 7.2 milliard UAH, among them the cost of the «Comprehensive Programme for Upgrading…» for 2002-2005 is assessed at 3.6 milliard UAH.

Some part of the programmes on metal inspection, reliability of steam generators, increase of the capacity factor as planned for 2004 in the amount of 155.2 million UAH is implemented in the period of power units' repair and is funded from the expense item «production services: repair».

The implementation of programmes related to the development and improvement of systems for personnel training, public protection against emergencies, measures on lifetime extension, etc., is planned for 2004 under the item «other operational expenditures» in the amount of 9.8 million UAH.

Since 2003 the costs of implementing the «Comprehensive Programme for Upgrading…» are identified in individual lines in the tariff items.

During the reporting period, NAEK "Energoatom" took measures to obtain loans for funding the completion of new nuclear power units by issuing NAEK "Energoatom" loan securities for the amount of 500 million UAH. The Ministry for Fuel and Energy conducted negotiations with international financial organisations regarding the involvement of foreign investments, with representatives of EBRD and Euratom, and discussed the status of completion and commissioning of the power units, equipment purchase and implementation of the upgrading and safety enhancement programme, public hearing and preparation of the environmental impact assessment report. Based on results of the meetings, NAEK "Energoatom", upon Bank request, submitted project proposals regarding the involvement in funding of Company expenses to implement the upgrading programme at KhNPP-2 and RNPP-4 after their commissioning.

With the purpose of legislative settlement of the issue associated with raising the funds required for NPP units decommissioning, the Law of Ukraine "On Settlement of Issues Related to Nuclear Safety" was put in force on 27 June 2004. Legal settlement of financial

and economic relations associated with termination of operation and decommissioning of nuclear installations and efficient accumulation and use of the decommissioning fund are the primary tasks of this Law. Provisions of the Law determine that the amount of money deducted from the operating organisation is established by the Cabinet of Ministers of Ukraine based on the decommissioning project. Prior to the approval of the nuclear installation decommissioning project, the amount of the operating organisation's deductions to the financial reserve is established through expert judgment based on the decommissioning concept. In the framework of the Agreement between the Government of Ukraine and the European Commission, the Ministry for Fuel and Energy put in force the "Concept for Decommissioning of Operating Nuclear Power Plants of Ukraine" by its Ordinance No. 249 of 12 May 2004. This document was approved, in particular, by the SNRCU and National Electric Energy Regulatory Commission of Ukraine.

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 12 July 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 the Special Drawing Rights (SDR) in national currency for every nuclear incident. Resolution of the Cabinet of Ministers of Ukraine No. 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 abide by the above documents, NAEK "Energoatom" and "ASKA" insurance company acting on behalf of the Nuclear Insurance Pool of Ukraine entered into a contract for insurance of civil liability for nuclear damage on 27 April 2004.

Proposals on the reinsurance of the remaining insurance sum within the above contract were also submitted to the British and Czech nuclear pools, which proceeded to the procedures required to determine the reinsurance rate after appropriate negotiations.

Operating organisation NAEK "Energoatom" came to agreement with the SNRCU and the National Commission for Regulating the Market of Financial Services of Ukraine regarding the stepwise increase in the financial coverage taking into account the reinsurance capabilities and conditions. Agreement was also reached with the National Electric Energy Regulatory Commission of Ukraine regarding the increase of the appropriate item in the tariff after signature of reinsurance contracts.

Therefore, the current tariff for the electricity produced by NAEK "Energoatom" includes the insurance amount according to the insurance sum of 50 million SDR. In increasing the insurance coverage to 150 million SDR by reinsurance in the West-European nuclear pools, the amount for the insurance payment in the electricity tariff will be increased as appropriate reinsurance contracts are signed.

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 summarised experience in personnel training of the leading IAEA member states.

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

The SNRCU licenses NPP personnel training in compliance with the regulation "Provisions on Licensing of Training the Ukrainian NPPs Personnel".

NAEK “Energoatom” developed and implemented branch regulation “Provisions on Work with Personnel of the National Atomic Energy Generating Company “Energoatom”. The document incorporates contemporary experience in NPP personnel training. It determines declared principles according to which systematic work with personnel inculcates in them safety culture, ensure the required qualification level and continuous readiness for their professional duties. This is very important for NPP 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 at the Enterprise “Atomremontservice” – they obtained 16 SNRCU licences to train personnel of different categories.

NPP training centres use 6 full-scale simulators for WWER-1000 units – KhNPP-1, ZNPP-1, 5, RNPP-3, SUNPP-1, 3; a full scale simulator for WWER-440 – RNPP-2. Simulators of KhNPP-1, ZNPP-5 and RNPP-2, 3 emergency control rooms have been commissioned. In addition, the creation of 4 multifunctional, 7 local simulators and computer training systems and a full-scale simulator of the ZNPP-3 unit and SUNPP-1 emergency control room is underway.

Personnel training is based on training and methodological materials developed in compliance with the NAEK "Energoatom" standard "Requirements on Training and Methodological Materials". The availability of these materials is one of the conditions to be satisfied to obtain a licence for personnel training.

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

Personnel of SSE ChNPP are trained in compliance with the above-mentioned training system.

Analytical simulator is used for initial training of personnel who directly operate the reactor facilities at ChNPP.

The simulator of telemanipulator MT-200 is used for initial training and professional development of personnel who will be involved in handling operations in SFSF-2.

The dynamics in the number of certified NPP experts and data on NPP personnel training are provided in Annex 6.

Ukraine has created a mechanism for the operating organisation to accumulate adequate funds as required by current legislation of Ukraine for financial coverage of decommissioning of nuclear installations, principles of nuclear and radiation safety being followed, and for collecting funds for insurance of civil liability for nuclear damage.

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 improving the production performances and upgrading the safety of nuclear installations.

4.3. Human Factors (Convention Article 12)

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

During the three years, all planned steps were taken to reduce the impact of human factor on NPP operational safety, appropriate information on the steps is provided in para. 4.3 of the previous Report and para. 4.2 of this Report.

The reloading machine control system, emergency protection system that incorporate the diversity principle for the first time in Ukraine, neutron flux in-core monitoring system are currently being upgraded and reconstructed within the branch programme intended to replace equipment of the process control system (PCS). The safety parameter display system, which serves for informational support to the operator, has been installed. New information computer systems and in-core monitoring systems that have been implemented at RNPP-4 and KhNPP-2 permit essential improvement of the man-machine interface owing to the introduction of new information display means and to the improved quality of information performances. These measures allowed to reduce the potential impact of human factor on the technological process.

Symptom-oriented emergency instructions are currently implemented at power units to improve the personnel reliability in power unit control in mitigating emergencies. The following steps are taken for this purpose:

- a working team responsible for the development of operational documentation, training materials and conduct of training on the use of symptom-oriented instructions has been created;
- a list of symptom-oriented instructions for WWER-440 and WWER-1000 has been made;
- personnel responsible for the development of operational documentation and training materials have been trained;
- the development of a symptom-oriented instructions for pilot power units of WWER-440 and WWER-1000 NPPs is underway.

Preparedness of personnel for the mitigation of emergencies, control of accidents and prevention of NPP operational events is ensured through:

- emergency training for personnel to occupy a certain position according to an individual programme;
- emergency training for operating personnel;
- training exercises on a full-scale simulator for operating personnel according to qualification maintenance programmes;
- full-scale training on mitigation of beyond design-basis accidents.

Full-scale simulators have been created in Ukraine, which permit not only training of personnel but also validation of transients determined by calculations.

Personnel training activities and other measures intended to improve the safety culture in the reporting period permitted the decrease in the number of NPP operational events resulting from personnel errors.

At the same time, as the example, there is the information on the event classified at level 1 on the INES that occurred on 15 February 2002 at Khmelnitsky unit 1 as a result of personnel's erroneous actions.

The event occurred because the valve on the compressed air intake duct to the air distributor was not closed. During assembling the valve control circuit, the valve actuated. Water from the wet refuelling pond started flowing to the reactor compartment rooms through the opened connector.

Findings of the plant investigation commission showed that unsatisfactory organisation and performance of valve turning and trial run were the direct cause of the event resulting from personnel's unqualified actions.

Corrective actions were developed on the basis of investigation findings and included changes and amendments to operational and administrative documents, as well as additional training of personnel.

The events caused by erroneous actions of operating personnel constituted 10 in 2001, 5 in 2002, 4 in 2003 and 2 in the first quarter of 2004.

During the reporting period, the number of events stably tended to decrease owing to the task-oriented training of operating personnel and the implementation of new systems, equipment and facilities at NPPs intended to decrease and eliminate the impact of human factor on technological process.

4.4. Quality Assurance (Convention Article 13)

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

Since the previous Review Meeting, the NAEK “Energoatom” quality system, which was described in para. 4.4 of the Second Report, has been further developed and improved.

In 2002 the "Comprehensive Programme for Improvement of Management and Quality System of NAEK Energoatom" to 2005 was developed and approved. Basic measures of the Programme are intended to:

- implement a system of strategic planning, and improve methods of operational planning and monitoring;
- improve the NAEK “Energoatom” administrative structure;
- implement a project management practice;
- introduce a classification approach in NAEK “Energoatom” activities;
- improve personnel qualification in quality assurance;
- improve supply management;
- certify the NAEK “Energoatom” quality system;
- assess the effectiveness of implementing the quality system standards;
- evaluate supplies;
- improve the corporate information system.

According to the developed regulatory framework and procedures, scheduled internal audits of the quality system were carried out on a regular basis at NAEK “Energoatom” and NPPs.

Based on findings of each evaluation, corrective and preventive measures were developed to improve production activities and quality systems.

Personnel were trained on the principles and methods of the quality system.

Pursuant to the terms of the granted licences, SSE Chornobyl NPP has developed and currently implement a quality control system that is based upon provisions of national standard DSTU ISO 9001-2001 "Quality Control Systems. Requirements".

The enterprise quality assurance programme is set forth in Quality Guides that are identified as the fundamental ones in the system of the enterprise documents.

The operating organisation developed the "Plan of Measures to Develop and Implement SSE ChNPP Quality Control Systems" constituting a structured list of activities for 2001-2005.

In order to form a quality policy and fundamental quality principles:

- the statement of policy and objectives regarding quality assurance of SSE Chornobyl NPP was published;
- the "General Quality Guide" was developed and implemented and constituted the basis for the development and approval of the quality guides "Termination of Operation of Chornobyl NPP Units" and "Conversion of the Shelter into Ecologically Safe System";

- the development and implementation of enterprise standards based on Ukrainian standard DSTU ISO 9001 and IAEA recommendations are underway.

A quality assurance department has been created; meetings of the working board are arranged every quarter. The meetings are held to discuss draft documents of the quality system, consider urgent questions related to the assessment of quality system implementation and performance and to the training of personnel on quality control.

The regulatory framework and procedures for assessing the ChNPP quality system were developed. Internal audits are carried out in compliance with the "Enterprise Standard. Quality Control. Internal Audit" by the audit team of the quality assurance department with involvement of trained auditors from personnel.

Self-evaluation of management activities is carried as required by the methodology "Enterprise Standard. Requirements on Quality Systems. Management Self-evaluation". Managers of the departments evaluate the work of personnel during visits to workplaces according to the schedule developed under the "Provisions on Planning of Work with Personnel at Chornobyl NPP".

Professional development and training of personnel are provided to ensure the effectiveness of activities. In doing so, a differentiated approach to training is applied depending on the role and functions of personnel: management staff, personnel of the quality assurance department, quality system auditors.

If incompliance is revealed – in particular, deviations of actual results from established objectives – their causes are identified. Based on results, a decision is made to take corrective measures to prevent recurrence of incompliance.

In 2001 the operating organisations introduced the selection and evaluation of suppliers in compliance with the established procedures. A schedule for the evaluation of suppliers is prepared annually; a reference book of suppliers and a list of approved suppliers are kept and updated.

Appropriate documents were developed for this purpose, namely: "Provisions on Evaluation of Goods Suppliers" and "Provisions on External Audits of Quality Systems (Programmes) of Suppliers of Goods, Activities and Services". The following measures are taken in compliance with appropriate requirements:

- a list is made of suppliers of products for systems important to safety;
- an organisational structure is built for evaluating the suppliers during tender procedures in compliance with the Law of Ukraine "On Purchase of Products, Activities and Services for the State Funds";
- a common schedule (procedure) for evaluating the suppliers is prepared.

Ukraine has developed a quality assurance policy and created mechanisms for its implementation: appropriate programme documents have been implemented and methodology for assessing their implementation has been introduced.

The implementation and improvement of the quality system allowed to:

- *improve the operational safety level;*
- *improve the production performances;*
- *reduce the average time of power units' scheduled outages;*
- *reduce the number of violations in normal operation;*
- *improve safety culture in operation of nuclear installations.*

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

4.5.1. Each Contracting shall take the 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 envisages a 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 organisation's safety assessment of operating power units is aimed at developing the main document justifying the safety – Safety Analysis Report (SAR) – which presents a comprehensive safety assessment and a system of technical and administrative measures intended for safety assurance.

The SARs were developed for KhNPP-2 and RNPP-4 that were to be commissioned. Based on the expert review of the operating organisation's submittals, the SNRCU made a decision on granting a licence to commission the power units in question. Detailed information on commissioning licensing is provided in para. 5.3 of this Report.

The development of SAR for operating power units is described in para. 2.1 of this Report.

Pursuant to the requirements established for power units to be constructed in future, preliminary and final safety analysis reports are to be prepared. The preliminary report must be based on the analysis of design documentation and constitutes the main document for obtaining a licence to construct a nuclear installation. According to the design, the SAR establishes safety classes of systems and components of a nuclear installation. Safety-significant systems and components are subject to certification in compliance with the procedure established by current legislation.

The final SAR incorporates changes to the design made during construction and results of pre-commissioning, initial criticality and power increase at the power unit.

The operating organisation is obliged to periodically review the safety of NPP units at intervals established by the state regulatory body but not less than once in 10 years and then submit review reports to the regulatory body. The draft regulation determining the requirements on periodic safety review to be implemented by the end of 2004 is currently in its final development stage. Based on the safety verification of a power unit, limits and conditions of its further operation are determined.

During the reporting period, the licensing process for completion of KhNPP-2 and RNPP-4 was underway. State reviews on nuclear and radiation safety of the SAR were carried out. The SNRCU granted licences for the "commissioning" stage of these power units (the conclusion of the state review of KhNPP-2 documents is provided in Annex 7). More detailed information is presented in para. 5.3 of this Report.

4.5.2. Verification by analysis, 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.

Following the previous Review Meeting, the nuclear installations were verified for compliance with the design requirements, standards, criteria and rules according to the procedure described in para. 4.5.2 of the previous Report.

Regulatory inspection is carried out by the on-site State Nuclear Safety Inspectorate, which is a regional office of the appropriate SNRCU Department. Inspectors' activity is governed by applicable regulations, special programmes and inspection schedules. In comprehensive inspections, the experts of relevant divisions of the State Inspection Department and SNRCU are involved in the commissions.

In the framework of technical cooperation with the IAEA, a peer review of the operational safety was carried out by OSART mission experts at Rivne NPP in September 2003. The report of the mission had pointed out, as a good practice, the 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 the operating organisation as confirmed by the complete performance of these assessments, adherence to the schedules of their performance and implementation of corrective measures determined on the basis of safety assessments.

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 legislative and regulatory framework for radiation protection of personnel and the public, which is described in para. 4.6 of the previous Report, was further improved.

The Law of Ukraine “On Amendments to the Law of Ukraine “On Human Protection against Ionising Radiation” was adopted. The amendments bring the requirements of the Law into compliance with provisions of the International Commission on Radiological Protection Publication 60. In particular, they concern intervention levels in terms of the averted absorbed dose for iodine prophylaxis of adults and intervention levels in terms of decisions on shelter and evacuation.

Completion of the "Programme for Transition of Ukrainian Nuclear Power Facilities to the Requirements of the Radiation Safety Standards of Ukraine, NRBU-97", as implemented by Joint Ordinance of the Ministry of Health of Ukraine and SNRCU No. 86/41 of 7 March 2003, was one of the most important achievements in the regulation of nuclear and radiation safety after the previous Review Meeting, which became possible owing to joint efforts of the operating organisations and state nuclear regulatory bodies. Under supervision of the SNRCU and the Ministry of Health of Ukraine, the operating organisation brought all doses to personnel and the public, as well as levels of radiation impact on the environment, into accordance with radiation health and safety standards established by NRBU-97 through the existing reserve of radiation safety.

The implementation of new legislative and regulatory documents requires the fundamental modernisation of the existing system of individual dosimetry and creation of a unified state system of individual dosimetry on its basis.

Resolution of the Cabinet of Ministers of Ukraine No. 379 of 23 April 2001 approved the “Procedure on Creation of the Unified State Control and Accountancy System for Individual Exposure Doses of the Public”. A project and plan of step-by-step creation of this system were developed under this Resolution to be implemented after their approval. The main tasks of the system are to determine a unified procedure of individual monitoring, ensure methodical unity and effectiveness of measurement quality monitoring, and ensure registration, storage and access to dosimetry monitoring results.

The Ministry of Health of Ukraine developed methodologies for calculating radiation health and safety standards of the first group to monitor that exposure to personnel and the public, as well as the impact on the environment, are kept as low as reasonably achievable in practices. These methodologies regulate the determination of the «Permissible Discharge», «Permissible Release» and «Reference Levels». Indicators of releases and discharges to the environment are calculated in compliance with the established public dose limit quota for a specific facility.

The effectiveness of radiation protection measures is evaluated on the basis of radiation monitoring and analysis of dynamics in monitored indicators. Figure 1 of Annex 8

shows the dynamics in collective doses to personnel of Ukrainian nuclear power plants. Figure 2 shows the dynamics in average annual doses to NPP personnel. Figure 4 shows collective and individual doses to ChNPP personnel.

Figure 3 of Annex 8 presents the percentage distribution of personnel in intervals of average individual doses for 2003. The bar charts show that individual doses to most of the monitored persons at all NPPs are at the level below 2 mSv. The Chornobyl NPP is an exception were individual doses to most of the workers are between 0 and 5 mSv.

Figures 5-7 of Annex 8 show the dynamics in airborne radioactive releases (iodine, inert radioactive gases and long-lived radionuclides) from Ukrainian NPPs for the last five years.

The values of actual releases, as recorded by regular radiation monitoring systems at Ukrainian NPPs, are much lower than permissible releases (PR) that are established taking into account appropriate dose limit quotas for the public.

The total indexes (percentage ratio of the actual release to the permissible one) of airborne releases to the environment in terms of the main nuclides (inert radioactive gases, iodine radionuclides and long-lived radionuclides: ^{137}Cs, ^{134}Cs, ^{60}Co, ^{54}Mn, and ^{90}Sr) were in 2003 as follows: ZNPP – 0.32 %, RNPP – 0.61 %, SUNPP – 1.06 %, KhNPP – 0.16%.

The total indexes (percentage ratio of the actual discharge to the permissible one) of water discharges to the environment in terms of registered radionuclides (^{137}Cs, ^{134}Cs, ^{60}Co, ^{54}Mn, ^{90}Sr, ^{3}H) were in 2003 as follows: ZNPP – 9.90 %, RNPP – 1.34 %, SUNPP – 7.71 %, KhNPP – 3.28%.

The concentrations of radionuclides in the surface layers of the atmosphere are at the background level for all NPPs.

Radiation protection programmes were underway at each NPPs of Ukraine. After a detailed analysis of radiation protection for effectiveness, problems associated with its assurance were revealed and identified and a number of corrective measures were planned. In 2003 NAEK “Energoatom” developed the "Programme for Reducing Radiation Exposure to NPP Personnel", which combines measures taken at individual NPPs.

With regard to the completion and commissioning of KhNPP-2 and RNPP-4, appropriate programmes for radiation protection of operation and commissioning of new nuclear power units have been developed and are currently implemented. These programmes have been developed in compliance with the IAEA recommendations set forth in IAEA Safety Standards Series “Occupation Radiation Protection Safety Guide No. RS-G-1.1.

Radiation protection at Ukrainian NPPs is optimised through the following measures:

- Applying reference levels (RL) of radiation exposure to personnel, releases and discharges. The reference levels are established by administration of a nuclear installation and obligatorily approved by the state regulatory bodies for nuclear and radiation safety. Reference levels reflect the achieved level of safety at installations and are always lower than appropriate dose limits and permissible releases and discharges as established taking into account the dose limit quota for the public determined by NRBU-97.
- Applying administrative-technological levels of releases and discharges (investigation levels) for additional monitoring of operational modes of equipments at each NPP. The investigation levels are established by NPP administration below RL but with operating experience incorporated. Events of

exceeding these levels are investigated by a commission with involvement of the division from the institutional control service which activity deals with the event. Based upon investigation, corrective measures are taken as appropriate.

- Improvement of instrumentation systems, methodological and metrological tool and software.
- Implementation of quality system in radiation protection.

In Ukraine compliance with the protection optimisation principle in NPP operation is characterised by decrease in the number of exposed individuals whose annual effective dose exceeds 15 mSv (against the established dose limit of 20 mSv). The effectiveness of complying with principle is demonstrated in Figure 8 of Annex 8 showing the percentage ratio of individuals whose annual effective dose exceeds 15 mSv to the total number of personnel subject to monitoring. Dose input of the produced unit of electricity – the ratio of the personnel annual collective dose to the amount of generated electricity – is another indicator used to assess radiation protection of NPP personnel (Figure 9 of Annex 8).

Compliance with NRBU-97/D-2000 requirements in terms of regulating potential exposure, risks in its implementation and probability of critical events rests with the ChNPP for the following facilities:

- industrial complex for solid radioactive waste management;
- spent nuclear fuel storage facility;
- liquid radioactive waste treatment plant.

