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Report of Ukraine

ON COMPLIANCE WITH THE CONVENTION ON NUCLEAR SAFETY OBLIGATIONS (INF CIRC/449)

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FOREWORD

This report is the second document prepared by the Ukrainian authorities concerning the fulfilment of requirement imposed by provisions of the Convention on Nuclear Safety (Hereafter referred to as Convention).

This report is based on the Convention on Nuclear Safety (CNS/PREP/Final Document 2, 1997-04-05) that was ratified by the Verkhovna Rada (Ukrainian Parliament) on December 17, 1997.

Structure and contents of this Report meet both recommendations provided by the First Review Meeting of Contracting Parties (CNS/PREP/Final Document 2, 1997-04-05), as well as «Guidelines for National Reports Submission in Compliance with the Convention on Nuclear Safety» (IAEA, Information Circular, INFCIRC/572/Rev.1, October 21, 1999). Structure of this report is focused on eliminating remarks to the first Report of Ukraine in the part of insufficient detailing, and avoiding duplication of materials that have been provided in the first Report. The objective of this report is to highlight any changes and amendments both in legal and regulatory framework and in the nuclear power sector of Ukraine that occurred for the last three years.

The Report is also based on effective Ukrainian norms and laws as well as on official reports by the central executive authorities performing monitoring and regulation of the safe nuclear energy utilisation.

Actual data given in the Report aside from specifically stipulated, have been provided as of September 30, 2001.

Hereinafter the respective articles of the Convention on Nuclear Safety are given in italics.

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INTRODUCTION

Nuclear power forms the essential part of the Ukraine's fuel and energy complex.

For the last decade the nuclear power plants of Ukraine (NPPs) have maintained electric power production at the level of about 74-79 billion kWh while the electricity generation by fossil power plants dropped more than twice. This was caused, firstly, by the decrease in electricity consumption by the industries, and, secondly, by the lack of necessary domestic fossil fuel and technological wear of the fossil power plants' equipment. According to the statistics, in 2000 NPPs generated 45.3% of electric power, fossil power plants – 48%, and hydroelectric power plants produced 6.7%. At that, the overall design capacity of nuclear power units in operation is 11835 MW.

To identify the basic principles and priorities of the Ukrainian state policy in the energy field and to support efficient functioning of the Ukraine's fuel-energy sectors the President of Ukraine issued the Order No. 42/2001 dated February 27, 2001 on «Development of Energy Strategy of Ukraine for the Period till 2030 and Future Prospects».

This Strategy will include a Program for development of electric power, coal, nuclear, oil and gas branches of Ukraine. While developing the Strategy the following aspects shall be taken into account:

- global energy processes;
- current status of the state power supply and its energy self-reliance;
- environmental issues of power industry functioning and development.

Today in Ukraine there are 13 nuclear power units, which are used to produce the electric power. These power units are equipped with WWER type reactors located at 4 NPP sites. The nuclear power units and their main features are given in Annex 1.

The Cabinet of Ministers by its Decree of June 8, 1998 #830 appointed the National Nuclear Energy Generating Company «Energoatom» (NNEGC Energoatom) an Operating Body (Utility) responsible for all nuclear power plants in operation in Ukraine. Pursuant to the Resolution of the Cabinet of Ministers #399 dated May 25, 2001 a State Specialised Enterprise Chornobyl NPP was established on the basis of the Separate Entity Chornobyl NPP of NNEGC Energoatom by withdrawing it from the structure of the Company. The main tasks of this new enterprise are the decommissioning of Units 1-3 of Chornobyl NPP, transformation of Shelter facility into the ecologically safe system, etc.

To settle the spent nuclear fuel and radioactive waste management problems the Cabinet of Ministers adopted Decree #542 dated April 5, 1999, according to which a new «Comprehensive

Program on Radwaste Management» was established, and following the Order No. 7 issued by the Minister of Fuel and Energy on January 13, 2000 the «Comprehensive Program on Creation of Nuclear Fuel Cycle of Ukraine. Management of NPP Spent Nuclear Fuel» was established.