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. Automated systems for radiation monitoring of the environment are currently implemented. Such systems are operated at ZNPP and RNPP complementing GAMMA 1 and GAMMA 2 systems, are being installed at KhNPP and are planned to be installed at SUNPP. Radiation monitoring regulations for facilities with releases and discharges necessarily includes monitoring of the location area: atmosphere (air, atmospheric precipitation); hydrosphere (surface and ground water, drinking water); soil, agricultural products, radioactive contamination indicator organisms, bottom sediments, sand, and levels of gamma radiation (gamma background) on location.

Regulatory supervision is ensured through inspections, analytical assessments of annual reports on current operational safety of NPPs and other reports as submitted by the operating organisations to the SNRCU in compliance with the established procedure.

According to the ordinance of the State Chief Medical Doctor of Ukraine, the quality system of individual dosimetry of NPP personnel is periodically assessed through reference measurements of individual doses using regular and control dosimeters issued by the dosimetry and radiation health and safety department of the Scientific Radiation Medicine Centre under the Ukrainian Academy of Medical Sciences.

Ukraine has created legislative provisions for ensuring strict compliance with fundamental principles of radiation protection: justification, optimisation, and non-exceeding that guarantee safety of the public and the environment.

Regulation of the radiation exposure to personnel and the public, as well as the environmental impact, has been brought into compliance with ICRP and IAEA recommendations.

The operating organisation takes administrative and technical measures to ensure the safety and protect personnel, the public and the environment.

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 following the previous Review Meeting, Ukraine has taken measures to develop the system of emergency planning and response to radiation accidents and incidents. The system of emergency preparedness for nuclear and radiation events continued its activity under the Unified State System for Prevention and Response to Man-made and Natural Emergencies (USSE), whose description and a list of regulations in force in emergency preparedness are provided in Section 4.7 of the previous Report.

In addition to the documents identified in the Second Report, Ukraine entered into force the following documents:

- Plan of state-level response to emergencies, as approved by Resolution of the Cabinet of Ministers of Ukraine No. 1567 of 16 November 2002. The main objective of the document is to identify control bodies, force and means of the USSE involved in response to state-level emergencies and to ensure timely and single-principle assistance to affected population and local governmental bodies.
- Plan of response to radiation accidents, as approved by Joint Ordinance of the SNRCU and the Ministry for Emergencies No. 87/211 of 17 May 2004 and registered in the Ministry of Justice, Reg. No. 720/9319 of 10 June 2004. The document incorporates the IAEA recommendations set forth in “Preparedness and Response for a Nuclear or Radiological Emergency” No.GS-R-2 and “Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency” EPR-METHOD-2003; in particular, recommendations related to the classification of radiation accidents and establishment of categories of radiation hazards of installations and activities.
- Standard plan of response to accidents and emergencies at Ukrainian NPPs, as developed by NAEK “Energoatom” in 2004 to implement provisions of the Plan of Response to Radiation Accidents. The plans of response to accidents and emergencies at NPP, which are brought into compliance with the typical plan, are to be implemented by 1 September 2004.
- Standard provisions on emergency groups and teams at NPP, as developed by NAEK “Energoatom”. Based upon this document, each NPP has developed appropriate installation-wise provisions and created emergency groups and teams.

In the framework of the USSE, the SNRCU is responsible for the functional subsystem “Safety of Nuclear Power Facilities” acting at the level of installation and state level. SNRCU Ordinance No. 9 of 22 January 2003 approved the revised Provisions on this functional subsystem. The document enhances the role of the on-site State Nuclear Safety Inspectorates, determines the procedure of their interaction with NPP personnel and state administrations of NPP satellite towns, regional offices of the Ministry for Emergencies and other USSE subsystems.

In order to improve the regulatory framework governing the USSE functional subsystem “Safety of Nuclear Power Facilities” and to further enhance the role of State Inspectorates in this subsystem, the “Provisions on Actions of the On-site State Nuclear Safety Inspectorate in Emergencies” was developed in 2003 and approved by SNRCU Ordinance No. 145 of 1 December 2003.

The SNRCU Information Crisis Centre (henceforth – the SNRCU ICC) is the executive division of the USSE functional subsystem "Safety of Nuclear Power Facilities", which activity is highlighted in Section 4.7 of the previous Report. In 2001-2003 the SNRCU ICC moved to a new location. Working rooms and equipment of new SNRCU ICC was planned taking into account previous experience in its operation. In 2004 installation of a reliable power supply system – diesel generator – was started at the ICC.

The SNRCU makes efforts to improve the licensee's emergency preparedness. In 2003-2004 the regulation "Requirements on On-site and Off-site Crisis Centres" was developed to establish requirements on the functions, location, activation period, facilities, communication and information transfer systems, reliability of systems and equipment of NPP crisis centres – internal (on-site) and external (outside the boundaries of the access control area). The document was registered by SNRCU Ordinance No. 2 of 16 January 2004 and registered in the Ministry of Justice, Reg. No. 136/8735 of 31 January 2004.

Measures intended to prevent accidents at NPPs and to mitigate their consequences are ensured by NAEK "Energoatom" within the System of Preparedness for and Response to Accidents and Emergencies at Ukrainian NPPs (henceforth – NAEK "Energoatom" SER), which constitutes a part of the Ministry for Fuel and Energy's USSE functional subsystem "Nuclear Energy and Fuel Energy System". Information on the task and concept of the NAEK "Energoatom" SER emergency planning and response is provided in Section 4.7 of the previous Report.

Pursuant to the document "Basic Provisions on the NAEK "Energoatom System of Preparedness and Response to Accidents and Emergencies at Ukrainian NPPs", the main and alternative crisis centres must function in the operating organisation.

The NAEK "Energoatom" alternative crisis centre has been created on the premises of the former crisis centre of the Chornobyl NPP in the village of Dniprovske in Chernigiv Region. The premises of the alternative crisis centre are used in accident-free periods to train personnel for actions in the event of accidents at NPPs.

The main NAEK "Energoatom" crisis centre is to be commissioned in July 2004.

The creation of the emergency satellite communication network of NAEK "Energoatom" has started; this will permit continuous and reliable communication between NPPs and the operating organisation. Such communication was already in place between NAEK "Energoatom" and Khmelnitsky NPP in July 2004.

In order to train plant personnel for actions in emergency conditions, improve their knowledge and skills in confining accidents and mitigating their consequences, and working out emergency response plans, annual full-scale emergency response training takes place, which procedure of preparation and conduct is described in para. 4.7 of the previous Report.

In October 2001 such training was conducted at South Ukraine NPP, in August 2002 – at Zaporizhya NPP, in September 2003 – at Khmelnitsky NPP, in May 2004 – at Rivne NPP. Representatives of the "Rosenergoatom" Concern, all NPPs of Ukraine, Ministry for Fuel and Energy of Ukraine, Ministry for Emergencies, and SNRCU took place in the training. During each training session, the SNRCU engaged its ICC, and the on-site State Nuclear Safety Inspectorate participated in the training at the installation-wise level. The specific objective of the last training at Rivne NPP was to work out actions of NPP management staff, divisions, NPP emergency groups and teams in the event of an accident involving a radioactive release beyond the designed protective barriers resulting from the damage of NPP process equipment caused by a terrorist act. In order to ensure response to an accident at the state level as envisaged by the Plan of Response to Radiation Accidents, an interdepartmental operational staff consisting of representatives from different ministries,

including the SNRCU, Ministry of Health, and the Ministry for Fuel and Energy, was established in the Crisis Centre of the Ministry for Emergencies.

Annual training and exercises to verify the effectiveness of public protection plans in the event of radiation accidents at NPPs are conducted according to plans of the Ministry for Emergencies on administrative territories belonging to areas of possible radioactive contamination.

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

In Ukraine, pursuant to the requirements of the "Provisions on Notification and Communication in Emergencies", the notification system has been integrated into the Unified National Communication System, whose arrangement is described in Section 4.7 of the previous Report.

Taking into account recommendations of IAEA Guide EPR-ENATOM-2000 regarding the distribution of functions among competent national bodies and communication centres in terms of the "Convention on Early Notification of a Nuclear Accident" and "Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency", the Cabinet of Ministers of Ukraine adopted Resolution No. 1570 of 2 October 2003 "On Appointment of Competent National Authorities as regards Implementation of International Conventions in Nuclear Energy". According to this Resolution, the SNRCU is responsible for functions of a unified competent national communication centre maintaining twenty-four-hour duty and functions of a competent national body authorised with international information exchange. The Ministry for Emergencies bears responsibility for functions of a competent national body authorised to send and receive requests for assistance in the event of a nuclear or radiation accident and obtain proposals on the assistance.

In order to fulfil the above Resolution of the Cabinet of Ministers of Ukraine and improve cooperation of the Ministry for Emergencies and SNRCU concerning notification of emergencies, Joint Ordinance No. 154/487 was issued on 9 December 2003 to regulate the interaction procedure between operative duty services of the Ministry for Emergencies and SNRCU in the event or threat of an emergency.

In addition to the above international conventions, the SNRCU is responsible for intergovernmental agreements with other countries, which provide for mutual early notification and subsequent information exchange in the event of a nuclear accident or radiation emergency. In 2003 appropriate resolutions of the Cabinet of Ministers approved two such agreements: Agreement between the Cabinet of Ministers of Ukraine and the Government of the Bulgarian Republic No. 1308 of 20 August 2003 and Agreement between the Cabinet of Ministers of Ukraine and the Government of the Latvia Republic No. 1309 of 20 August 2003. As of 1 July 2004, there are currently 12 such agreements concluded between Ukraine and Sweden, Turkey, Byelorussia, Slovakia, Hungary, Finland, Norway, Poland, Germany, Austria, Bulgaria and Latvia. To implement these agreements the SNRCU ICC staff conducted periodic testing of communication with competent bodies of the above countries.

The SNRCU regularly participates in emergency training conducted at the international level to work out procedures of mutual notification between member states to the abovementioned international conventions. In May 2001 the SNRCU participated in

JINEX-1 training with a conditional accident at the Gravelines NPP (France), and in January 2002 – in training arranged by the IAEA to for practical testing of new forms of EMERCON notifications envisaged by IAEA Guide EPR-ENATOM-2000.

In order to test on-line communication between its own crisis centre and competent organisations in terms of the above conventions, the IAEA conducts periodic emergency training CONVEX. The SNRCU ICC took part in two such training sessions in 2003 and in four in 2004.

Ukraine is pursuing further development and improvement of the emergency preparedness and response system.

The emergency planning system provides for emergency preparedness at the state and installation-wise level through emergency training and drills.

For the three years, Ukraine has extended international cooperation in this field by entering into appropriate agreements with Bulgaria and Latvia.

SECTION V. SAFETY OF INSTALLATIONS

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.

Requirements on siting are established by the Ukrainian legislative and regulatory documents. The decision-making procedure and requirements on materials justifying the need to construct a nuclear installation are determined by Article 37 of the 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) resulting from planned construction, commissioning, operation and decommissioning;
- designed measures to prevent the adverse impact on the environment and mitigate this impact.

Criteria for evaluating factors that can affect safety of a nuclear installation are determined by regulations on nuclear and radiation safety, as well as by the state civil engineering standards. These documents identify indicators that characterise natural, economic and demographic conditions in site area, data on pre-operational monitoring of the environment, and meteorological, climatologic, geologic, seismological, hydrological, hydrogeological, engineering-geological and geochemical characteristics.

During the reporting period, Ukraine did not select new sites for nuclear installations.

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

Legislative and regulatory documents of Ukraine govern the evaluation of the potential safety impact of a proposed nuclear installation on individuals, society and the environment.

Pursuant to the Ukrainian legislation, the likely safety impact of a nuclear installation is evaluated through a state ecological review.

According to Article 13 of the Law of Ukraine "On Ecological Review", the state ecological review is arranged and carried out by ecological expert departments, specialised establishments, organisations or specially-appointed commissions of the authorised central executive body, the Ministry for Environment and Natural Resources of Ukraine.

In compliance with Article 36 of the Law of Ukraine “On Ecological Review”, the environmental impact assessment of a planned or ongoing activity is to justify its usefulness and ways of implementation, possible alternative solutions, characteristic of the environment, types and levels of environmental impact under normal and extreme

conditions, possible changes in its qualitative state, ecologic and economic consequences of the activity, measures to reduce ecological risk and meet requirements on ecological safety.

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

The SNRCU grants a licence provided that there is a favourable conclusion of the state ecological review and other legislatively-required reviews.

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

During the last three years, all factors associated with changes in the environmental conditions, industrial and household activity, and demographic indicators were re-evaluated for all NPP sites of Ukraine. This information is presented in updated safety analysis reports (SAR).

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

- a decision made on co-location of an additional nuclear installation on site (in Ukraine such re-evaluations were carried out through a state ecological review at ZNPP with regard to the construction of a spent nuclear fuel storage facility and at KhNPP and RNPP with regard to the construction of the power units);
- new scientific data that indicate the need to revise the input data on 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 data on hydrogeological, engineering-geological, other types of monitoring, for example, subsidence or sloping of structures.

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

According to 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 nearby states, transboundary EIA is

developed in compliance with the “Convention on Environmental Impact Assessment in a Transboundary Context”.

In developing the KhNPP-2 and RNPP-4 completion projects, the following reports were published in mass media:

- Environmental Impact Assessment of Khmelnitsky-2 Completion Project. Mouchel Consulting Ltd., 1998;
- Environmental Impact Assessment of Rivne-4 Completion Project. Mouchel Consulting Ltd., 1998;
- Environmental Impact Assessment of Rivne-4 and Khmelnitsky-2 Completion Project. Environmental Impact Assessment of Alternative Non-nuclear Electricity Generation Means. Mouchel Consulting Ltd., 1998.

In the framework of consultation with the public, power units’ completion materials and, in particular, environmental impact assessments were provided both to national and foreign organisations, international information agencies and other mass media, including official representatives of other states.

In 2002 upon request of the Minister of Emergencies of the Republic of Byelorussia, the SNRCU provided him with the information on and description of nuclear installations in the exclusion area of the Chornobyl NPP.

Ukraine has developed legislative and regulatory provisions to ensure compliance with the justification principle for activities related to ionising radiation.

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

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

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 the SNRCU completed the development and put in force the regulation «General Provisions on Safety Assurance of Nuclear Power Plants» (NP 306.1.02/1.034-2000). This document establishes criteria, requirements and conditions of safety operation, as well as principles and nature of technical and administrative safety measures as described in detail in para. 5.2.1 of the previous Report.

The designs of all nuclear installations constructed in Ukraine after the implementation of this regulation were subjected to revision regarding compliance with the established requirements. In particular, substantial 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 administrative measures incorporated in designs to prevent the violation of limits and conditions of safe operation, the occurrence of design-basis accidents and to mitigate their consequences ensure the safety in any of the design-basis initiating events.

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.

Technical and administrative decisions made to upgrade and improve the safety level incorporate scientific and technical achievements and are implemented in compliance with the established requirements, namely: they should be proven by experience or by trial operation.

The licensing procedure provides for the need to introduce at first a technology at one "pilot" power unit and then to adapt this measure to other power units provided there are favourable results of trial operation. This procedure completely complies with the international experience and permits the implementation of measures on the basis of operational experience and proven practice.

New computer information and control safety-significant systems (emergency and preliminary protection, neutron flux monitoring) that had been developed with the use of up-to-date information technology and new element base were implemented in a pilot mode at ZNPP. These systems were implemented at new units of RNPP and KhNPP only after results of their trial operation were obtained and analysed. The introduction of new nuclear fuel design at KhNPP was preceded by its implementation during four years at the Kalinin NPP of the Russian Federation.

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's information support system included in the NPP unit monitoring and control system, which also provides for a system of on-line generation of summarised information for personnel on the safety of the reactor and NPP unit as a whole.

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

Experts of the OSART mission that took place at the Rivne NPP in September 2003 pointed out, as favourable practice, the upgrades in the main control room: in particular, the implementation of the data processing system, which performance is clear and reliable and which prevents the generation of unnecessary signals, and installation of a high-quality mnemonic circuit of equipment layout in the main control room, which allows the personnel to monitor the state of equipment and configuration of the power unit.

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 essentially improved after implementation of the regulatory licensing of such activity of "design".

Ukraine ensures actual compliance with requirements to 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 authorisation to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements.

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

This section provides information on the implementation of legislation on the example of the permit obtained by NAEK "Energoatom" for KhNPP-2 commissioning. The licensing of RNPP-4 commissioning was carried out in accordance with the established procedure similarly to KhNPP-2. The SNRCU issued a licence to operate RNPP-4.

In compliance with the Law of Ukraine "On Authorising Activity in Nuclear Energy", the operating organisation NAEK "Energoatom" submitted an application to the SNRCU for a licence to operate the nuclear installation of KhNPP-2. The content of documents submitted by NAEK "Energoatom" together with the licence application was determined by the following: construction licence (No. 13/2-B-KhNPP-2-04-2000); the "Procedure for Commissioning and Operation of Khmelnitsky Unit 2 and Rivne Unit 4" approved by the SNRCU on 2 April 2002 and the "Licensing Plan of Commissioning and Operation of Khmelnitsky Unit 2 and Rivne Unit 4". The schedules of reviews and evaluation of the application documents are determined by the "Plan of SNRCU Measures to Implement Presidential Order regarding Completion and Commissioning of KhNPP-2" and the "Schedule of KhNPP-2 SAR Review" approved by the SNRCU.

Review and comprehensive assessment of the application documents are carried out by the SNRCU through state review on nuclear and radiation safety, which is an inseparable part of the authorising process. Experts of the State Scientific and Technical Centre for Nuclear and Radiation Safety of the SNRCU and Riskaudit Consortium were involved in the state review of safety justification materials, operational documentation and start-up programmes. Findings and proposals of the experts are finalised in the "Conclusion on State Review on Nuclear and Radiation Safety of Khmelnitsky 2 Safety Substantiation" (as presented in Annex 7).

SAR is one of the most important licensing documents reviewed by experts. Taking into account the great number and scope of documents included in the SAR, findings of the preliminary review were immediately submitted to the operating organisation to incorporate comments and make necessary corrections. To date the review of all KhNPP-2 SAR sections that were submitted has been completed.

The submitted SAR was developed in compliance with the requirements of the regulation KND 306.302-96 "Requirements on the Content of the Safety Analysis Report for WWER NPPs at the Stage of Issuing a Commissioning Authorization".

General approaches used in the preliminary evaluation of the SAR materials consisting 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 SAR, 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 possibility to keep 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.

Pre-commissioning work was assessed for compliance with requirements of applicable standards and rules on nuclear and radiation safety. Associated programmes were developed taking into account experience in Zaporizhzhya-6 commissioning and contain the main tasks, evaluation criteria and work procedures for each pre-commissioning stage.

Documentation on pre-commissioning work and operations at the stage of power unit commissioning was developed and implemented. All stage-specific programmes were approved.

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

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

Compliance of the KhNPP-2 design with the requirements of the applicable Ukrainian standards, rules and regulations was also evaluated against findings of other state reviews, namely: conclusions of fire safety, ecological safety, radiation health and safety and occupational safety reviews.

Based on findings of the state review of KhNPP-2 SAR materials, the following general conclusions were made:

- the operating organisation demonstrated in the submittals that it is capable of ensuring compliance with legislative requirements, standards, rules and regulations on nuclear and radiation safety;
- the scope of documents justifying the safety of KhNPP-2 covers all safety aspects, analysis of these documents confirms their acceptability;
- the quantitative safety target – the integral reactor core damage frequency – complies with international recommendations and experience in operation of similar power units in other states and is lower than the value of this safety indicator established by national standards and rules.

In parallel with the state review on nuclear and radiation safety of the documents required to obtain a licence for KhNPP-2 commissioning, the State Inspection Department for Nuclear and Radiation Safety carried out an inspection of the submittals for completeness and reliability. The following was checked:

- availability of operational documentation and pre-commissioning work;
- availability status of structures and buildings;

- availability status of systems and equipment;
- preparedness of personnel;
- implementing status of measures intended to ensure accountancy and control of nuclear materials;
- emergency planning and emergency preparedness;
- implementing status of safety enhancement measures;
- assessment of testing results for all sub-stages.

Based on results of the state review and findings of the inspections, the State Nuclear Regulatory Committee of Ukraine made a decision to issue commissioning licences to the NAEK "Energoatom" for KhNPP-2 and RNPP-4.

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 the SAR and reflected in the technical specifications are observed and specified on the basis of operational experience, assessment of the current safety level, new scientific and technical information and in accordance with new regulations that have been developed and implemented.

For example, the implementation of regulations determining technical requirements on the primary coolant of nuclear installations and the quality of the secondary water chemistry brought about the need to revise NPP technical specifications and, appropriately, limits and conditions of safety operation at all nuclear installations.

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 approved operating technical specifications. During the reporting period, Ukraine revised and re-approved this main operational document taking into account findings of the comprehensive safety assessment and regulatory requirements that have been implemented.

In order to maintain the capability of safety-significant 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. Conditions of maintenance, repair and inspection of safety systems are established in the NPP technical safety substantiation. Administrative and technical measures are determined to exclude the potential of unauthorised changes in the circuits, instrumentation and algorithms of control safety systems. After maintenance and repair, systems and equipment are checked for operability and compliance with design characteristics, checking results being documented.

The operability of safety systems, safety-significant systems, monitoring and control means and state of the parent metal and welds of safety-significant 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 prepared by NPPs. Unscheduled inspections can be conducted upon demand of the regulatory body.

Tests not identified by technical specifications and operating instructions are conducted in accordance with programmes containing measures to ensure the safety of these tests. Testing programmes are approved by the operating organisation. Decisions on the conduct of tests are approved by the state regulatory body.

The operating organisation submits findings of safety monitoring inspections and periodic reports on analysis of the current safety level to the regulatory body. The periodicity of submission and requirements on the contents of the reports are determined by current regulations.

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

The licensee develops special instructions and guidelines to determine personnel actions in the event of design-basis and beyond design-basis accidents, which are based upon indications of events, reactor state indicators and prediction of anticipated accident conditions. All these actions are intended to restore safety functions and restrict radiation consequences.

According to findings of the OSART mission conducted at the Rivne NPP in 2003, the guidelines are written clearly and cover all issues to be solved in the event of an emergency, in particular:

- identification of events, including 14 postulated accidents;
- key safety functions related to response: notification, organisational structure, information management, measures for protection of personnel, the public and the environment, as well as minimisation and mitigation of accident consequences;
- methods for identifying radiation sources and calculations of predicted doses;
- consideration of intervention levels and action levels in accordance with NRBU-97 and justification of a decision to refuse intervention;
- fire protection measures;
- provision for medical aid;
- resource and logistical support, etc.

Additional information is provided in paras 4.2, 4.3 and 4.7 of this Report.

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

During the time following the previous Review Meeting, the system of engineering and technical support of the operating organisation was improved.

In order to create an integral and efficient system of scientific and engineering support in the operation of nuclear power plants, the Scientific and Technical Centre (Separate Entity “STC”) was established in 2003, which is a separate division of NAEK “Energoatom”.

With the purpose of further development of fundamental and applied research in the field of NPP safety, the Institute for Safety Issues of Ukrainian NPPs was established by an Ordinance of the Presidium of the Ukrainian National Academy of Sciences on 18 February 2004. The main areas of this institute’s scientific activity are identified as follows:

- safety and effectiveness of NPP operation;
- technology for utilization of radioactive waste;
- technology for decommissioning NPP units.

NAEK "Energoatom" maintains permanent communication with the Russian Federation organisations that took part in NPP design and now continue to provide engineering support.

Engineering and technical support is provided by subcontract and special divisions of the plants in compliance with approved instructions that determine obligations, interrelations and organisation of activities. In particular, divisions dealing with engineering and technical support develop regulations and instructions, observe the implementation of programmes related to safety systems, analyse results of tests, as well as visual and non-destructive examinations. The NPP organisational structure covers all types of technical support including individual upgrading activities undertaken by licensed subcontractors.

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

According to the "General Provisions on Safety Assurance of Nuclear Power Plants", the operating organisation 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 accidents.

Information on all events of normal operation violation, emergencies and accidents that occur at NPPs is communicated to the state regulatory body. Investigations are carried out in compliance with the "Provisions on Procedure for Investigation and Account of NPP Operational Events", which determines:

- categories of events;
- procedure for investigation of events (determination of direct and route causes, assessment in terms of safety impact, development of corrective measures);
- procedure for account of events;
- format of notification of events as submitted to the regulatory body.

In case of each operational event at the installation, the following is provided:

- Immediate notification of the event (within an hour);
- Preliminary notification on the event (within 24 hours);
- Classification of the event;
- Report on investigation of the event (within 15 days following its occurrence).

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

The 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 with data for the current year on an annual basis. If necessary, appropriate regulatory decisions are made.

According to the 2001 analysis data, the number of NPP operational events stably tends to decrease. The number of events decreased by 1.15 times in 2003 as compared to the previous year and by 1.67 times in 2002 against 2001. The average number of events per unit decreased almost by half in 2003 as compared to the averaged value of this indicator and is the lowest for the recent six years.

The tendency to decreasing the following events is also positive:

- limits and conditions of safe operation – from 8 in 2001 to 1 in 2003;
- actuation of safety systems for the direct purpose in the mode not related to the assurance of a safety function – from 2 in 2001 to 1 in 2003;
- inoperability of train/trains of safety systems – from 11 in 2001 to 7 in 2003.

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

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

Operation of installations is supported by an information database on incidents, which is included in the unified information system of the operating organisation – "Information System on Operational Events at Ukrainian NPPs". The system provides for the 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 operational experience:

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

The IAEA and WANO are regularly informed of significant events on the basis of bilateral information exchange.

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

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 state policy regarding authorisation in the use of nuclear energy. The completed development of the safety analysis reports permitted licensing of nuclear installations in accordance with the legislatively-established procedure.

The operating organisation ensures compliance with the requirements of technical specifications developed and approved in accordance with the established procedure, as well as revision and amendment of this document.

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 stages of nuclear installations.

Ukraine created and implemented a mechanism of notifying the regulatory body of safety-significant 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.

SECTION VI. CONCLUSIONS

Summarising the aforesaid information that characterises the steps and measures taken by Ukraine to comply with the obligations under the Convention on Nuclear Safety, the following can be stated:

1 The full-scale national nuclear programme is implemented taking into account strategic and ongoing tasks that promote achieving the accepted level of nuclear and radiation safety and energy sovereignty of the State.

The stabilisation and economic development measures taken by Ukraine have enhanced the operating organisations' capability to comply with legislative obligations in the full scope. Creation of legislative framework, implementation of governmental decisions and adequate tariff policy in nuclear industry have promoted the implementation of safety upgrading plans, improvement of the main indicators of activities and creation of a special nuclear installations decommissioning fund.

The improvement and optimisation of the operating organisations' administrative structure during the reporting period have resulted in creating a corporate energy generating company and specialised enterprise for successive decommissioning of all nuclear power units in Ukraine.

A system of scientific establishments has been created for scientific and engineering support to the operating organisations, whose activities are intended to conduct fundamental and applied research with the purpose of revealing and solving safety issues in ongoing activity.

2 Ukraine has created legislative and regulatory frameworks for complete implementation of associated obligations and authorities by all entities of legal relations in nuclear energy.

Since the previous Review Meeting, 11 legislative acts have replenished the national legislation of Ukraine. The main objective of law-making has been achieved: issues that required regulation have been settled at the legal level, and inconsistencies between standards and provisions of different legislative acts have been eliminated. Implementing and elaborating the provisions of the main law of nuclear legislation – "On Nuclear Energy Use and Radiation Safety" – in appropriate legislative acts is the most important result of legislative development. Legal, administrative and financial provisions have been established for the insurance of the operator's civil liability for nuclear damage and creation of special funds for nuclear installation decommissioning. The regulated values of public exposure under conditions of a radiation accident have been brought into compliance with the ICRP recommendations.

With the purpose of developing national legislation of Ukraine, a number of Presidential Decrees and Resolutions of the Cabinet of Ministers of Ukraine have been issued. In particular, they are related to the enhancement and improvement of the functions assigned to the state regulatory body and separation of its authority from other central executive bodies, licensing procedure of nuclear installations, safety of nuclear material transportation, emergency response, physical protection and interaction regarding appropriate issues at the interstate level, strategy of decommissioning and the Shelter conversion into an ecologically safe system, etc.

The legal regulation system for nuclear and radiation safety has been complemented with 26 new regulations that govern the unsettled issues.

The development of the legislative and regulatory framework has resulted in adequate regulatory provisions for licensing the operation of nuclear installations. The transient period of authorising regulation, which involved issuing of temporary permits for operation of the power units, has been completed.

3 The legislative status of the SNRCU, as an independent regulatory body, has essentially strengthened in the reporting period. This is due to the created governmental infrastructure and support of high-level officials of the State.

Cooperation with other central executive bodies entrusted with regulatory and supervisory functions, as well as with operating organisations, has been extended.

The SNRCU performed its functions in view of implementing an internal quality assurance system. Systematic development and implementation of quality documents have permitted proper organisation of the conduct and monitoring of regulatory activity.

Supervisory functions of the regulatory body have been sufficiently enhanced. Inspection procedures and programmes have been implemented, additional authority has been delegated to state inspectors, and the number of resident inspectors has been increased.

Up-to-date methodologies of risk-informed approaches are implemented in state regulation. Regulatory, methodological and technical provisions are created, required technologies are mastered.

The effectiveness and efficiency of the state regulation, as assessed, are commensurate with the achieved safety level of the activity and decrease in risks of critical events.

Measures of regulatory inspection over the operating organisations' compliance with safety upgrading plans, requirements of legislation, standards, rules and regulations have resulted in favourable trends in safety state and dynamics of events in normal operation. Implementing a list of current safety indicators, which is in its completion development stage, will be the next step.

Policy of state regulation is carried out under conditions of openness. Awareness of the public has essentially increased, and the public has obtained an opportunity to participate in the regulatory process.

4 The first stage of the safety analysis of pilot power units covering all WWER designs has been completed in Ukraine. Safety analysis has been carried out for all NPPs in terms of additional, as compared to the design, parameters, principles and criteria.

Application of up-to-date PSA methods has permitted the assessment of the core damage frequency, determination of dominant accident sequences and spectra of minimal cross-section of the main contributors to the core damage frequency.

Results of the in-depth safety assessment and findings of the state review demonstrate that the scope of the analyses is adequate to confirm that the safety level complies with national and international requirements; safety deficiencies which would require termination of operation have not been revealed.

Site-specific factors and indicators have been reassessed for all NPPs. Modernization and safety upgrading measures are planned and implemented on the basis of the analysis using up-to-date methodologies. Results of the safety analysis for KhNPP-2 and RNPP-4 that have been commissioned permit Ukraine to plan bringing the safety level of operating power units to that of the above nuclear installations.

All licences for life stages of nuclear installations have been issued by the SNRCU on the basis of safety analysis reports developed by the operating organisation.

5 The quality system was efficiently developed in the operating organisations. During the reporting period, the quality system was implemented in such activities as strategic and operational planning, monitoring and supervisory functions, project and supply management, improvement of administrative and managerial provisions, evaluation of suppliers and development of the corporate information system. Regular self-evaluations of activities and preventive and corrective measures facilitated the improvement of production performances and the mode of normal operation, decreased the power units' scheduled maintenance time, and increased the operator's adherence to safety culture.

6 Since the previous Review Meeting, all elements of the NPP personnel training system have been improved.

The creation of new full-scale, multifunctional and local simulators, application of up-to-date methodologies and training manuals, staffing of the centres with qualified trainers and instructors, as well as licensing of training centres and personnel of nuclear installations in compliance with legislation, have resulted in stable tendency of the personnel availability factor towards increase, decrease in the number of NPP operational events and provision of the required number of qualified personnel for process operations, operating procedures and management of design-basis and beyond design-basis accidents.

7. Since the previous Review Meeting, Ukraine has completed implementing the recommendations of the International Commission on Radiological Protection into national legislation and regulations. Dose limits of personnel and the public, permissible releases and discharges, intervention levels and levels of making decisions on refuse of intervention comply with basic IAEA safety standards and ICRP recommended indicators. Completing the period of nuclear industry's transient to new radiation health and safety standards is significant achievement of Ukraine for this period. In order to ensure compliance with these standards, a system of reference and administrative-technological levels has been implemented at all NPPs; events of exceeding these levels are subjected to investigations and obligatory corrective and preventive measures.

8. Progress has been achieved in developing the emergency preparedness system for nuclear and radiation accidents. A package of regulations has been implemented, which identify competent national bodies for the implementation of international conventions in the field of nuclear energy, management bodies, forces and means involved in response to state-level emergencies, classify radiation accidents and hazard categories of facilities and activities, and govern requirements on response to emergencies at NPPs, composition, purpose and obligations of emergency teams, actions of the State Nuclear Safety Inspectorate and requirements on on-site and off-site crisis centres.

Emergency response plans are worked out and preparedness of the system and its components for actions in emergency conditions is verified on a regular basis.

Therefore, Ukraine has successively taken all the required steps to achieve the main objectives declared in the Convention on Nuclear Safety: high level of nuclear safety, efficient protection against potential radiation hazard, prevention of accidents with radiological consequences and mitigation of consequences should they occur.

The information set forth in the National Report demonstrates that Ukraine complies with all obligations of the appropriate articles under the Convention.

Annex 1

List of NPPs Existing in Ukraine

1. Operating Power Units

NPP	Power Unit No.	Electric Power, MW	Reactor Type	Date of Commissioning
Zaporizhya	1	1000	V-320	October 1984
	2	1000	V-320	July 1985
	3	1000	V-320	December 1986
	4	1000	V-320	December 1987
	5	1000	V-320	August 1989
	6	1000	V-320	October 1995
South Ukraine	1	1000	V-302	December 1982
	2	1000	V-338	January 1985
	3	1000	V-320	September1989
Rivne	1	420	V-213	December 1980
	2	415	V-213	December 1981
	3	1000	V-320	December 1986
Khmelnitsky	1	1000	V-320	December 1987

2. Power Units Being Commissioned

NPP	Power Unit No.	Electric Power, MW	Reactor Type	Date of Commissioning (as scheduled)
Khmelnitsky	2	1000	V-320	2004
Rivne	4	1000	V-320	2004

3. Power Units to Be Constructed

NPP	Power Unit No.	Electric Power, MW	Reactor Type	Date of Commissioning (as scheduled)
Khmelnitsky	3	1000	V-320	Research is underway
	4	1000	V-320	

4. Shut down Power Units

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

Annex 2

List of Programme Documents on Safety Improvement

1. "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units", approved by CMU Resolution No. 5-4-R dated 29 August 2002.
2. "Schedule for Implementing Measures of the "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" for SUNPP Site (for 2003-2006)".
3. "Programme of Priority Measures on Safety Upgrading of Ukrainian NPP Units", Kyiv, 1999, approved by Letter of the State Nuclear Regulatory Administration of Ukraine No. 15/338 dated 3 February 2000.
4. "Long-term Programme for Upgrading ZNPP Units 1-6", 1998, approved by the Chief Executive Director of NAEK "Energoatom" on 17 March 1998.
5. "Typical Programme for Periodic Inspections of Base Metal, Welds and Claddings of Equipment and Piping of WWER-1000 Nuclear Power Plants. AIEU-9-01 (PM-T.O.03.061-01)".
6. Typical Programme for Periodic Inspections of Mechanical Properties of WWER-1000 NPP Piping Metal. TPMK-10-01.
7. Schedule for KhNPP-2 Commissioning, approved by the Minister for Fuel and Energy of Ukraine.
8. KhNPP Automated Radiation Monitoring System (NAEK "Energoatom") dated 21 October 2002.
9. Programme (Revised) for Assessing WWER-1000 Pressure Vessel Metal Embrittlement Based on Tests of Surveillance-Specimens (SS) (2002-2007), agreed upon by the Deputy Chairman of the State Nuclear Regulatory Administration of Ukraine on 28 November 2002.
10. "Programme of Activities on Equipment Qualification at Ukrainian NPPs", approved by Executive President of NAEK "Energoatom", 2001.
11. "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006", approved by President of NAEK "Energoatom" on 31 July 2000.
12. "Programme for Improving Radiation Safety at NPP" (developed by each NPP and agreed upon by NAEK "Energoatom").
13. "Comprehensive Programme for Improving Operational Reliability of Steam Generators PGV-1000 at Operating Power Units", approved by President of NAEK "Energoatom" on 8 November 2000.
14. Programme for Improving the Capacity Factor at SE ZNPP, SE RNPP, SE KhNPP, SE SUNPP till 2008.
15. Measures on Reducing the Consumption of Electricity for In-house Power Supply at SE ZNPP, SE RNPP, SE KhNPP, SE SUNPP for 2003-2008.
16. Programme for Creating and Developing NAEK "Energoatom" Emergency Response System for 2000-2005, approved by Vice President of NAEK "Energoatom", 2000.
17. Comprehensive Programme of Administrative and Technical Measures to Extend the Lifetime of Ukrainian NPPs (for 2003-2010).

18. Programme for Upgrading Radiation Monitoring Systems at Ukrainian NPPs for 2001-2010.

19. Programme for the Replacement of NPP Safety System Electrotechnical Equipment Whose Service Life Expired in 2001-2005.

20. Programme for Implementing Comprehensive Diagnostics of Process Equipment at Ukrainian NPPs for 2001-2010.

21. Programme of First-priority Measures to Improve Fire Safety of Ukrainian NPP Units to 2005 Inclusive, agreed upon by Letter of the State Secretary of the Minister for Fuel and Energy of Ukraine No. 33/323 dated 8 May 2003.

22. Programme for Bringing Cable Systems at NPP Units into Compliance with Technical Regulations.

23. Comprehensive Programme for Ensuring Reliability and Economic Efficiency of Turbine Facilities at Ukrainian NPPs.

24. Comprehensive Programme for Maintaining Safety of WWER-1000 Reactor Containment for 2002-2010, approved by the Chief Executive Director of NAEK "Energoatom" on 15 August 2002.

25. Schedule of Measures on Safety Upgrading High-pressure Heaters of Turbine Regeneration Systems at Ukrainian NPPs.

26. Programme (Temporary) for Eddy-current Inspection of PGV-1000 Stem Generator Heat-exchange Tubes for 1999-2006 with Amendments and Changes No. 02.09.636.03.00.

27. Technical Decision No. TR-M.1.2.3.4.03.TH.31.(02) "On Exclusion of Thermocycling of Nozzles of Emergency Water Supply to Steam Generator from Emergency Feedwater Pump".

28. "Programme for Implementing Comprehensive System for Diagnostics of Process Equipment at Ukrainian NPPs for 2003-2010" (under development).

29. Programme for Upgrading and Modernization of Chemical Shop Equipment and Improvement of Chemical Technologies for 2003-2007, approved by Vice President of NAEK "Energoatom" on 17 June 2003.

30. Programme for Implementing Risk-informed Approaches in Regulation and Operation of Ukrainian NPPs.

31. "Branch Programme for Creating and Improving the National Manpower Development System for Nuclear Energy of Ukraine", approved on 11 April 1997.

32. "Plan of NAEK "Energoatom" On Implementing State Policy in Protection of the Population and Territory against Man-made and Natural Emergencies, Their Prevention and Immediate Response till 2005", approved by Vice President on 5 May 2001.

Annex 3

ANALYSIS OF IMPLEMENTING STATUS OF IAEA RECOMMENDATIONS WITHIN SAFETY IMPROVEMENT PROGRAMMES

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

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
AREA: GENERAL (G)					
G1	Classification of components	II		Completed	Classifiers have been developed for all power units. The classifiers are currently revised to be optimised and to reduce unjustified burden on the licensee.
G2	Qualification of equipment	III	Paras 3, 11, 16 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) Para. 6.1 "Programme of Priority Measures on Safety Upgrading of Ukrainian NPP Units" (2000). "Programme of Activities on Equipment Qualification at Ukrainian NPPs" "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	NAEK "Energoatom" supervises the implementation of a branch procedure for equipment qualification. "Lists of Equipment and Components of Safety-significant Systems Subject to Qualification (for WWER-1000/V-320 Design)" and "Branch Programme of NPP Equipment Qualification" have been developed. All equipment being installed is subjected to complete qualification in compliance with the licensing procedure.
G3	Reliability analysis of safety class 1 and 2 systems	II	Paras 17, 45 - 48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-200)	Underway	A reliability analysis of systems has been carried out for pilot power units within SAR. A system for collecting and assessing data on reliability of components has been implemented at all NPPs.
AREA: REACTOR CORE (RC)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
RC1	Prevention of inadvertent boron dilution in the primary coolant	II	Paras 10, 45 - 48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). Para.6.3 "Programme of Priority Measures on Safety Upgrading of Ukrainian NPP Units" (2000).	Underway	Additional protections and interlocks have been implemented to avoid uncontrolled boron dilution. Work is underway to arrange new places for boron concentration monitoring. Accidents associated with unanticipated primary absorber dilution are analysed within SAR.
RC2	Control rod insertion reliability. Fuel assembly deformation	III	Para.6.1 "Programme of Priority Measures on Safety Upgrading of Ukrainian NPP Units" (2000).	Completed	From 1995 to 2001 NPP units implemented a number of measures intended to improve the reliability of control rod insertion in the core, which permitted elimination of this issue.
RC3	Subcriticality monitoring during reactor shutdown conditions	II	Para. 10 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). Para.6.1 "Programme of Priority Measures on Safety Upgrading of Ukrainian NPP Units" (2000). "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006" "Long-term Programme for Upgrading ZNPP Units 1-6. 1998", paras 73, 75, 77, schedule – 2000-2008.	Underway	
AREA: COMPONENT INTEGRITY (CI)					
CI1	Reactor pressure vessel embrittlement and monitoring	III	Para.6.1 "Programme of Priority Measures on Safety Upgrading of Ukrainian NPP Units" (2000). Programme (Revised) for Assessing WWER-1000 Pressure Vessel Metal Embrittlement Based on Tests of Surveillance-Specimens (SS) (2002-2007).	Underway	

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
CI2	Non-destructive testing	III	"Typical Programme for Periodic Inspections of Base Metal, Welds and Claddings of Equipment and Piping of WWER-1000 Nuclear Power Plants. AIEU-9-01 (PM-T.O.03.061-01)" Typical Programme for Periodic Inspections of Mechanical Properties of WWER-1000 NPP Piping Metal. TPMK-10-01 Programme (Revised) for Assessing WWER-1000 Pressure Vessel Metal Embrittlement Based on Tests of Surveillance-Specimens (SS) (2002-2007). Programme (Revised) for Assessing WWER-1000 Pressure Vessel Metal Embrittlement Based on Tests of Surveillance-Specimens (SS) (2002-2007).	Completed	NPPs widely apply equipment non-destructive testing methods (visual, ultrasonic, eddy-current). Non-destructive testing methods and means, as well as personnel, are subjected to qualification based on applicable technical regulations.
CI3	Primary pipe whip restraints	II		Underway	Movement restraints have been installed. The application of the leak-before-break concept must be studied.
CI4	Steam generator collector integrity	III	Paras 1, 8 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) Typical Programme for Periodic Inspections of Base Metal, Welds and Claddings of Equipment and Piping of WWER-1000 Nuclear Power Plants. AIEU-9-01 (PM-T.O.03.061-01)	Underway	NPPs have taken compensatory and temporary measures identified by IAEA.
CI5	Steam generator tube integrity	II	"Comprehensive Programme for Improving Operational Reliability of Steam Generators PGV-1000 at Operating Power Units". Programme (Temporary) for Eddy-current Inspection of PGV-1000 Stem Generator Heat-exchange Tubes for 1999-2006 with Amendments and Changes No. 02.09.636.03.00.	Completed	Tube damping criteria have been developed, criteria of maximally permissible leaks have been established; non-destructive testing methods (eddy-current) are used in maintenance.
CI6	Steam and feedwater piping integrity	III	Para. 1 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) Typical Programme for Periodic Inspections of Base Metal, Welds and Claddings of Equipment and Piping of WWER-1000 Nuclear Power Plants. AIEU-9-01 (PM-T.O.03.061-01).	Underway	
AREA: SYSTEMS (S)					
S1	Primary circuit cold overpressure protection	II	Para. 9 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Measures are underway to provide for primary cold overpressure protection

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
S2	Mitigation of steam generator primary collector break	II	Paras 1, 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) Para.6.3 "Programme of Priority Measures on Safety Upgrading of Ukrainian NPP Units".	Underway	Design analysis of primary steam generator collector break is currently carried out within SAR with the use of up-to-date codes. Based on SAR results, the development of special emergency procedures to be included in the emergency operating instructions is planned.
S3	RCP seal cooling system	II	Para. 20 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Installation of common-unit standby diesel stations at power units is underway
S4	PPORV qualification for water flow	II	Para. 11 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	PPORV is under replacement or upgrading depending on its type
S5	ECCS sump screen blocking	III	Para. 2 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Thermal insulation is under replacement
S6	ECCS water storage tank and suction line integrity	I	"Unified Instruction on Periodic Inspections of Base Metal, Welds and Claddings of Equipment and Piping of WWER-1000 Nuclear Power Plants". AIEU-9-94	Completed	A system of non-destructive testing of ECCS storage tank and suction lines is applied
S7	ECCS heat exchanger integrity	II	"Unified Instruction on Periodic Inspections of Base Metal, Welds and Claddings of Equipment and Piping of WWER-1000 Nuclear Power Plants" AIEU-9-94	Completed	A system of non-destructive testing of components is applied, a system of radioactive monitoring and pressure difference on heat exchanger has been implemented. Crosspiece TQ-TG has been installed.
S8	Power-operated valves on ECCS injection lines	I		Completed (refuse from implementation is justified)	Results of ZNPP-5 PSA show that failure of pilot-operated valves on ECCS is not a dominant contributor to the reactor core damage.
S9	SG PORV and BRU-A qualification for water flow	III	Paras 1, 3 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	
S10	Performance of steam generator safety valves at low pressure	II	Para. 3 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
S11	Steam generator level control valves	I		Underway	Steam generator level control valves are under replacement
S12	Emergency feedwater makeup procedures	I	Para. 19 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	A branch technical description has been developed (providing for makeup for demineralized water emergency storage tanks from fire water collectors)
S13	Cold emergency feedwater supply to steam generators	I	Para. 19 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Technical decision "On Exclusion of Thermocycling of Nozzles of Emergency Water Supply to Steam Generator from Emergency Feedwater Pump". No. TR-M.1.2.3.4.03.TH.31.(02).
S14	MCR and ECR ventilation systems	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	SAR provides for risk analysis of impacts on MCR (ECR) personnel resulting form toxic gases generated in external man-made events. Based on the analysis, measures will be developed to exclude the risk of personnel injure.
S15	Hydrogen removal system	II	Para. 15 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	A system for hydrogen detection and recombination in containment rooms is under implementation.
AREA: INSTRUMENTATION AND CONTROL (I&C)					
I&C 1	I&C reliability	II	Para. 54 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	Sensors, transducers and secondary devices not complying with up-to-date requirements are being replaced and added. All newly installed devices comply with the requirements of current technical regulations. The process parameter monitoring system including diagnostics tasks is being upgraded with replacement of the process control system.
I&C 2	Safety system actuation design	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway (justification for refuse from implementation)	Special measures are not provided for. The adequacy of the existing system reliability (ECCS actuation based on active principle – voltage supply) must be assessed within SAR.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
I&C 3	Automatic reactor protection for power distribution and departure from nucleate boiling	I	Para. 54 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	Within upgrading the in-core monitoring system
I&C 4	Human engineering of MCR	II		Completed	The Westinghouse operator information support system SPDS has been commissioned for commercial operation at MCR and ECR of power units within the INSP. The system provides both general and very detailed information for the operator on the performance of safety functions for all designed modes of operation and on integrity monitoring of physical safety barriers by key safety functions, including that for violation of design-basis emergency modes. Since SPDS implementation, the man-machine interface at MCR and ECR has improved.
I&C 5	Control and monitoring of power distribution in load follow mode	II	Para. 54 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	This measures is underway within upgrading the in-core monitoring system, including replacement of in-core measurement channels (neutron measurement channels), metrological qualification of the in-core monitoring system is in process. Direct monitoring of coolant temperatures at the fuel assembly outlet and along circulation loops is possible within the SPDS design independently of Hindukush processing.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
I&C 6	Condition monitoring for mechanical equipment	I	Para. 21 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). Para. 54 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	
I&C 7	Primary circuit diagnostic system	II	"Programme for Implementing Comprehensive Diagnostics of Process Equipment at Ukrainian NPPs for 2001-2010"	Underway	Programme is under development
I&C 8	Reactor vessel head leak monitoring system	III		Completed	There is a leak monitoring system for the upper head assembly by electrical terminals, temperature monitoring channels, and reactor vessel flange. Direct monitoring and display of information on air temperature in the reactor upper assembly has been implemented by 28 thermistors of in-core monitoring system cold compensation junctions, this allows continuous diagnostics of leaks in the reactor upper assembly by temperature monitoring and electric terminal junctions and even local determination of energy release by comparison of data on radioactivity on the upper assembly head and R-3. Further improvement is planned within the "Programme for Implementing Comprehensive Diagnostics of Process Equipment at Ukrainian NPPs for 2001-2010"
I&C 9	Accident monitoring instrumentation	II	Paras 13, 15, 54 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
I&C 10	Technical support centre	II		Underway	A technical support centre and its staffing are under implementation at NPPs
I&C 11	Water chemistry control and monitoring equipment (primary and secondary)	I	Programme for Upgrading and Modernisation of Chemical Shop Equipment and Improvement of Chemical Technologies for 2003-2007.	Underway	
AREA: ELECTRICAL POWER (E)					
E 1	Off-site power supply via startup transformers	I		Underway	Required calculations of load balance have been performed. Projects to implement this measure are underway in compliance with results of calculations.
E 2	Emergency diesel generator reliability	I	Para. 20 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Common-unit standby diesel stations are being installed at power units.
E 3	Emergency protection of safety system diesel generators	I	Para. 20 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Measures to improve the reliability of existing standby diesel stations have been developed and are being implemented.
E 4	On-site power supply for incident and accident management	II	Para. 20 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Common-unit standby diesel stations are being installed at power units.
E 5	Emergency battery discharge time	III	Paras 4, 60 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005). Programme for the Replacement of NPP Safety System Electrotechnical Equipment Whose Service Life Expired in 2001-2005.	Completed	Replacement of storage batteries whose lifetime has expired is underway.
E 6	Ground faults in direct current circuits	II	Programme for the Replacement of NPP Safety System Electrotechnical Equipment Whose Service Life Expired in 2001-2005.	Underway	
CONTAINMENT (Cont.)					
Cont. 1	Containment bypass	II	Para. 14 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	LOCAs that can cause containment bypass have been analysed within SAR , associated measures are underway.
AREA: INTERNAL HAZARDS (IH)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
IH 1	Systematic fire hazard analysis	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) Programme of First-priority Measures to Improve Fire Safety of Ukrainian NPP Units to 2005 Inclusive.	Underway	With SAR for pilot units. Adaptation of the results to other units is provided for.
IH 2	Fire prevention	III	Paras 6, 7 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) Programme of First-priority Measures to Improve Fire Safety of Ukrainian NPP Units to 2005 Inclusive.	Underway	Fire-resistant doors are being installed, cables are being covered with fire-proof compounds, etc.
IH 3	Fire detection and extinguishing	II	Para. 16 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) Programme of First-priority Measures to Improve Fire Safety of Ukrainian NPP Units to 2005 Inclusive.	Underway	
IH 4	Mitigation of fire effects	II	Programme of First-priority Measures to Improve Fire Safety of Ukrainian NPP Units to 2005 Inclusive.	Underway	Replacement of fire vales in ventilation systems by certified ones is underway.
IH 5	Systematic flooding analysis	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
IH 6	Protection against flood for emergency electric power distribution boards	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
IH 7	Protection against dynamic effects of main steam and feedwater line breaks	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	The risk of secondary line break is analysed within SAR development. Based on the analysis, associated measures will be developed.
IH 8	Polar crane interlocking	II		Completed	Safe routes and load movement methods have been developed.
AREA: EXTERNAL HAZARDS (EH)					
EH 1	Seismic design	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
EH 2	Analyses of plant specific natural external conditions	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
EH 3	Man-induced external events	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AREA: ACCIDENT ANALYSIS (AA)					
AA 1	Scope and methodology of accident analysis	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 2	Quality assurance of plant data used in accident analysis	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 3	Computer code and plant model validation	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 4	Availability of accident analysis results for supporting plant operations	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	This measure is provided for within the programme for implementing risk-informed regulation of 10 June 2003 (implementation schedule – 2003-2006).
AA 5	Main steam line break analysis	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 6	Overcooling transients related to pressurized thermal shock	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 7	Steam generator collector rupture analysis	II	Para. 1 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 8	Accidents under low power and shutdown conditions	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 9	Severe accidents	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 10	Probabilistic safety assessment (PSA)	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development. PSA-1 for internal initiating events for pilot units has been carried out.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
AA 11	Boron dilution accidents	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 12	Spent fuel cask drop accidents	I	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA13	Anticipated transients without scram	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 14	Total loss of electrical power	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 15	Total loss of heat sink	II	Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AREA: OPERATION					
Oper. Pro 01	Procedures for normal operation			Underway	Pilot technical specifications on WWER-1000 safety operation (for ZNPP-5) are being developed.
Oper. Pro 02	Emergency operating procedures			Underway	Symptom-oriented emergency instructions for ZNPP-5 are under development within the INSP programme, a decision has been made on technical support to the Westinghouse project.
Oper. Pro 03	Limits and conditions		Paras 45-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Revision of limits and conditions is underway within the development of pilot technical specifications on WWER-1000 safe operation (for ZNPP-5).
Man. 01	Need for safety culture improvements			Implemented on a permanent basis	
Man. 02	Operating experience feedback			Completed	NPPs have a structural programme for operating experience feedback using both internal experience and that of other NPPs. The system is under permanent improvement.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
Man. 03	Quality assurance programme		Para. 18 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Completed	A quality assurance system has been implemented at NPPs. The system is being improved.
Man. 04	Data and document management			Completed	"The plant documentation management system" project has been implemented at NPPs.
Plant Oper.01	Philosophy on use of procedures			Underway	
Plant Oper.02	Surveillance programme			Underway	Operational surveillance programmes have been developed. Ageing management programmes are under development.
Plant Oper.03	Communication system			Completed	The communication system is subject to continuous improvement.
Rad. Prot. 01	Radiation protection and monitoring		Paras 22, 23 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	
Training 01	Training programmes			Completed	
Emerg.Plan. 01	Emergency centre			Underway	

1.1 Individual Safety Issues and Their Ranking at WWER-440/V-213 NPPs

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
AREA: GENERAL (G)					
G 1	Classification of components	II		Completed	Classifiers have been developed for all power units. The classifiers are currently revised to be optimised and to reduce unjustified burden on the licensee.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
G 2	Qualification of equipment	III	Para. 30 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	NAEK "Energoatom" supervises the implementation of a branch procedure for equipment qualification. "Branch Programme of NPP Equipment Qualification" has been developed". All equipment installed is subjected to complete qualification in compliance with the licensing procedure.
G 3	Reliability analysis of safety class 1 and 2 systems	II	Paras 17, 45 - 48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	A reliability analysis of systems has been carried out for pilot power units within SAR. A system for collecting and assessing data on reliability of components has been implemented at all NPPs.
AREA: REACTOR CORE (RC)					
RC 1	Prevention of inadvertent boron dilution in the primary coolant	II	Para. 42 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Neutron analysers of boric acid solution (NAS-B) for measuring boron-10 concentration have been partially replaced. Compensatory measures are under way: input monitoring of fresh boric acid for boron-10 content; periodic monitoring of boron-10 concentration in boron-containing media.
AREA: COMPONENT INTEGRITY (CI)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
CI 1	Integrity of pressurized reactor vessel	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Heating of water supplied to the reactor from ECCS passive part (ECCS accumulators) to 55 C has bee implemented. Heating of boric acid tanks to 55 C has been implemented (from 1991 to 1992 heating systems for ECCS tanks were commissioned, which were based on embedded electric heaters). Measures have been implemented to reduce neutron flux – used of shielded dummy assemblies (shielded assemblies were installed at unit 1 reactor, shielded assemblies are not required to be installed at unit 2 reactor). Measures have been implemented to reduce neutron flux – use of profiled fuel; transfer to 5-year fuel campaign (core load with small neutron leak). Core arrangement with small neutron leak is used at units 1,2.
CI 2	Non-destructive testing	III	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	NPPs widely apply equipment non-destructive testing methods (visual, ultrasonic, eddy-current). Non-destructive testing methods and means, as well as personnel, are subjected to qualification based on applicable technical regulations.
CI 3	Primary pipe whip restraints	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	There is a design regular set of support restraints on primary and secondary piping and equipment in the containment at RNPP units 1 and 2.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
CI 4	Steam generator collector integrity	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	Sealing unit of primary collector covers PGV-213 has been upgraded. Upper parts (necks) of the steam generator “hot” collectors have been replaced. "Hot" primary collectors have been repaired. Pneumohydraulic inspection of steam generator heat exchanger tubes has been introduced along with eddy-current inspection of collectors. Eddy-current inspection of steam generator heat exchange tubes has been implemented. System SGLM-201 has been implemented to monitor primary-to-secondary coolant leak by N16 isotope. The steam generator blowdown system has been improved at unit 1.
CI 5	Steam generator tube integrity	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	Pneumohydraulic inspection of steam generator heat exchanger tubes has been introduced along with eddy-current inspection of collectors. A system for continuous monitoring of primary coolant leaks in steam generators by steam activity has been implemented at power unit 2. A decision on the implementation at unit 1 will be made on the basis of trial commercial operation at power unit 2.
CI 6	Steam-generator feedwater distributing group collector	I	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	The distributing collector has been replaced by a modernized one made of stainless steel.
AREA: SYSTEMS (S)					
S 1	Primary circuit cold overpressure protection	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Technical measures to exclude cold overpressure have been taken. The algorithm of protections and interlocks has been implemented.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
S 2	Mitigation of steam generator primary collector break	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Covers of steam generator primary hot collectors have been replaced by thickened ones restricting the leak cross section in case of cover breakaway or cracking of primary flange collector to Dnom90. The sealing unit of primary collector covers PGV-231 has been upgraded to mitigate primary-to-secondary leaks.
S 3	RCP seal cooling system	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	
S 4	PPORV qualification for water flow	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	PPORV have been replaced by up-to-date ones meeting the requirements of technical regulations. The primary overpressure protection is to be upgraded at units 1 and 2.
S 5	ECCS sump screen blocking	III	Para. 28 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Upgrading of the sump screens is underway. Thermal insulation has not been replaced in the containment. The upgrading of the sump screen is determined as compensatory measure.
S 6	ECCS suction line integrity	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Inspection of welds on ECCS suction lines and ECCS sump tank has been made stricter.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
S 7	ECCS heat exchanger integrity	II	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	A device is being installed to prevent and monitor clogging of heat exchangers and to ensure their cleaning. An emergency procedure to mitigate consequences of primary-to-secondary leak has been developed and partially implemented. An emergency procedure has been developed for design-basis accidents, a similar procedure for beyond design-basis accidents will be prepared after the development of symptom-oriented instruction.
S 8	Power-operated valves on ECCS injection lines	I	"Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	2 cut-off valves have been installed on each safety system train.
S 9	SG PORV and BRU-A qualification for water flow	II	Para. 30 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Completed	SG PORV and SG safety valves (SV) have been replaced. Czech SG SV have been replaced by “SEBIM” PORV (France) on all SG of units 1, 2.
S 10	Performance of steam generator safety valves at low pressure.	II		Completed	New safety and/or relief valves to be remotely controlled from MCR in any secondary pressure value have been installed. Czech SG SV have been replaced by “SEBIM” PORV (France) on all SG of units 1, 2.
S 11	Steam generator level control valves.	I	Para. 33 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Completed	SG valves and SG level control system have been replaced. Control devices 810-250-EA have been replaced by more reliable and modernized control devices 1046-250-EN.
S 12	Emergency feedwater makeup procedures	I	Para. 29 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Emergency feedwater supply system is being installed.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
S 13	Vulnerability of steam generators emergency feedwater supply system	III	Para. 29 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	The SG feedwater system is being upgraded.
S 14	MCR ventilation system	II		Completed	Systems have been separated and positive pressure is maintained.
S 15	Hydrogen removal system.	II		Underway	A system for automated hydrogen concentration monitoring in accidents is being installed in containment rooms. A system for hydrogen recombination in accidents is being installed in containment rooms.
S 16	Primary-circuit emergency off-gassing.	II		Completed	A gas-off system has been installed for gas relief from the reactor head assembly, from upper pints of the steam generator primary collector. The system of emergency gas-off from SG collectors is based on designed air vents. A system for drainage of main circuit hydraulic locks has been implemented.
S 17	Essential service water system	II		Underway	Measures are underway to ensure the required quality of service water.
AREA: INSTRUMENTATION AND CONTROL (I&C)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
I&C 1	I&C reliability.	II	"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units" "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	Updrading of the in-core monitoring system is underway. Automatic power controller, reactor power restrictor, internal seismic protection system are being upgraded. Information control system has been modernized. The system for generation of reactor protections (neutron flux monitoring equipment) has been partly improved. Gas-discharge indicators (IMG) were replaced in blocks BIC-06R). Measurement of levels in liquid and solid waste storage tanks has been arranged. The system for coolant level measurement in the reactor in cold condition has been partly modernized. The radiation monitoring system in the fresh fuel storage facility has been modernized. A system for monitoring the exposure dose rate in the fresh fuel storage facility has been implemented. Transducer-sensors of flow rate, level and pressure in safety-significant systems have been partly replaced. NFMS-2 has been replaced by NFMS-7.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
I&C 2	Safety system actuation design.	I	"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units" "Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"		Automatic actuation of control rod electric drives has been replaced by manual one. Relay circuit of reactor protection has been replaced by process parameter emergency protection. A circuit for measuring and alarming when setpoint of 10^0C is reached between the primary saturation temperature and the temperature in the reactor hot legs has been implemented.
I&C 3	Analysis of reactor scram actuation signal.	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	A list of design-basis accidents is being analysed and specified within SAR. Based on the analysis, the completeness of reactor emergency shutdown system actuation signals will be reassessed and associated measures will be developed.
I&C 4	Human engineering of control rooms.	II	"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	RNPP units 1,2 are equipped with safety parameter display systems (SPDS)
I&C 5	Physical and functional separation of MCR and ECR	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Safety impact analysis of existing connections between MCR and ECR is underway within SAR. Based on the analysis, corrective measures will be developed to ensure complete physical and functional separation of MCR and ECR.
I&C 6	Monitoring of mechanical equipment condition.	I	Para. 35 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
I&C 7	Primary circuit diagnostic system.	I	Para. 35 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Local systems for reactor diagnostics are being developed and implemented. According to the schedule approved by NAEK "Energoatom" for introduction of subsystems of the comprehensive diagnostic system (CDS), a subsystem for the diagnostics of rotating mechanisms by mobile devices has been introduced (DIMEX-2).
I&C 8	Reactor vessel head leak monitoring system.	I	Para. 35 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	
I&C 9	Accident monitoring instrumentation.	II	"Programme for Component-by-Component Replacement of Automated Process Control Subsystems at WWER-1000 and WWER-440 Units of Ukrainian NPPs for 2000-2006"	Underway	A system for measurements and alarm when the margin to primary saturation temperature is below 10^0C has been implemented. Automated process control subsystems are being replaced in compliance with the schedule. All installed equipment is subjected to qualification in accordance with the licensing procedures.
I&C 10	Technical support centre.	II		Completed	On-site crisis centre has been commissioned.
I&C 11	Water chemistry control and monitoring equipment (primary and secondary)	I	"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	The concept has been developed of a system for automated chemical monitoring, control and diagnostics of primary circuit water chemistry. A system for automated chemical monitoring, control and diagnostics of secondary circuit water chemistry has been developed and implemented at NPP.
AREA: ELECTRIC POWER SUPPLY (EL)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
EL 1	Startup logic of emergency diesels	I	"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	A project is being developed and implemented to establish priority of diesel generator safety functions over in-house protections.
EL 2	Diesel generator reliability.	I	"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	The actuation of diesel generators has been accelerated (the starting time has been decreased).
EL 3	Protection signals for emergency diesel generators.	I	"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	A technical decision has been implemented for actuation of diesel generator internal protections upon signals "Accident" and "Scheduled Loading".
EL 4	On-site power supply for incident and accident management.	I	Para. 39 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	The control circuits for open switchyard ORU-330 and 110-kV components provide for installation of the second storage battery and additional diesel generator, which is manually controlled for power supply to air compressors and recharge of ORU-330/110 kV storage batteries (SB) in the mode of total blackout. To ensure reliable and accident-free performance of the emergency power supply system, the following has been done: - SB-10, 12,13,14 at power unit 1 and SB-24 at power unit 2 have been replaced by up-to-date «VARTA» storage batteries that have sufficient capacity to maintain safety functions.
EL 5	Emergency battery discharge time.	II	Para. 36 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	SB have been replaced. Uninterruptible power supply units (UPS) for reliability category I and II equipment have been replaced. Equipment is replaced because its lifetime expires.
AREA: CONTAINMENT (Cont)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
Cont. 1	Strength characteristics of bubbler condenser under maximum pressure differential possible in LOCA	III	Para. 44 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Bubble condenser structures are being strengthened. The containment has been closed on structures of the connection corridor of the SG box and bubble vacuum system of accident confinement. Loose places of the containment are sealed by injection of sealing material and by welding annually during scheduled outage according to Programme No. 350-1,2-Pr-ONIO.
Cont. 2	Bubbler condenser thermodynamic characteristics	II	Para. 44 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Work is underway to strengthen metal structures.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
Cont. 3	Containment leak flow rates.	II	Para. 43 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Strength of the containment system under design-basis overpressure has been justified. Technical decision "On Use of Repair-Emergency Exhaust Ventilation System V-4 as a System for Air Relief from the Containment in Leaktight Testing" has been implemented. The leak flow rate in the containment is measured during tests for strength and density after scheduled outage. The strength of the containment system for design-basis underpressure has been partially justified. Decision "On Refusal from Tests by Design Underpressure of Accident Confinement Area at Rivne NPP Units 1,2" has been implemented. A methodology has been developed and implemented for determining gas leak from the accident confinement system, pressure gauges have been replaced by more accurate ones meeting the requirements of PNAE G-10-021-90).
Cont. 4	Maximum pressure drops on walls between pressurized box rooms.	II	Para. 43 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	
Cont. 5	Containment pressure peak and spray system actuation after coolant leak	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005) "Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Analysis is underway within SAR. Development of associated measures is planned on the basis of the analysis.
AREA: INTERNAL HAZARDS (IH)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
IH 1	Systematic fire hazard analysis	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	A fire hazard analysis methodology has been developed. A fire safety analysis is in progress within SAR.
IH 2	Fire prevention.	II	Para. 31 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)"	Underway	Replacement of existing fire doors is underway. Design estimate documentation is being prepared for the installation of fire partitions to separate safety-significant components and to separate backup trains of safety systems. An algorithm has been implemented for reactor quick shutdown in case of a fire on the board of the control and protection system. Automation is being replaced in entrance cabinets of safety system equipment relay protection units. The drencher fire-extinguishing system, fire alarm, fire doors at units 1,2 DSG have been upgraded.
IH 3	Fire detection and extinguishing	II	Para. 31 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)"	Underway	Fire alarm has been upgraded. Fire detection system equipment is under replacement.

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
IH 4	Mitigation of fire effects.	II	Para. 31 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)"	Underway	Thermal stability of cables has been brought into compliance with regulatory requirements. Fire resistance of turbine hall metal structures is improved by their covering with fireproof compound. Ventilation systems of cable rooms at power units 1,2 have been covered with sewed-in mattresses of superfine basalt fibre with fire endurance of 1.5 hours. A system for smoke removal from fire-hazardous rooms, evacuation corridors and halls is under development and implementation.
IH 5	Systematic flooding analysis.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
IH 6	Turbine flying components	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
IH 7	Internal hazards caused by high-energy piping breaks.	III	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
IH 8	Heavy load drop.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development. Instrumental inspection of crane runways at units 1,2 is underway.
AREA: EXTERNAL HAZARDS (EH)					

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
EH 1	Seismic design.	III		Underway	Ventilation equipment has been installed at ventilation systems of safety-significant systems in accordance with PNAEG-5-006-87. The systems for cooling of containment rooms and instrument vault are being upgraded. Equipment installation is underway. Ventilation systems of the information computer system have been upgraded. Seismic-design equipment has been installed, which is designed for NPPs to ensure reliable performance of electronic equipment.
EH 2	Analyses of plant-specific natural external conditions.	I		Completed	Subsidence of buildings and structures at units 1,2 is monitored. Verification drilling has been completed for biolocation of units 1,2. A cycle of radio logging surveys has been performed for units 1,2,3. Deformations of earth and engineering structures at RNPP units 1,2 have been assessed and predicted. The location of the main reactor flange has been adjusted (elimination of reactor lurch).
EH 3	Man-induced external events.	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AREA: ACCIDENT ANALYSIS (AA)					
AA 1	Scope and methodology of accident analysis.	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 2	Quality assurance of plant data used in accident analysis.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
AA 3	Computer code and plant model validation.	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 4	Availability of accident analysis results for supporting plant operations.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 5	Main steam line break analysis.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 6	Overcooling transients related to pressurized thermal shock.	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 7	Steam generator collector rupture.	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 8	Accidents under low power and shutdown conditions.	II	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 9	Severe accidents.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 10	Probabilistic safety assessment (PSA).	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 11	Boron dilution accidents.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR development
AA 12	Spent fuel cask drop accidents.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR Administrative and technical measures have been developed and implemented for spent fuel cask transportation.
AA 13	Anticipated transients without scram.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR
AA 14	Total loss of electric power.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
AA 15	Total loss of heat sink.	I	Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Underway within SAR
AREA: OPERATION (OP)					
OP 1	Procedures for normal operation		"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Completed	Operating instructions have been developed. They are improved on a permanent basis.
OP 2	Emergency operating procedures		"Comprehensive Programme of Priority Mesures on Upgrading and Safety Improvement of Ukrainian NPP Units"	Underway	Symptom-oriented emergency instructions are under development.
OP 3	Limits and conditions		Paras 47-48 "Comprehensive Programme for Upgrading and Safety Improvement of Ukrainian Nuclear Power Plant Units" (2002-2005)	Underway	Limits and conditions are revised within SAR development.
OP 4	Need for safety culture improvements			Implemented on a permanent basis	Safety culture is improved on a permanent basis.
OP 5	Operational experience feedback				NPPs have a structural programme for operating experience feedback using both internal experience and that of other NPPs. The system is under permanent improvement
Man. 03	Quality assurance programme			Completed	A quality assurance system has been implemented at NPPs. The system is being improved
Man. 04	Data and document management			Completed	"The plant documentation management system" project has been implemented at NPPs.
Plant Oper.01	Philosophy on use of procedures			Underway	
Plant Oper.02	Surveillance programme			Underway	Equipment operational surveillance programmes have been developed. Ageing management programmes are under development
Plant Oper.03	Communication system			Completed	The communication system is subject to continuous improvement

Issue No.	Issue Title	Issue Rank	Drawback Elimination Programme, Deadline	Status	Comment
Rad. Prot. 01	Radiation protection and monitoring			Underway	
Training 01	Training programmes			Completed	
Emerg.Plan. 01	Emergency centre			Underway	

Annex 4

List of Regulations on Nuclear and Radiation Safety in Force

Laws of Ukraine

1 "On Nuclear Energy Use and Radiation Safety" No. 39 dated 8 February 1995.

2 "On Radioactive Waste Management" No. 255 dated 30 June 1995.

3 "On Uranium Mining and Milling" No. 645 dated 19 November 1997.

4 "On Human Protection Against Ionising Radiation" No. 15 dated 14 January 1998.

5 "On General Provisions of Further Operation and Decommissioning of Chornobyl NPP and Transformation of Destroyed Unit 4 of This NPP into an Ecologically Safe System" No. 309 dated 11 December 1998.

6 "On Authorising Activity in Nuclear Energy Use" No. 1370 dated 11 January 2000.

7 "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation" No. 2064 dated 19 October 2000.

8 "On Environmental Protection" No. 1264 dated 25 June 1991.

9 "On Health and Epidemiological Well-being of the Population" No. 4004 dated 24 February 1994.

10 "On Ecological Review" No. 45 dated 9 February 1995.

11 "On Civil Liability for Nuclear Damage and Financial Coverage" No. 2893-III dated 13 December 2001.

12 "On Amendments to the Law of Ukraine "On Human Protection Against Ionising Radiation" No. 2397-III dated 26 April 2001.

13 "On Ratification of the Agreement on Cooperation Between the Cabinet of Ministers of Ukraine and European Atomic Energy Community in Nuclear Safety and Agreement on Cooperation Between the Cabinet of Ministers of Ukraine and European Atomic Energy Community in Controlled Nuclear Fusion" No. 3104-III dated 7 March 2002.

14 "On Amendments to Some Laws of Ukraine with Regard to Passing the Law of Ukraine "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation" No. 747-IV dated 15 May 2003.

15 “On Amendments to Some Laws of Ukraine with Regard to Passing the Law of Ukraine “On Authorising Activity in Nuclear Energy” No. 887-IV dated 22 May 2003.

16 “On Amendments to the Law of Ukraine “On General Provisions of Further Operation and Decommissioning of Chornobyl NPP and Transformation of Destroyed Unit 4 of This NPP into an Ecologically Safe System” No. 1064-IV dated 9 July 2003.

17 “On Amendments to the Code of Ukraine on Managerial Infringements” No. 1284-IV dated 18 November 2003.

18 “On Amendments to the Law of Ukraine “On Nuclear Energy Use and Radiation Safety” No. 1417-IV dated 3 February 2004.

19 “On Settlement of Issues Related to Nuclear Safety” No. 1868-IV dated 24 June 2004.

20 “On Amendments to Article 12 of the Law of Ukraine “On General Provisions of Further Operation and Decommissioning of Chornobyl NPP and Transformation of Destroyed Unit 4 of This NPP into an Ecologically Safe System” No. 1907-IV dated 29 June 2004.

21 “On Amendments to Some Laws of Ukraine on Insurance of Personnel of Nuclear Installations” No. 1971-IV dated 1 July 2004.

Resolutions of the Ukrainian Cabinet of Ministers

1 “On Order of Issuing Safeguards on Release of Foreign Juridical Persons from Civil Liability for Nuclear Damage” No. 733 dated 13 September 1995.

2 “On Approving the Provision on Order of Identifying Size and Impose of Fines for Enterprises, Establishments, and Organisations Acting in Area of Nuclear Engineering in Case of Violation from Regulations, Rules, and Standards on Safety or Conditions of Permits for Work” No.708 dated 29 June 1996.

3 “On Identifying Central Authority and Connection Station for Nuclear Material Physical Protection” No. 861 dated 30 July 1996.

4 “On Approving Contract Between the Ukrainian Cabinet of Ministers and the Russian Federation Government on Collaboration in Area of Nuclear Materials Transportation” No.980 dated 19 August 1996.

5 “On Concluding the Agreement between the Ukrainian Cabinet of Ministers, the Russian Federation Government, the Slovak Republic Government, the Czech Republic Government on Collaboration in Area of Nuclear Materials Transportation

between the Russian Federation and the Czech Republic through the Territory of Ukraine and the Slovak Republic" No. 1063 dated 05 September 1996.

6 "Issues of the Chornobyl Centre on Nuclear Safety, Radioactive Waste and Radiation Ecology" No. 1177 dated 28 September 1996.

7 "On Developing the National Atomic Energy Generating Company NAEK "Energoatom" No. 1268 dated 17 October 1996.

8 "On Approving Provision on State System for Nuclear Materials Account and Monitoring" No. 1525 dated 18 December 1996.

9 "On Supervisory Council of Chornobyl Centre on Nuclear Safety, Radioactive Waste and Radio-ecology" No. 36 dated 20 January 1997.

10 "On Approving Order of Developing and Approving Regulations, Rules, and Standards on Nuclear and Radiation Safety" No. 163 dated 08 February 1997.

11 "On Approving Provision on the Main Measures for Radioactive Materials Transportation through the Territory of Ukraine " No. 1332 dated 29 November 1997.

12 "On ChNPP Unit 1 Prescheduled Decommissioning" No. 1445 dated 22 December 1997.

13 "On Approving Order of Conducting Special Testing for Issuing Permit to Physical Persons for Work at Nuclear Facilities and with Nuclear Materials" No. 1471 dated 25 December 1997.

14 "On Approving Provision on the State Environmental Monitoring System" No. 391 dated 30 March 1998.

15 "On Assigning the Operating Organisation-Operator of Nuclear Facilities" No. 830 dated 08 June 1998.

16 "On Approving Order of Civil Hearing on Nuclear Energy Use and Radiation Safety" No. 1122 dated 18 July 1998.

17 "On Single System for Preventing and Response to Emergency Situations of Man-made and Natural Character " No. 1198 dated 03 August 1998.

18 "On Measures for Preparing National Report of Ukraine on Nuclear Safety" No. 1463 dated 18 September 1998.

19 "On Approving Agreement between the Government of Ukraine and the Government of Canada on Collaboration in Nuclear Energy Peaceful Use" No. 1760 dated 09 November 1998.

20 “On Approving Agreement between the Ukrainian Cabinet of Ministers and the Government of French Republic on Collaboration in Area of Nuclear Energy Peaceful Use” No. 183 dated 13 February 1999.

21 “On Safeguard of Releasing Participants of Implementing Plan of Measures at the Shelter from Civil Liability for Nuclear Damage” No. 223 dated 18 February 1999.

22 “On Complex Programme for Radioactive Waste Management” No. 542 dated 05 April 1999.

23 “On Order of Approving Work Program on the Shelter Transformation to Environmental Safe System” No. 1249 dated 13 July 1999.

24 “On Concluding Contract between the Ukrainian Cabinet of Ministers, the Government of Russian Federation, and the Government of Kazakhstan Republic on Assistance in Developing the Joint Enterprise for Nuclear Fuel Production for WWER-1000” No. 1474 dated 13.August 1999.

25 “On Concluding the Agreement on Amendments to the Contract on Grant (Chornobyl NPP Nuclear Safety Project) between the European Bank for Reconstruction and Development as the Manager of Costs Submitted According to the Grant from Nuclear Safety Account, the Government of Ukraine and Chornobyl Nuclear Power Plant” No. 1942 dated 21 October 1999.

26 “On State Monitoring of National and International Projects in Area of Nuclear and Radiation Safety and Radio-ecology” No. 1219 dated 04 August 2000.

27 “On Approving the List of Activities Connected with Assuring Physical Protection of Nuclear Facilities and Nuclear Materials Underlying to Obligatory Licensing” No. 1115 dated 12 June 2000.

28 “On Urgent Measures on Increase of Safety and Nuclear Engineering Functioning Reliability” dated 12 October 2000. No. 1553.

29 “On Approving the Lists of Personnel Duties and Specialities for Nuclear Facilities Operation, Training of which Underlies to Licensing, and Duties of Personnel Directly Providing Monitoring of Nuclear Power Plant Reactor Facility ” No. 1683 dated 08 November 2000.

30 “Some Issues of State Regulation of Activity for Ionising Radiation Sources Use” No. 1718 dated 16 November 2000.

31 “On Approving the Order of Licensing Single Kinds of Activity in Area of Nuclear Energy Use” No. 1782 dated 06 December 2000.

32 “On Supervision Council of Chornobyl Centre for Nuclear Safety, Radioactive Waste and Radio-ecology” No. 1912 dated 28 December 2000.

33 “On Unit 3 Prescheduled Decommissioning until Chornobyl NPP Final Closure” No. 598 dated 29 March 2000.

34 “On Measures on Preventing Emergency Situations During Transportation of Hazardous Loads by Motor Transport” No. 104 dated 29 January 1999.

35 “On State Program for Radioactive Waste Management” No. 480 dated 29 April 1996.

36 “On Approving Provision on Providing Announcement and Connection in Emergency Situations” No. 192 dated 15 February 1999.

37 “On Some Issues of the State Nuclear Regulatory Committee” No. 313 dated 02 April 2001.

38 “On Approving the Order for Payment and Amount of Payment for Authorising Procedures in Nuclear Energy” No. 440 dated 6 May 2001.

39 “On Approving the Concept of the State Scientific and Technical Programme of Priority Safety Areas of Nuclear Energy Facilities till 2010” No. 398-r dated 21 August 2001.

40 “Plan of State-level Response to Emergencies” No. 1567 dated 16 November 2002.

41 “On Approving the List of Ionising Radiation Sources the Use of which is Released from the Licensing” No. 912 dated 01 July 2002.

42 “On Obligatory Insurance of Civil Liability for Nuclear Damage” No. 953 dated 23 June 2003.

43 “Procedure and Rules on Obligatory Insurance of Civil Liability for Nuclear Damage” No. 953 dated 23 July 2003.

44 “Provisions on Nuclear Insurance Pool of Ukraine” No. 953 dated 23 July 2003.

45 “On Appointment of Competent National Authorities as Regards Implementation of International Conventions in Nuclear Energy ” No. 1570 dated 02 October 2003.

46 “Procedure for Determining the Level of Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Radiation Sources According to Their Category” No. 625 dated 26 April 2003.

47 “Procedure for State Inspection of Physical Protection Systems of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Radiation Sources and Plans of Interaction in Case of Nuclear Terrorist Acts” No. 327 dated 12 March 2003.

48 “Procedure for Interaction of Executive Bodies and Legal Entities Dealing with Nuclear Energy in Case of Illicit Trafficking of Radiation Sources” No. 813 dated 2 June 2003.

49 “Agreement between the Cabinet of Ministers of Ukraine and the Government of the Latvia Republic on Early Notification of Nuclear Accidents, Information Exchange and Cooperation in Nuclear Safety and Radiation Protection” No. 1309 dated 20 August 2003.

50 “Some Issues on Rejection of Production under Frontier Control in Favour of the State” No. 1955 dated 17.February 2003.

51 “Agreement between the Ukrainian Cabinet of Ministers and the Government of Bulgarian Republic on Operative Announcement on Nuclear Accidents and Cooperation in Nuclear and Radiation Safety” No. 144 dated 29 January 2003.

52 “On Approving the Procedure for Determining Rates in Obligatory Insurance of Civil Liability for Nuclear Damage” No. 1307 dated 20 August 2003.

53 “Shelter Implementation Plan” No. 421 dated 31 March 2003.

54 “On Amendment of the Licensing Procedure for Individual Activities in Nuclear Energy and Resolution of the Ukrainian Cabinet of Ministers No. 440 dated 6 May 2001” No. 125 dated 4 February 2004.

55 “On Approving the Order of State Monitoring of International Transportation of Reusable Goods” No. 86 dated 28 January 2004.

SNRCU Regulations

1 Radiation Safety Regulations of Ukraine NRBU 97. Approved by the Order of the Ministry of Health of Ukraine No. 208 dated 14 July 1997 and Implemented by the Resolution of the Chief State Physician of Ukraine No. 62 dated 01 December 1997.

2 Radiation Safety Regulations of Ukraine: Radiation Protection from Potential Radiation Sources NRBU-97/D-2000. Approved by the Resolution of the Chief State Physician of Ukraine No. 116 dated 12 July 2000.

3 General Provisions on Nuclear Power Plants Safety Assurance (NP 306.1.02/1.034-00). Approved by the Order of the State Nuclear Regulatory Administration of Ukraine No. 63 dated 09 December 1999, and registered in the Ministry of Justice of Ukraine Reg. No. 132/4353 dated 06 March 2000.

4 Provision on Licensing the Personnel of NPs of Ukraine (ND 306.203-95). Approved by the Resolution of the Ministry of Environmental Safety of Ukraine No. 155 dated 29 December 1995 and registered in the Ministry of Justice of Ukraine, Reg. No. 48/1073 dated 05 February 1996.

5 Provision on Personnel Training of Ukrainian NPPs (NP 306.2.02/2.010-98). Approved by the Resolution of the Ministry of Environmental Safety of Ukraine No. 9 dated 16 January 1998, and registered by the Ministry of Justice of Ukraine Reg. No. 419/2859 dated 03 July 1998.

6 Requirements on Structure and Content of Safety Analysis Report on Nuclear Power Plants and Research Reactors Decommissioning (NP 306.3.02/3.040-00), approved by the Resolution of the Ministry of Environmental Safety of Ukraine No. 177 dated 31 October 2000, and registered by the Ministry of Justice of Ukraine Reg. No. 842/5063 dated 21 November 2000.

7 Rules on Nuclear Materials Account and Monitoring at Installation (NP 306.4.07.016-98), approved by the Resolution of the Ministry of Environmental Safety of Ukraine No. 13 dated 24 December 1998, and registered by the Ministry of Justice of Ukraine Reg. No. 18/3311dated 15 January 1999.

8 The State System of Nuclear Materials Account and Monitoring. Filling the Forms of Report and Account Documentation at Enterprises. Instruction. ND-306-802-93. Approved by the Ordinance of the State Nuclear Supervision of Ukraine in 1993.

9 Rules on Treatment with Information on Physical Protection of Nuclear Installations, Nuclear Materials, Other Ionising Radiation Sources, with Limited Access to it (NP 306.4.08/1.013-98). Approved by the Resolution of the Ministry of Environmental Safety of Ukraine No. 191 dated 28 December 1998, and registered in the Ministry of Justice of Ukraine Reg. No. 114/3407 dated 25 February 1999.

10 Provision on Identifying Characteristics of Possible Attack on Nuclear Installations and Nuclear Materials and Using this Information in Physical Protection (NP 306.2.08/1.015-99). Approved by the SNRCU Ordinance No. 38 dated 30 September 2000, and registered in the Ministry of Justice of Ukraine Reg. No. 703/3996 dated 14 October 1999.

11 Rules on Physical Protection of Nuclear Material and Nuclear Installations (NP 306.4.08/1.019-99). Approved by the SNRCU Ordinance No. 34 dated 27 September 1999, and registered in the Ministry of Justice of Ukraine Reg. No. 748/4041dated 02 November 1999.

12 Rules on Assuring Storage of Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation (NP 306.4.08/1.042-00). Approved by Ordinance of the Ministry of Environment and Natural Resources of Ukraine (MENR) No. 241 dated 14 December 2000, and registered in the Ministry of Justice of Ukraine Reg. No. 13/5204 dated 12 January 2001.

13 General Provisions for Safety Assurance in Nuclear Power Plants and Research Reactors Decommissioning (NP 306.2.02/1.004-98).

14 Order of the State Inventory of Radioactive Waste (NP 306.2.04/3.005-98).

15 Order of Issuing Safety Certificates in Radioactive Materials Transportation (NP 306.5.06/2.008-98).

16 Provision on Licensing the Personnel Training of Ukrainian NPPs (NP 306.2.02/2.010-98).

17 Licensing Requirements on Personnel Training of Ukrainian NPPs (NP 306.5.02/3.011-98).

18 Rules for Account and Control of Nuclear Materials at Facilities (NP 306.4.07.016-98).

19 Rules on Treatment with Information on Physical Protection of Nuclear Installations, Nuclear Materials, Other Ionising Radiation Sources, with Limited Access to it.

20 Rules on Physical Protection of Nuclear Materials and Nuclear Installations.

21 Provisions on Identifying Characteristics of Possible Kinds of Attack on Nuclear Installations and Nuclear Materials and Using these Characteristics in Physical Protection.

22 Rules on Conducting Account and Monitoring of Nuclear Materials at Installation.

23 Requirements on Quality Assurance Program at all Stages of Nuclear Installations Lifecycle.

24 General Provisions for Safety Assurance of Nuclear Power Plants (NP 306.1.02/1.034-2000).

25 List and Requirements on Form and Content of Documents Submitted for Obtaining the License for Each Stage of Storage Facility Lifecycle for Radioactive Waste Disposal.

26 Requirements on Structure and Content of Safety Analysis Report of Near-surface Storage Facilities for Radioactive Waste.

27 Requirements on Structure and Content of the Safety Analysis Report at the Stage of Decommissioning of Nuclear Power Plants and Research Reactors.

28 Requirements on Structure and Content of the Safety Analysis Report on Radioactive Waste Reprocessing Installations.

29 “Radiation Safety Standards of Ukraine, Supplement: Radiation Protection against Potential Radiation Sources”; (NRBU-97/D-2000).

30 “Methodology for Expert Assessment (Technical Evaluation) of the "Technical Safety Substantiation" Appendix to Safety Analysis Report for Operating Nuclear Power Plants (GND 06.7.02/2.053-01), approved by SNRCU Ordinance No. 73 dated 24 September 2001.

31 “Methodology for Expert Assessment (Technical Evaluation) of the "Analysis of Beyond Design-basis Accidents" Appendix to Safety Analysis Report for Operating Nuclear Power Plants (GND 306.7.02/2.047-01), approved by SNRCU Ordinance No. 40 dated 15 June 2001.

32 “Methodology for Expert Assessment (Technical Evaluation) of the "Probabilistic Safety Assessment" Appendix to Safety Analysis Report for Operating Nuclear Power Plants (GND 306.7.02/2.048-01), approved by SNRCU Ordinance No. 41 dated 15 June 2001.

33 “Methodology for Expert Assessment (Technical Evaluation) of the "Analysis of Design-basis Accidents" Appendix to Safety Analysis Report for Operating Nuclear Power Plants (GND 306.7.02/2.049-01), approved by SNRCU Ordinance No. 39 dated 15 June 2001.

34 “Safety Requirements and Conditions (Licensing Conditions) of Activities Related to Transportation of Radioactive Materials” (NP 306.5.06/2.063-02), approved by SNRCU Ordinance No. 116 dated 8 November 2002 and registered in the Ministry of Justice, Reg. No. 934/7222 dated 29 November 2002.

35 “Requirements on the Safety Analysis Report on Activities Related to Transportation of Radioactive Materials” (NP 306.5.06/3.064-02), approved by

SNRCU Ordinance No. 116 dated 8 November 2002 and registered in the Ministry of Justice, Reg. No. 935/7223 dated 29 November 2002.

36 “Safety Requirements and Conditions (Licensing Conditions) of Activities Related to Processing, Storage and Disposal of Radioactive Waste” (NP 306.5.04/2.060-02), approved by SNRCU Ordinance No. 110 dated 22 October 2002 and registered in the Ministry of Justice, Reg. No. 874/7162 dated 6 November 2002.

37 “Procedure for State Oversight of Safety Assurance in Shelter Implementation Plan Designs”, approved by SNRCU Ordinance No. 112 dated 28 October 2002.

38 “Rules for Keeping a System for Accountancy and Control of Nuclear Materials at Enterprises Other Than Nuclear Installations” (NP 306.5.07.061-02), approved by SNRCU Ordinance No. 85 dated 22 July 2002 and registered in the Ministry of Justice, Reg. No. 940/7228 dated 3 December 2002.

39 “Methodology for Expert Assessment (Technical Evaluation) of the "Additional Materials on Safety Analysis" Appendix to Safety Analysis Report for Operating Nuclear Power Plants (GND 306.7.02/2.058-02), approved by SNRCU Ordinance No. 38 dated 4 March 2002.

40 “Procedure for Developing and Issuing Standards and Rules on Nuclear and Radiation Safety by the State Nuclear Regulatory Committee of Ukraine” (GND 306.6.01/1.072-03), approved by SNRCU Ordinance No. 66 dated 23 May 2003.

41 “Requirements on the Procedure and Content of Activities on Extending the Lifetime of Information and Control Systems Significant to Safety of Nuclear Power Plants” (NP 306.5.02/2.068-03), approved by SNRCU Ordinance No. 42 dated 18 March 2003 and registered in the Ministry of Justice of Ukraine, Reg. No. 306/7627 dated 15 April 2003.

42 “Requirements on the Format and Content of Typical Certification for the Reactor Facility” (NP 306.5.02/3.056-02), approved by SNRCU Ordinance No. 111 dated 21 August 2003.

43 Ordinance of the Ministry of Health and SNRCU “On Abolition of SP AS-88 Provisions Regarding the Establishment of Permissible Releases and Discharges of NPP Radioactive Materials into the Environment” No. 196/59 dated 6 May 2003.

44 "Procedure for Issuing Certificates on Approval of Package Designs and Radioactive Materials, Special Conditions and Some Shipments” (NP 306.5.06/2.071-03), approved by SNRCU Ordinance No. 51 dated 7 April 2003 and registered in the Ministry of Justice, Reg. No. 392/7713 dated 23 May 2003.

45 “Safety Requirements and Conditions (Licensing Conditions) of Activities Related to Design of a Nuclear Installation or Radioactive Waste Disposal Facility” (NP 306.5.02/2.069-03), approved by SNRCU Ordinance No. 50 dated 4 April 2003 and registered in the Ministry of Justice, Reg. No. 322/7643 dated 23 April 2003.

46 “Procedure for State Inventory of Radioactive Waste” (NP 306.5.04/2.059-02), approved by SNRCU Ordinance No. 27 dated 11 February 2003 and registered in the Ministry of Justice, Reg. No. 160/7481 dated 25 February 2003.

47 “Procedure for Inspections and Checks of Radioactive Waste Disposal Facilities at Stages of Operation and Closure”, approved by SNRCU Ordinance No. 75 dated 19 June 2003.

48 “Procedure for State Oversight of Safety Assurance in Nuclear Energy”, approved by SNRCU Ordinance No. 141 dated 19 November 2003.

49 “Procedure of Information Submission for Planning Inspections of Nuclear Material Balance Areas at NPPs”, approved by SNRCU Ordinance No. 73/305 dated 17 June 2003 and registered in the Ministry of Justice, Reg. No. 552/7873 dated 7 July 2003.

50 “Provisions on Functional Subsystem “Safety of Nuclear Power Facilities”, approved by SNRCU Ordinance No. 9 dated 22 January 2003.

51 “Provisions on Actions of the On-site State Nuclear Safety Inspectorate in Emergency Situations”, approved by SNRCU Ordinance No. 145 dated 1 December 2003.

52 “Requirements on Organisation and Procedure of NPP Commissioning”, approved by SNRCU Ordinance No. 108 dated 21 August 2003 and registered in the Ministry of Justice, Reg. No. 762/8083 dated 3 September 2003.

53 “Instruction on the Procedure for Issuing Permits for Transportation of Radioactive Materials” (NP 306.6.06/2.080-03), approved by SNRCU Ordinance No. 125 dated 24 September 2003 and registered in the Ministry of Justice, Reg. No. 916/8237 9 October 2003.

54 “Recommendations on the Structure and Content of the Safety Analysis Report on Spent Nuclear Fuel Storage Facilities” (RD 306.8.02/2.067-03), approved by SNRCU Ordinance No. 33 dated 20 February 2003.

55 “Formats of Documents on Managerial Infringements in Nuclear and Radiation Safety”, approved by SNRCU Ordinance No. 89 dated 19 May 2004 and registered in the Ministry of Justice, Reg. No. 686/9285 dated 2 June 2004.

56 Joint Ordinance of the SNRCU and the Ministry for Emergencies and Public Protection against Consequences of Chornobyl Catastrophe of Ukraine “On Approval of Plan of Response to Radiation Accidents” No. 87/211 dated 17 May 2004, registered in the Ministry of Justice, Reg. No. 720/9319 dated 10 June 2004.

57 “Conditions and Procedure for Issuing Individual Written Permits for Activities or Operations at Stages of Commissioning, Operation and Decommissioning of a

Nuclear Installation", approved by SNRCU Ordinance No. 331/8930 dated 17 March 2004 and registered in the Ministry of Justice, Reg. No. 331/8930 dated 17 March 2004.

58 "Plan of Response to Radiation Accidents", approved by Joint Ordinance of the SNRCU and Ministry for Emergencies No. 87/211 dated 17 May 2004 and registered in the Ministry of Justice, Reg. No. 720/9319 dated 10 June 2004.

59 "Requirements on On-site and Off-site Crisis Centres", approved by SNRCU Ordinance No. 2 dated 16 January 2004 and registered in the Ministry of Justice, Reg. No. 136/8735 dated January 2004.

Structure of Tariff for Electricity Produced by NAEK "Energoatom"

Indicator	Unit	Tariff structure for 2004	
Planned production of electricity	mln. kW.h	77519,0	
Costs for production	**mln. UAH**	**3871,9**	
Production services	- '' -	529,3	
including: removal of spent fuel	- '' -	235.7	
utilization of spent fuel	- '' -	32,9	
extension of operational life	- '' -	15.5	
repair	- '' -	168,5	
operational support	- '' -	42.5	
NPP operational safety	- '' -	25.4	
Raw and auxiliary materials	- '' -	326.7	
including: NPP safety upgrading	- '' -	40,9	
Fuel	- '' -	1597,9	
Compensation for rise in fuel price	- '' -	157.0	*
Outside energy	- '' -	8.6	
Costs for labour remuneration	- '' -	426,6	
Social charges	- '' -	161.7	
Depreciation charges	- '' -	534,2	
including: NPP safety upgrading	- '' -	534.2	
Other costs	- '' -	129.9	
including: insurance charges	- '' -	31,9	**
Administrative expenses	**- '' -**	**136.5**	
Other operational expenses	**- '' -**	**145,2**	
including: social development	- '' -	107.1	
development of production	- '' -	22.4	
other costs	- '' -	15,7	
Percentage for bank loan	**- '' -**	**123,8**	
including: percentage for bonds	- '' -	59,4	
Total	**- '' -**	**4277,4**	
Financial result from operational activity	- '' -	1368.3	
Financial result from common activity	- '' -	1244.5	
Profit tax	- '' -	278.3	
Net profit	**- '' -**	**1014.0**	
including capital investments	- '' -	198,0	
including: 30-km area	- '' -	98,0	***
safety upgrading, reconstruction, modernization	- '' -	105,1	
costs for fuel purchase for K2/R4	- '' -	292.7	****
dividends for 2004	- '' -	142,1	
payment of loans	- '' -	93.0	*****
costs on bonds	- '' -	63.2	
nuclear fuel cycle fund	- '' -	120.0	
costs for K2/R4 completion	- '' -	0.0	
Commodity output	**mln. UAH**	**5569,9**	
Reserves	- '' -	**208.6**	
Commodity output incorporating reserves	- '' -	**5361,3**	
Tariff	**kop./kW.h**	**6.91**	
Profitability	**%**	**30,2**	

* valid till 31 December 2004. Costs in the amount of 92 mln. UAH will be directed to funding the fuel purchase for K2/R4 from 1 June to 31 December 2004 (because of completing the compensation for the difference in fuel prices for 2003)
** as well as 21.6 mln. UAH is funded from unspent money envisaged for insurance in the 2003 tariff
*** valid till 15 April 2005.
**** as well as 92 mln. UAH is funded from costs released because of completing the compensation for the difference in fuel prices for 2003 since June 2004 and 2 mln. UAH from costs additionally received from sold electricity not included in the 2003 tariff
***** valid till 31 December 2004. As well as 93 mln. UAH is funded from costs additionally received from sold electricity not included in the 2003 tariff

Dynamics in Number of Licensed NPP Experts for 1999 - 2004

Dynamics in Number of Licensed NPP Experts for 1999 - 2004							
Entity	1999	2000	2001	2002	2003	2004	2004 (plan)
SE ZNPP	144	159	132	162	153	158	160
SE KhNPP	28	28	31	30	24	31	41
SE RNPP	41	41	34	55	66	75	81
SE SUNPP	42	43	37	52	72	79	80
SSE ChNPP	*51*	*39*	*34*				
Total	306	310	268	299	315	343	362

Data on NPP Personnel Training in 2003

Training type	NAEK			Including 2003				
	2002	2003		ZNPP	RNPP	KhNPP	SUNPP	Management staff
	actual	plan	actual	actual	actual	actual	actual	actual
Initial training	3118	2639	4051	1292	970	334	649	806
Qualification maintenance	16393	16239	19141	7960	2110	3123	5795	153
Qualification improvement	4674	4632	4995	868	2968	539	432	188
Total (man*course)	24183	23510	28187	10120	6048	3996	6876	1147

APPROVED
Ordinance of SNRCU Board
No. _____ of 24 June 2004

CONCLUSION
STATE REVIEW
ON NUCLEAR AND RADIATION SAFETY

Khmelnitsky-2 Safety Substantiation Materials

The state review on nuclear and radiation safety of the materials substantiating the safety in commissioning power unit 2 of the Khmelnitsky nuclear power plant (KhNPP-2) has been carried out in accordance with Article 40 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety" with involvement of the State Enterprise "State Scientific and Technical Centre for Nuclear Radiation Safety" (SSTC NRS) and French-German Company Riskaudit, which upon request of the State Nuclear Regulatory Committee of Ukraine reviewed and assessed the Preliminary Safety Analysis Report on KhNPP-2, Programme for Quality Assurance in Commissioning Stage, Pre-commissioning Programmes, basic Operational Documentation and Emergency Procedures submitted by NAEK "Energoatom" together with an application for a licence for the operating organisation for the "commissioning" stage of the nuclear installation life cycle.

According to Article 4 of the Law of Ukraine "On Authorising Activity in Nuclear Energy", the review objective is to:

- carry out a comprehensive assessment of all safety-related factors;
- assess the level of KhNPP-2 safety in terms of compliance with internationally accepted requirements;
- assess quality assurance programmes, pre-commissioning programmes and operational documentation in terms of compliance with legislation, standards, rules and regulations on nuclear and radiation safety.

Conclusions on individual areas are based on expert evaluations provided in the SSTC NRS Report on Review of the "Safety Analysis Report. Khmelnitsky NPP, Unit 2" (Registration No. 2004-SAR-3262/1-2KhNPP) and in SSTC NRS Reports on Reviews of NAEK “Energoatom” documents submitted in the licensing package (Registration No. 04-09-3174, 04-09-3150, 04-09-3184, 04-09-3194, 04-09-3204).

1. ASSESSMENT OF THE OPERATING ORGANISATION’S CAPABILITY TO ENSURE COMPLIANCE WITH LEGISLATION, STANDARDS, RULES, AND REGULATIONS ON NUCLEAR AND RADIATION SAFETY

The State Enterprise NAEK “Energoatom” was created in compliance with Resolution of the Ukrainian Cabinet of Ministers "On Creation of the National Atomic Energy Generating Company Energoatom", No. 1268 dated 17 October 1996 according to the Law of Ukraine "On Nuclear Energy Use and Radiation Safety".

NAEK “Energoatom” includes Directorates of NAEK “Energoatom” and NPPs that exercise their rights as separate entities.

NAEK “Energoatom” is subordinated to the state management body for nuclear and radiation safety – Ministry for Fuel and Energy of Ukraine.

NAEK “Energoatom” was appointed the "operating organisation – operator of nuclear installations of the Zaporizhzhya, Rivne, Khmelnitsky, South Ukraine Nuclear Power Plants" by Resolution of the Ukrainian Cabinet of Ministers No. 830 of 8 June 1998.

The objective of the operating organisation’s activity is determined on the basis of society requirements on the protection of individuals, the public and the environment against potential radiation hazards associated with nuclear installations. This objective consists in achieving and unconditional assurance of the level of nuclear and radiation safety as required by the Laws of Ukraine and current rules, standards and regulations on nuclear and radiation safety (NRS).

The main tasks of the operating organisation are to maintain the design level of NPP safety, continuously upgrade the NPP safety level based on the requirements of standards, rules, and regulations on NRS, advanced international practice and operational experience.

Obtaining permits (licences) for individual activities is one of the main functions of the operating organisation in compliance with legislation. Based on obtained permits (licences), the operating organisation carried out siting, design, construction, commissioning, operation, decommissioning and preservation of nuclear installations.

The submitted documents describe in sufficient detail the administrative structure of the operating organisation, personnel training system, including licensing personnel, quality assurance system of pre-commissioning, development and maintenance of operating documentation.

NAEK “Energoatom” also provided documents confirming the financial capability to perform functions imposed by current legislation on the operating organisation, in particular, to ensure a proper level of nuclear and radiation safety at NPPs during operation. At the same time, the operating organisation has not created a fund for decommissioning nuclear installations as required by Article 33 of the Law of Ukraine "On Nuclear Energy Use and Radiation Safety”.

Based on the above and taking into account the favourable experience of NAEK “Energoatom” in operation of nuclear power plants, it can be concluded that NAEK “Energoatom” meets the requirements for the operating organisation and can ensure compliance with the requirements of standards, rules and regulations on nuclear and radiation safety in KhNPP-2 commissioning.

NAEK “Energoatom” must settle the issue of a nuclear installation decommissioning fund during KhNPP-2 commissioning period.

2 INFORMATION ON KHMELNITSKY NPP

The Khmelnitsky NP site is located in the northwest region of Ukraine, to the north of the Khmelnitsky region, in the western part of the Slavuta district.

The NPP site is located at a distance of 15 km from the Slavuta district centre in the southeast direction; 100 km from the Khmelnitsky regional centre in the south direction; 44 km from the nearest regional centre Rivne in the northwest direction; 265 km from the state capital Kiev in the eastern direction.

There are two power units on the KhNPP site. Construction of power unit 1 was started in November 1981. Construction of power unit 2 was started in February 1985. Power acceleration of KhNPP-1 took place on 22 December 1987. KhNPP-1 is currently operated in basic mode. In June 2004, power unit 2 was in the stage of commissioning.

3 GENERAL CHARACTERISTIC OF KHNPP-2

Khmelnitsky-2 is based on the unified design of WWER-1000 (V-320) NPPs, which was developed in 1978 (Zaporizhzhya-1).

The reactor facility includes the following main systems:

- reactor coolant circuit (RCC);
- primary pressure maintenance system;
- primary overpressure protection system;
- passive part of the emergency core cooling system (system of accumulators).

The RCC includes:

- vessel-type pressurized water nuclear power reactor WWER-1000;
- four circulation loop, each loop includes:
  - steam generator PGV-1000M;
  - reactor coolant pump GTsN-195M;
  - reactor coolant piping with Dnom 850 mm, connecting equipment of the loops with the reactor.

KhNPP-2 completion is carried out in compliance with the terms of Licence No. 13/2-B-KhNPP-2-04-2000, which authorises the activity “Construction of Nuclear Installations". This licence was issued by the Ministry for Environment and Natural Resources of Ukraine on 26

April 2000.

The licence determines:

- the scope of activities to be carried out during completion;
- conditions and a list of documents to be met and developed to prepare for commissioning of the power unit.

The KhNPP-2 construction licence contains a requirement to implement the "Programme for Upgrading WWER-1000 (V-320) Units of Ukrainian NPPs. Khmelnitsky NPP, Power Unit 2". The procedure of its implementation is determined in the Decision "On Implementation of Measures on Khmelnitsky-2 Safety Improvement and Upgrading", which was approved by President of NAEK “Energoatom” and agreed upon by Chairman of SNRCU on 22 April 2003.

Resulting from the implementation of the upgrading programme, KhNPP-2 substantially differs from the unified design of WWER-1000 (V-320). The main advantages are as follows:

- reactor loading with new nuclear fuel modification (FA-A), which have no drawbacks peculiar to the previous designs. (This nuclear fuel modification is being tested at ZNPP-3);
- up-to-date process control system at the power unit (PCS);
- up-to-date system of radiological monitoring of the power unit and the 30-km observation area.

In making a list of measures to be implemented prior to KhNPP-2 start-up, the operating organisation’s subsequent activity (after power unit start-up) related to safety and reliability improvement on a permanent basis is identified as mandatory condition.

4 EXPERT CONCLUSIONS ON INDIVIDUAL AREAS

4.1 Pre-commissioning Programmes

In compliance with Licence No. 13/2-B-KhNPP-2-04-2000 authorising the “Construction of Nuclear Installations”, pre-commissioning activities and tests of equipment and systems must be carried out in the following scope:

- functional testing and component-wise testing of equipment and systems;
- containment testing for strength and leak-tightness;
- hydraulic testing, washing and trial run;
- inspection of the main equipment of the nuclear steam supply system (NSSS).

The main tasks, success criteria and work procedure for each stage are set forth in pre-commissioning programmes.

The pre-commissioning programmes have been developed on the basis of NP 306.5.02/3.076-2003 "Requirements on the Organisation and Procedure of NPP Commissioning", taking into account practical experience in Zaporizhzhya-6 commissioning as well. The scope of the presented programmes is sufficient and covers all pre-commissioning stages; the quality of the programmes is satisfactory. This permits a conclusion that they are acceptable for ensuring the safety in KhNPP-2 commissioning.

The operating organisation must ensure that the implementation of these programmes is supervised and that appropriate reports on testing are submitted to the SNRCU according to the established procedure.

4.2 Operational Documentation

The technical specifications on safe operation of KhNPP-2 have been reviewed by experts. According to the requirements of NP 306.1.02/1.034-2000, this is a document that establishes limits and conditions of safe operation of the power unit, contains rules and basic methods of power unit safe operation, describes a general order of operations related to power unit safety, and determines dependencies between reactor operating modes and state of systems/equipment.

The requirements set forth in the technical specifications are intended to keep the safety level incorporated in the design and ensure, depending on the operating mode, the availability of equipment needed to keep the power unit within limits of normal operation or to successfully implement emergency operating instructions (procedures) as required by NP 306.1.02/1.034-2000.

The document has been developed on the basis of operational experience of existing nuclear power units of Ukraine and has a number of essential drawbacks peculiar to technical specifications on safe operation of power units in service. For example, a list of parameters (limits of safe operation, requirements on the number and availability of systems and equipment) that characterise individual states of the reactor is not always complete and sufficient to identically determine the requirements on the reactor facility.

During the commissioning period (till the first scheduled outage), the technical specifications must be revised and completed to eliminate the drawbacks revealed, incorporate results of pre-commissioning work and comply with the safety analysis report.

4.3 Emergency Procedures

The accident and emergency operating instruction for the reactor, guideline on beyond design-basis accident management and plan of response to accidents and emergencies were reviewed by experts within this area.

Pursuant to the requirements of NP 306.1.02/1.034-2000, the emergency operating instruction has been developed as a document containing rules and actions of personnel to manage the NPP in mitigating accidents and emergencies. The rules and actions are based on indicators of events that occurred, modes and states of the power unit, prediction of conditions expected during the process of accident transients.

Like the technical specifications, the emergency operating instruction (EOI) is based on operating experience of the existing units of Ukrainian NPPs and also has a number of essential drawbacks. For example, some emergency modes in the emergency operating instruction are mistakenly attributed to design-basis accidents in contradiction with the single-failure principle determined in NP 306.1.02/1.034-2000, namely: failure of two trains of the emergency core cooling system (ECCS) in primary leaks, "sticking" of more than one control rod in initiating events that require reactor shutdown.

Moreover, EOI does not completely meet the results of the design-basis accident analysis provided in the PSAR regarding the description and prediction of emergency processes.

The guideline on beyond design-basis accident management determines actions of plant personnel under conditions of beyond design-basis accidents, which are intended to change the scenarios of a beyond design-basis accident with the purpose of terminating its development and preventing severe damage or melting of the core. The incompliance of the general concept of this document with up-to-date requirements is an essential drawback of this guideline. Taking into account that the guideline deals with beyond design-basis accidents that can be accompanied by numerous failures of systems and components, one cannot always predict the development of an accident and personnel actions to manage such accidents; therefore, the guideline on beyond design-basis accidents must be symptom-oriented. Based on the analysis of beyond design-basis accidents, the operating organisation must develop and implement additional means for the management of beyond design-basis accidents.

During the commissioning period, emergency procedures must be revised and completed to eliminate the revealed drawbacks in terms of their compliance with the safety analysis report.

4.4 Preliminary Safety Analysis Report

4.4.1 The preliminary SAR is an important part in the package of documents required to obtain a commissioning licence. The PSAR contains information required to understand and justify design basis of the power unit, safety criteria and principles incorporated in the design, operational issues and quality assurance.

The KhNPP-2 PSAR has been developed on the basis of regulation KND 306.302-96 "Requirements on the Content of the Safety Analysis Report on WWER NPPs at the Stage of Issuing Permission for Commissioning" and "Safety Analysis Report. Structure and Content of the Safety Analysis Report on KhNPP-2 and RNPP-4. 43-923.202.020.TP00", approved by letter of the SNRCU No. 15-348 of 12 April 2001.

PSAR materials contain results of a comprehensive safety assessment of KhNPP-2, in particular, regarding the following aspects:

- general description of the nuclear power plant;
- characteristic of the NPP area and site;
- design substantiation of buildings, structures, systems and components;
- reactor description;
- description of the reactor coolant circuit;
- description of safety systems:
- description of process control systems;
- description of power supply systems;
- description of power unit auxiliary systems;
- description of the steam turbine facility;
- management of radioactive waste;
- protection from radiation;
- description of operation;
- pre-commissioning programme;
- analysis of design-basis accidents (ADBA);
- description of limits and conditions of safe operation;

- quality assurance programmes;
- decommissioning programmes;
- probabilistic safety analysis (PSA);
- description of fire safety systems.

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

- analysis of NPP systems and site covering the determination, purpose and design basis of systems, description of structure and flow charts, information on control, monitoring and testing of systems, normal performance of systems and their performance under failures. Based on the information, the system design was assessed for compliance with safety requirements, principles and criteria;
- analysis of design-basis accidents including a list of initiating events, input data on computer models, description of accident development ways and results of initiating event analysis. The provided information is analysed to determine the possibility to ensure compliance with safety limits established by current NRS regulations of Ukraine 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, success criteria, modelling of failure trees, analysis of accident sequences, personnel reliability and results of quantitative assessment and their interpretation. The analysis resulted in the assessment of the total reactor core damage frequency constituting 4.21 10^{-5}, which is lower than the value of this safety target as established by NP 306.5.02/3.076-2003 for operating power units and those under construction (10^{-4}).

The KhNPP-2 SAR is preliminary and does not cover the following aspects:

- the level-1 probabilistic safety analysis was carried out for internal initiating events relative to the core. The analysis does not consider other radiation sources and accident sequences that cause releases beyond regulated values. Moreover, the probabilistic safety analysis did not completely incorporate all potential effects (flooding; steaming; piping whipping etc.);
- the application scope of the results of the design-basis accident analysis of initiating event categories related to reactor cooldown and shut down power unit, radioactive waste and spent fuel management is limited;
- the PSAR does not contain results of the beyond design-basis accident analysis.

4.4.2 Pursuant to the requirements of NP-306.1.02/1.034-200, the analysis of NPP site conditions, established design characteristics of process systems, interaction of systems, description of operational issues, quality assurance programme, fire safety analysis determine the general safety level and compliance of the design with the requirements of current NRS standards, rules and regulations of Ukraine. Compliance of the KhNPP-2 design with the requirements of current NRS standards, rules and regulations of Ukraine is also confirmed by findings of state reviews in other areas, namely:

- Conclusion of the review conducted by the State Fire Safety Department of the Ministry for Emergencies of Ukraine;
- Conclusion of the state ecological review;
- Conclusion of the state health and epidemiological review;
- Conclusion of the review conducted by the State Occupational Safety Supervisory Body of Ukraine.

4.4.3 The PSAR information on the design description is quite complete and systemised and covers all aspects related to KhNPP-2 safety. At the same time, the PSAR contains a number of drawbacks. Below are the main of them:

- according to the decision of the operating organisation, the KhNPP-2 core is to be loaded with alternative fuel assemblies (FA-A). The existing PSAR revision does not contain exhaustive material which would justify the safe operation of the KhNPP-2 reactor loaded with FA-A starting from the first fuel loading. During PSAR review, the operating organisation provided additional materials containing sufficient justification of the safe operation of the KhNPP-2 reactor loaded with FA-A. Appropriate corrections must be made to the PSAR materials during commissioning;
- the justification of the KhNPP-2 reactor pressure vessel service life (40 years) is based on design calculations performed in 1983-1984 and cannot be considered adequate. Since after 1983-1984 new approaches, methodologies and high-efficient software were developed for assessing the strength and lifetime of the reactor pressure vessel, they must be reassessed with the use of proven methodologies and certified software tools meeting the contemporary level of development of science, engineering and technologies. Based on operating experience, the operating organisation must implement a new system for reactor pressure vessel monitoring and to implement a branch programme for reactor pressure vessel inspection;
- findings of the review conducted by the State Fire Safety Department of the Ministry for Emergencies contain a number of comments related to fire safety in process control rooms, in rooms and evacuation corridors of the reactor compartment and comments related to the issues of timely fire detection by automated systems at Khmelnitsky-2. The operating organisation must develop and agree with the state fire supervisory bodies compensatory administrative and technical measures to eliminate the drawbacks till the initial criticality stage;
- the inspection conducted by the State Occupational Safety Supervisory Body division in Khmelnitsky region resulted in a number of comments and revealed numerous drawbacks. The operating organisation must take measures to eliminate the drawbacks till the initial criticality stage.

4.4.4 Confirmation that safety criteria area ensure by the design determines the possibility to restrict radiation impact on personnel, the public and the environment within established limits under normal operation, violation of normal operation, emergencies, design-basis accidents and possibility to mitigate accident consequences. The calculational values of the annual

doses to the public on the boundary of the access control area as provided in the PSAR do not exceed the permissible contribution to the dose limit. The information on radiation impact provided in the PSAR is sufficiently complete and systematised but there are the following drawbacks:

- the scope of the information on restriction of radiological impacts under normal operation, design-basis and beyond design-basis accidents is not sufficiently complete in terms of compliance with accepted international practice. In addition to the requirements of national regulations, the collective dose of the public and personnel, parameters of radiation conditions in permanently-attended rooms and on NPP site (for power unit emergency modes) must be calculated and provided in the PSAR.

NAEK "Energoatom" must develop a regulation to determine methodological criteria of NPP personnel radiation protection optimisation taking into account collective doses.

4.4.5 The PSAR materials describe the sources of generation and accumulation of radioactive waste, operating conditions of ventilation systems and gas treatment systems, airborne release radiation monitoring systems, solid and liquid radioactive waste management systems. The information on radwaste management provided in the PSAR is sufficiently complete and systemised but there are the following drawbacks:

- the PSAR does not contain information on the creation of systems for long-term storage of spent nuclear fuel (selection of the optimal variant of spent fuel long-term storage for Ukrainian NPPs). This issue must be immediately solved in the near future at the level of the operating organisation.

4.4.6 The following tasks were performed in the KhNPP-2 analysis of design-basis accidents:

- a list of initiating events that were analysed was made;
- acceptance criteria were established, compliance with which must be shown through an analysis of each of the selected initiating events;
- a list of representative initiating events that required a quantitative analysis was made;
- databases were developed on the nuclear steam supply system (NSSS) and containment, their information was used in computer modelling of reactor systems and equipment for the quantitative analysis of initiating events;
- a detailed description is provided of computer models used for analysing processes in the NSSS and containment of KhNPP-2;
- qualitative and quantitative analyses of initiating events were carried out, calculational data were obtained and further used to confirm compliance with acceptance criteria after occurrence of initiating events.

The general approaches used for the analysis of design-basis accidents consist in analysing the development of transients following initiating events with the purpose of verifying the compliance with acceptance criteria regarding:

- cooling conditions (maintenance of integrity) of fuel elements;

- maintenance of reactor primary circuit integrity (in the events when the primary circuit integrity is not directly affected by an initiating event);
- maintenance of power unit containment integrity;
- release of radioactive products beyond the containment boundaries and public doses resulting from the release of these products to the environment.

The analysis of design-basis accidents used a programme for quality assurance in the organisation and conduct of activities – this ensured proper documentation of the results of the design-basis accident analysis.

Based on the expert evaluation, a general conclusion can be made that the KhNPP-2 design-basis accident analysis confirms the compliance with designed safety limits following most of the analysed events taking into account the single-failure principle and conservatism in the selection of initial and boundary conditions. Based on the expert evaluation, the need has been determined to complete the design-basis accident analysis with additional data and appropriate analyses. The discrepancy between calculational results of fuel cladding temperatures for Zaporizhzhya "pilot" unit 2 and KhNPP-2 were an individual issue identified in the expert evaluation. Especially substantial discrepancies were revealed in calculating the consequences of the maximum design-basis accident (two-sided rupture of the reactor coolant circuit – Dnom= 850 mm). This value was substantially higher for the "pilot" power unit. The Developer was proposed to explain these discrepancies. Based on the expert evaluation of additional materials and repeated calculations provided by the developer, the following was determined:

- in "initial" calculations the developer did not take into account the conservative assumption on the work of one of the ECCS trains in "leak", i.e. during calculation the performance of two ECCS trains for core cooling was taken into account. This resulted in more "optimistic" results as compared to the design-basis accident analysis for the "pilot" unit, where this assumption was made in the analysis;
- at the same time, in the calculational analysis o "large" primary leaks within the Zaporizhzhya-5 design-basis accident analysis, a number of additional assumptions were made (for example: greater transport delay in the ECCS actuation; incorporation of the maximum temperature value in ECCS tanks (TQ13,23,33B01; TQ10B01) - 90 °C; etc.) These assumptions were modelled in the design-basis accident analysis for the "pilot" power unit upon request of a technical consultant to the design, SCIENTECH Inc., for the determination of the maximally conservative conditions of the calculation;
- automated supply of emergency feedwater from safety system upon an appropriate emergency signal pumps was introduced at KhNPP-2. At Zaporizhzhya-5, certain actions of operating personnel area required for this, which are not modelled in the design-basis accident analysis. The automated feedwater supply conditions the decrease of the second peak of the fuel cladding temperature in the calculation of the KhNPP-2 maximum design-basis accident.

All the above factors resulted in differences in the design-basis accident analyses for the "pilot" power units and KhNPP-2. Based on the expert evaluation, it should be noted that the repeated analysis of "large" leaks for KhNPP-2 was carried out in compliance with regulatory requirements on establishing initial and boundary conditions and incorporation of single failure.

4.4.7 The following tasks were performed in the level-1 probabilistic safety analysis (PSA) for internal initiating events relative to the reactor core of KhNPP-2 unit at rated power:

- initial data on equipment reliability were collected and processed, reliability parameters required for calculations were determined;
- data on abnormal events and occurrences were collected and processed, events were identified and grouped, their frequencies were calculated;
- databases on systems were developed;
- success criteria were analysed;
- system analysis was carried out;
- accident sequences were analysed;
- personnel reliability was analysed;
- quantitative assessments of core damage frequency (CDF) were obtained, contributors of individual initiating events (groups of initiating events) and contributors of dominant accident sequences were determined;
- significance, uncertainty and sensitivity of results were analysed;
- main results of the probabilistic safety analysis were interpreted and priority areas in KhNPP-2 safety improvement were identified;
- safety upgrading measures for KhNPP-2 and additions to the list of beyond design-basis accidents were determined with the use of the probabilistic approach based on the PSA results.

The approaches and methods applied in the probabilistic safety analysis consist in quantitative assessments of the total reactor core damage frequency and its components depending on the frequency of internal initiating events relative to the reactor core taking into account system, functional and phenomenological dependencies and impact of personnel actions.

The approaches and methods applied in the probabilistic safety analysis comply with national requirements excluding approaches to collection and processing of component reliability data, frequencies of initiating events and personnel reliability assessment. As compared to the scope of the probabilistic safety analysis for "pilot" units of Ukrainian NPPs, in the PSA for KhNPP-2 a list of safety upgrading measures was additionally made and the impact of these measures on the reactor core damage frequency was determined; based on the PSA results, a list of additional emergency measures was also made, which should be considered in the final determination of a list of beyond design-basis accidents for KhNPP-2. Therefore, it can be stated as a preliminary conclusion that the probabilistic safety analysis has confirmed compliance of KhNPP-2 safety level with requirements on nuclear and radiation safety and international experience. However, for the final acceptance of such a conclusion, the results of the probabilistic safety analysis must be revised to incorporate comments of this review.

4.4.8 Based on results of the analysis and taking into account the above-said, it can be considered that the scope of the safety substantiation presented in the PSAR is sufficient for KhNPP-2 commissioning.

PSAR materials must be revised and completed during commissioning to incorporate comments of the state review on NRS, incorporate results of pre-commissioning work and actual characteristics of the power units that will be obtained during pre-commissioning tests, and

the final revision of the safety analysis report must be submitted for approval in compliance with the established procedure. A plan of measures intended to incorporate comments of the review report must be developed and agreed with the SNRCU prior to the initial criticality stage.

Over the two years, the following analyses within continuation of the in-depth safety assessment must be carried out and associated results must be presented:

- deterministic analyses of initiating events and probabilistic safety analysis for operation under cooldown and at shut down power unit;
- probabilistic safety analysis as regards fuel management;
- reassessment of the total reactor core damage frequency taking into account internal (fire, flooding, etc.) and external (earthquake, tornado etc.) initiating events;
- assessment of radiation releases for different classes of design-basis and beyond design-basis accidents and maximum release frequency;
- analysis of beyond design-basis accidents as regards the determination of conditions, means and personnel actions to prevent severe core damage;
- assessment of safety upgrading measures (including decrease of core melting frequency).

GENERAL CONCLUSIONS

1) The operating organisation demonstrated its capability in the submitted documents to ensure compliance with the requirements of legislation, standards, rules and regulations on nuclear and radiation safety.

2) The scope of KhNPP-2 safety substantiation documents covers all safety aspects. Analysis of these documents demonstrated their acceptability.

3) The quantitative safety indicator – the total reactor core damage frequency – constitutes $4.21\ 10^{-5}$; this complies with international recommendations and operational experience of similar power units in other countries and is below the value of this safety target as established by NP 306.5.02/3.076-2003 for operating power units and those under construction (10^{-4}).

4) At the same time, there is a number of drawbacks to be eliminated during commissioning or in accordance with individual schedules agreed upon by SNRCU, namely:

- complete implementing the measures of the safety upgrading programme as planned for the period after power unit start-up;
- develop missing parts of the in-depth safety assessment;
- revise operational documentation and emergency procedures;
- implement a reliable system for reactor pressure vessel monitoring;
- revise PSAR materials in terms of incorporating comments of the sate NRS review and results of pre-commissioning work;
- develop a regulation to determine methodological criteria for NPP personnel radiation protection optimisation taking into account collective doses;
- develop and agree with the state fire supervisory bodies compensatory administrative and technical measures on fire safety, deadline – prior to initial criticality stage;

- implement measures to eliminate drawbacks determined by inspection of the State Occupational Safety Supervisory Body division in Khmelnitsky region, deadline – prior to initial criticality;
- create a decommissioning fund;
- create systems for long-term storage of spent nuclear fuel.

Deputy Chairman	_____	V. Redko
SNRCU	"____"_____2004	
Head of Department	_____	O. Semenov
Nuclear Installation Safety Regulation	"____"_____2004	
Director of SSTC NRS	_____	V. Vasilchenko
	"____"_____2004	
Review Leader		O. Zeleny
Head of Department	_____	
NPP Operational Safety		

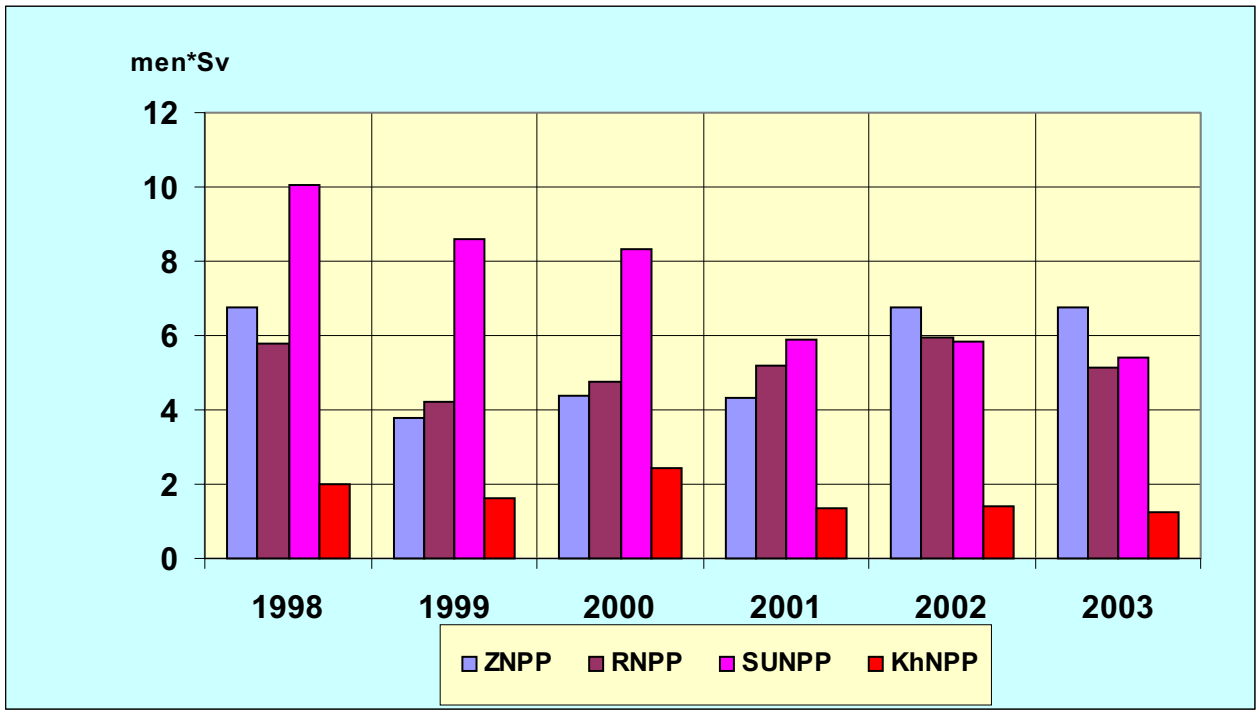

Figure 1. Collective Dose of WWER NPP Personnel (including personnel on assignment) for 1998 – 2003.

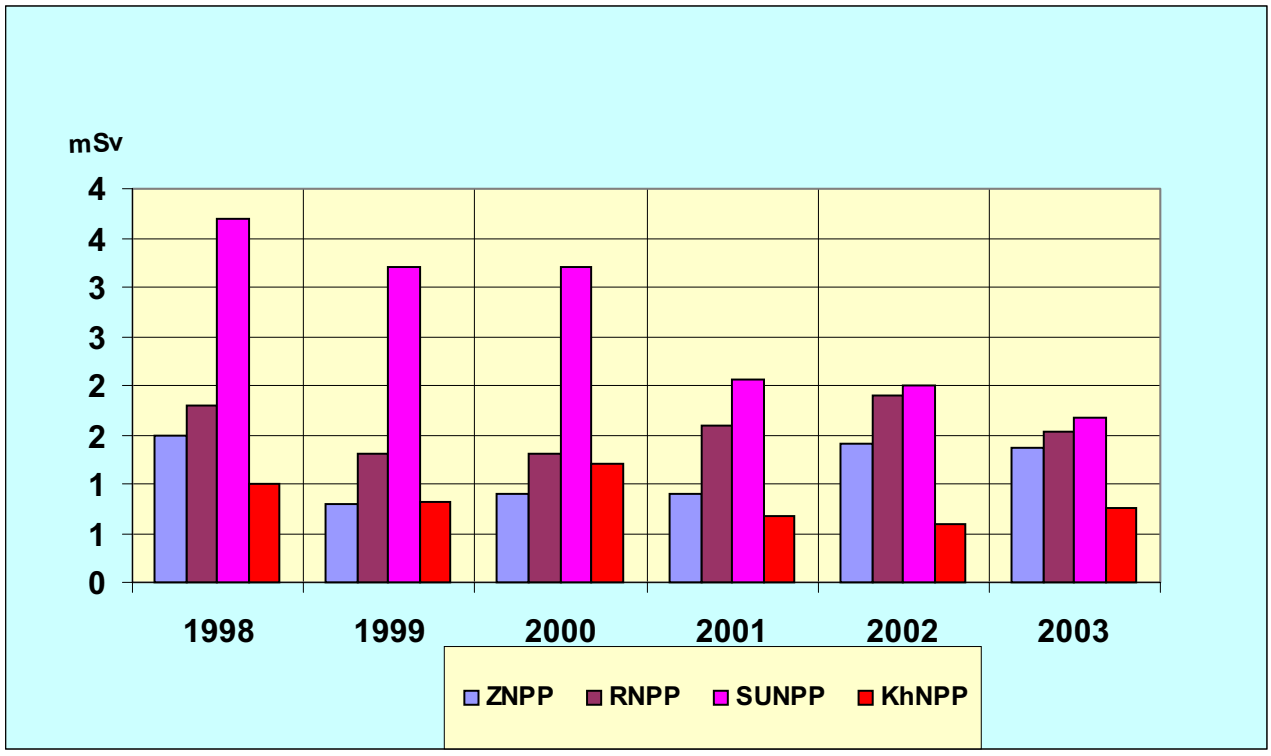

Figure 2. Average Individual Dose of WWER NPP Personnel for 1998-2003.

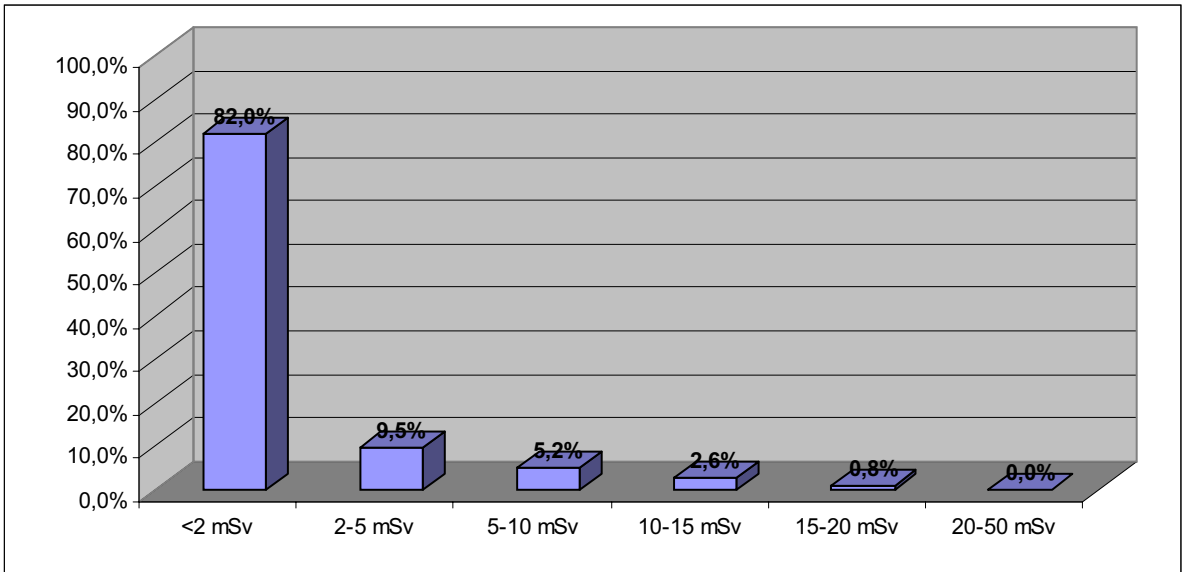

Figure 3. Percentage Distribution of NAEK "Energoatom" NPP Personnel by Average Individual Doses for 2003

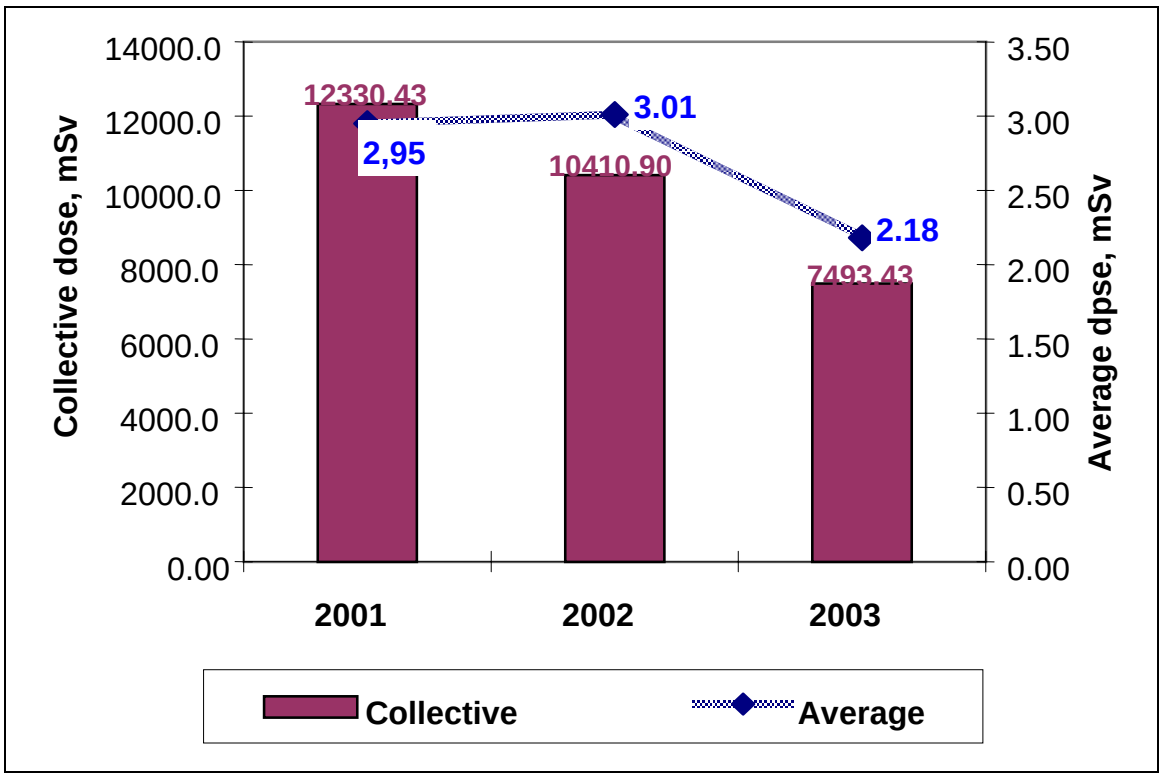

Figure 4. Individual and Collective Doses of SSE ChNPP Personnel

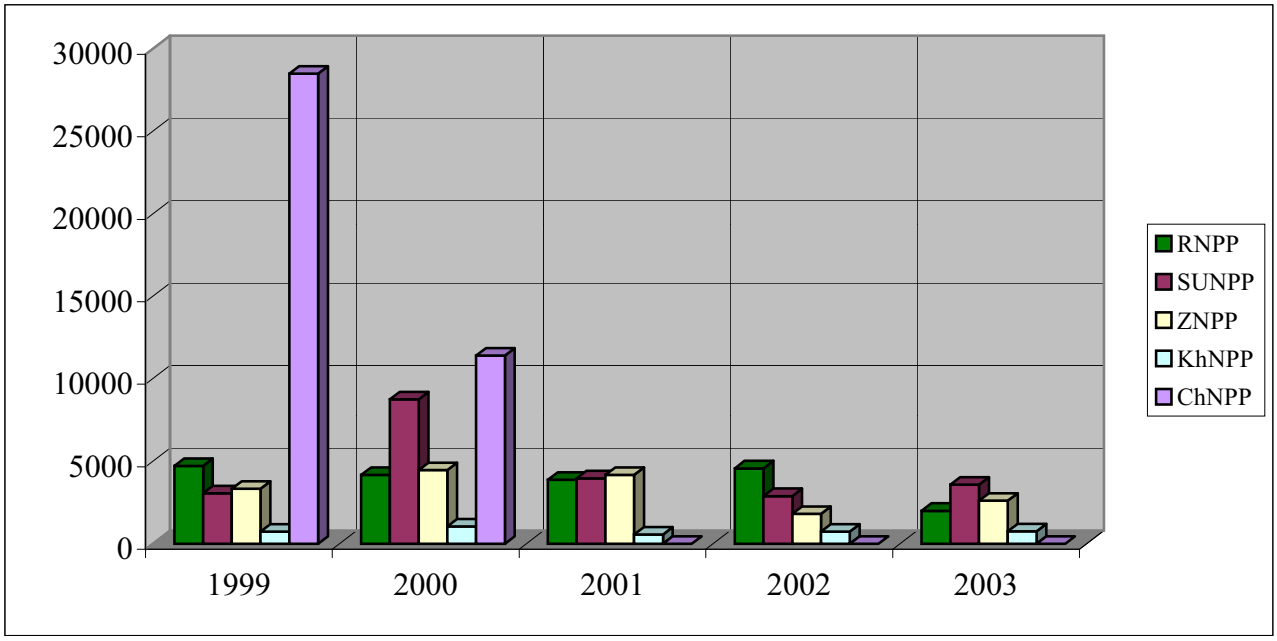

Figure 5. Iodine Releases from Ukrainian NPPs, kBq/day

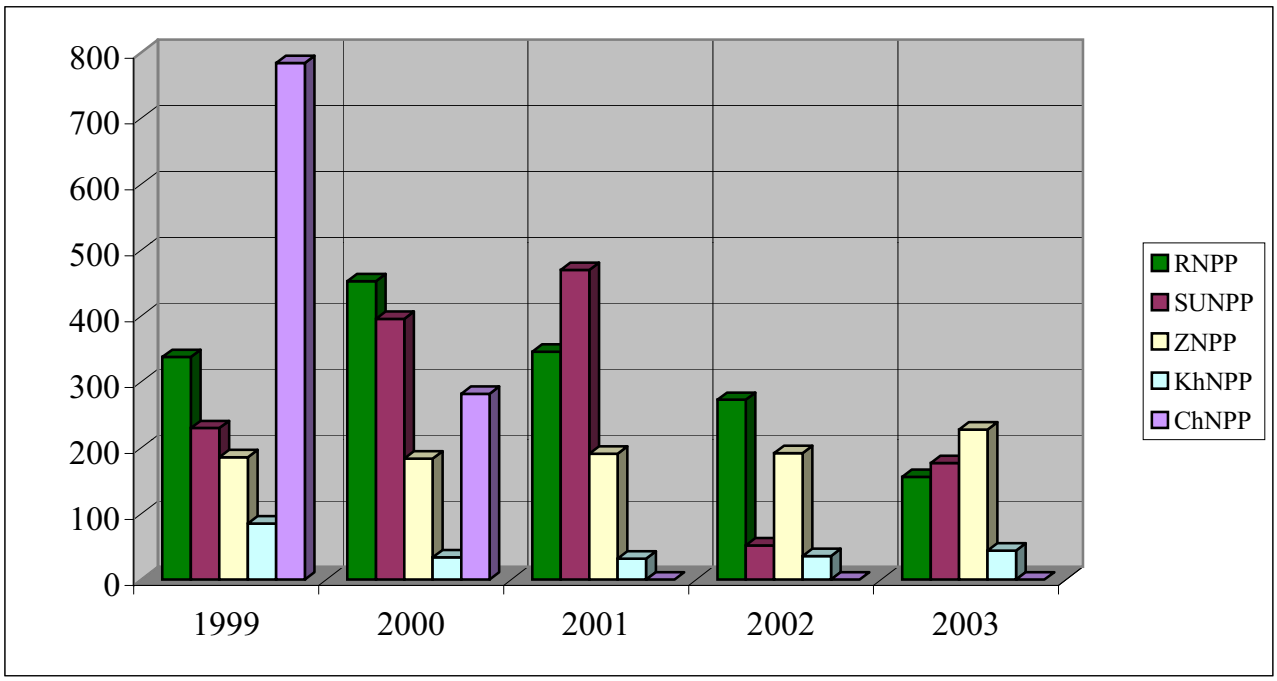

Figure 6. Releases of Inert Gases from Ukrainian NPPs, GBq/day

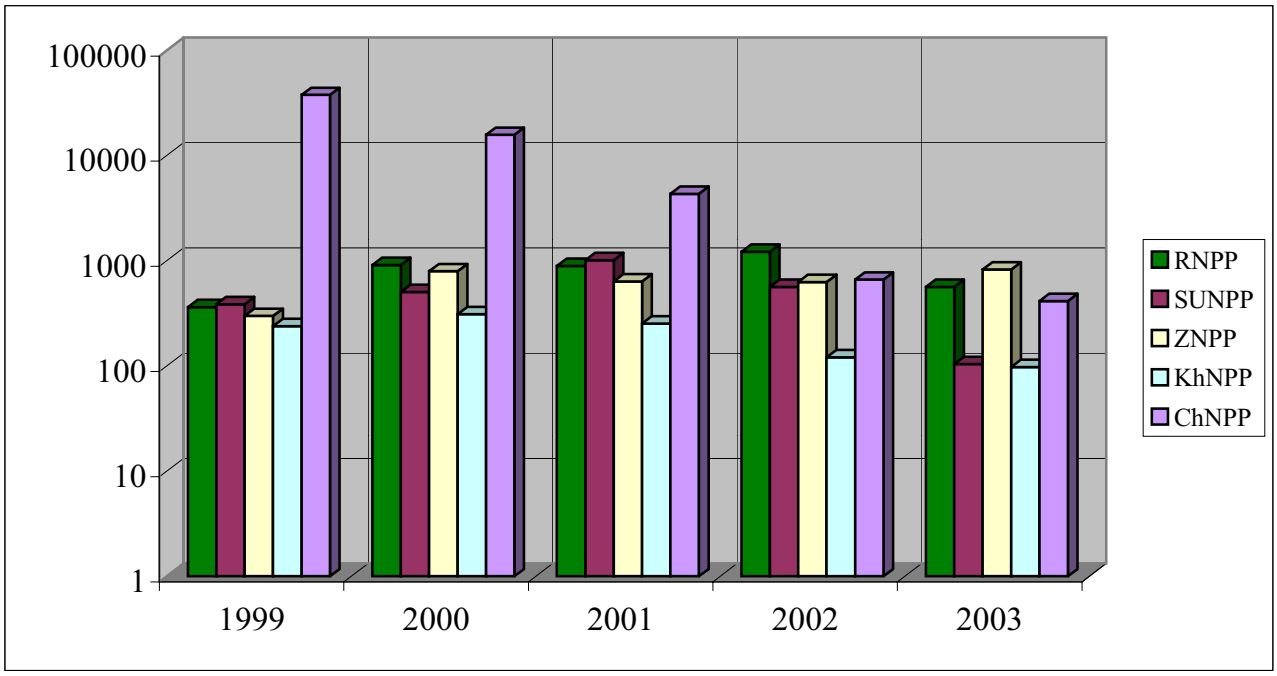

Figure 7. Releases of Long-lived Radionuclides from Ukrainian NPPs, kBq/day

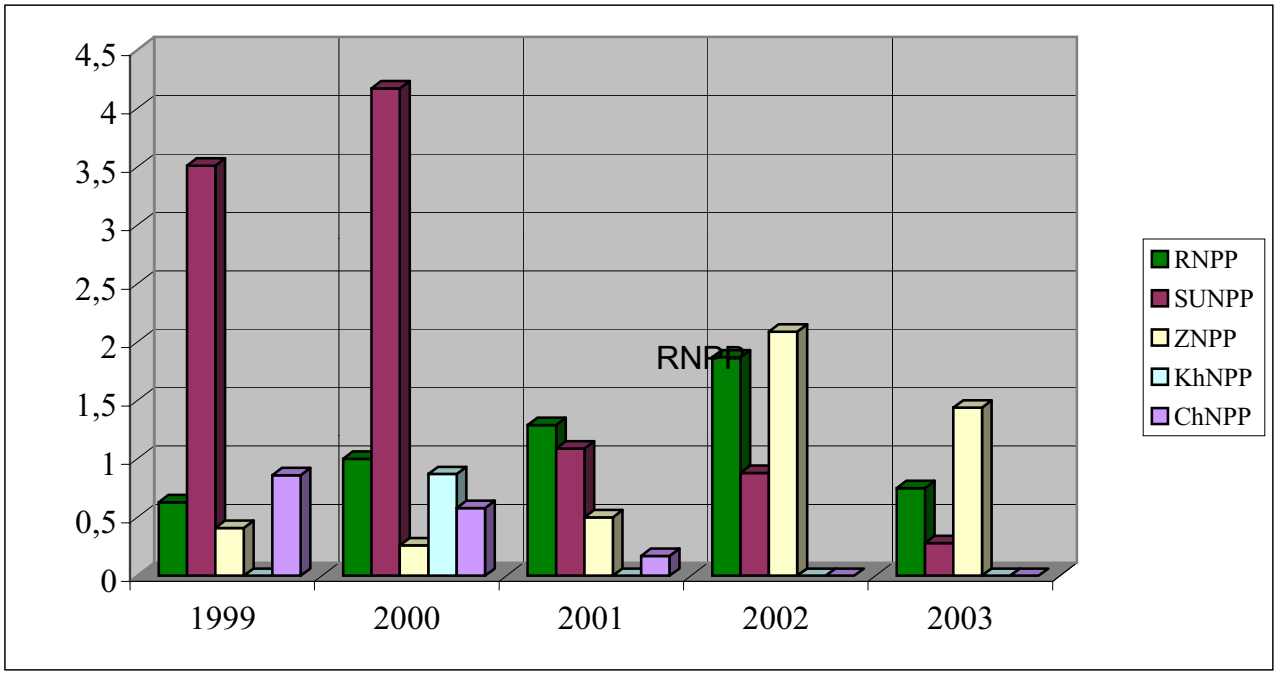

Figure 8. Percentage Ratio of Individuals Whose Annual Effective Dose Exceeds 15 mSv for Ukrainian NPPs

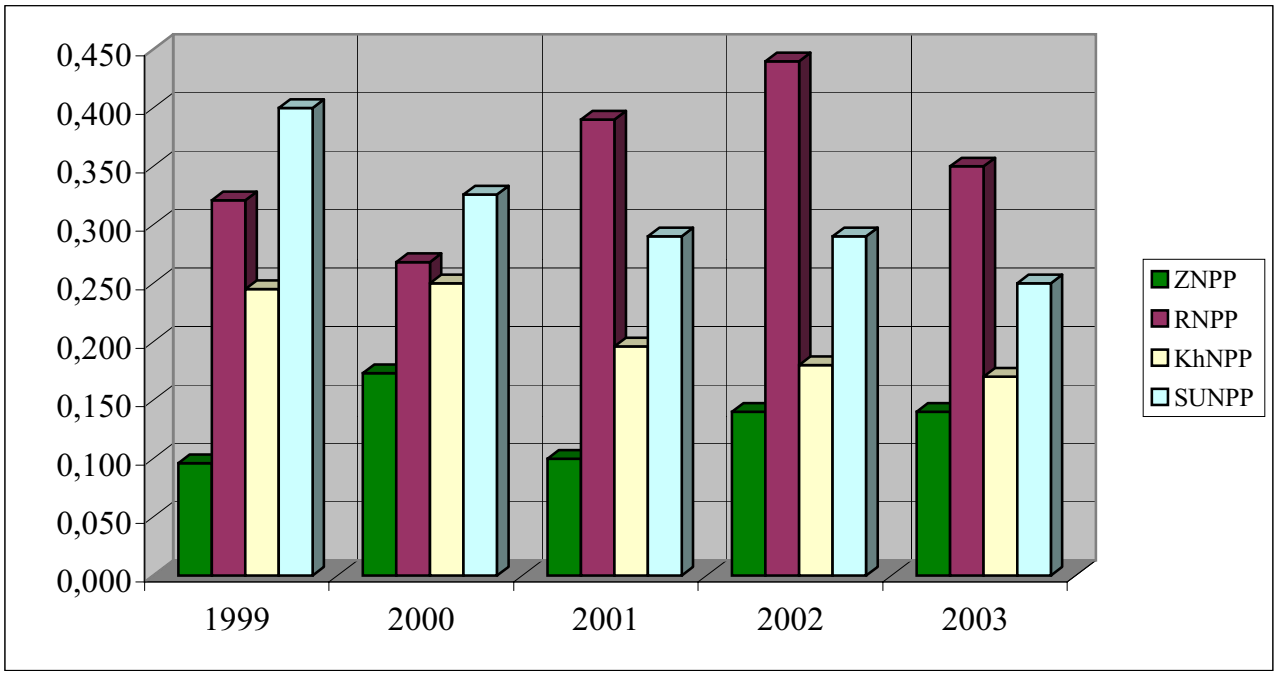

Figure 9. Ratio of Collective Dose to Produced Electricity for Ukrainian NPPs, man*cSv/MW*y

Scheme of Implementing New Decisions into Practice