In accordance with the adopted decisions and with the financial assistance of Nuclear Safety Account (jointly established by «G-7», European Commission and some other countries) a storage facility of spent nuclear fuel is being constructed on Chornobyl site. The design of the storage facility allows for safe storage of 25000 spent fuel assemblies and 3000 spent additional absorbers in a dry-type storage facility. After commissioning a new storage, the existing one will be decommissioned.

Activities on the first stage of spent nuclear fuel storage were completed at ZNPP based on the method of «dry» storage in the reinforced concrete casks. The Nuclear Regulatory Committee completed assessment of the Storage Safety Analysis Report and granted the license to the Operating Body-Utility.

Pursuant to the Memorandum of Understanding between Governments of «G-7» countries, the European Commission and the Government of Ukraine on Closure of Chornobyl NPP, dated December 20, 1995, and following the commitments undertaken by Ukraine under the Convention of Nuclear Safety, the Cabinet of Ministers of Ukraine approved Resolution No. 598 dated March 29, 2000 on «Early Closure of Nuclear Power Unit # 3 Operation and Final Closure of Chornobyl NPP». As a result, the operation of Chernobyl Unit 3 was stopped on December 15, 2000. The Resolution by the Cabinet of Minister dated November 29, 2000 #1747 on «Final Shut-down of Chornobyl NPP» approved both the «Comprehensive Program on Closure of Chornobyl Unit 3 Operation» and «Comprehensive Program on Chornobyl NPP Decommissioning».

Unit 1 of Chornobyl NPP was completely shut-down in November 1996. In accordance with the «Program on Termination of Chornobyl Unit 1 Operation» the nuclear fuel is being removed from the reactor core.

Power unit 2 of Chornobyl NPP was shutdown in October 1991. Fuel assemblies were unloaded from the reactor and process equipment was preserved. At that time, the work specified by the «Program on Termination of ChNPP Unit 2 Operation» is on-going.

Chornobyl NPP developed the «Comprehensive Program on Chornobyl NPP Decommissioning», which was approved by the Resolution #1747 of the Cabinet of Ministers of Ukraine dated November 29, 2000. The Comprehensive Program covers two decommissioning stages: termination of operation and mothballing (preservation); further stages are given just conceptually. In accordance with the Comprehensive Program the annual scope of financing provided from the State Budget for the first five years, is foreseen at the level of Hr 500 M.

Based on the «Comprehensive Program on Chornobyl NPP Decommissioning», the Programs on shutdown of Chornobyl Units 1, 2 and 3 operation for the next stage, the State Nuclear Regulatory Committee of Ukraine and Chornobyl NPP started preparing a license for ChNPP decommissioning.

The very special place among the nuclear installations of Ukraine belongs to Chornobyl power unit # 4 («Shelter» Object), destroyed during the severe accident in April 1986. The undertaken emergency operating measures allowed to ensure the current safety of this facility. This was confirmed in a specific report on «Shelter» safety analysis and the prospective estimates of situation development (September 1996), on the basis of which the nuclear regulatory body issued a license for Chornobyl NPP «Shelter» operation to the operating body.

Transformation of the «Shelter» object into the ecologically safe system requires significant financial and material resources, utilisation of non-standard innovative science and engineering solutions. Therefore, in the Ukrainian Law «On Ratification of Convention on Nuclear Safety» Verkhovna Rada (the Parliament) of Ukraine warns of the following:

1. Verkhovna Rada of Ukraine adopted a critical decision to ratify the Convention on Nuclear Safety, thus supporting its adherence to the principles of nuclear safety culture and their practical implementation, and in view of that the international community and the IAEA member- countries recognise uniqueness of «Shelter» object located on the territory of Ukraine that is conditioned by the global consequences of Chornobyl disaster.

At present, there are no technologies for transforming the «Shelter» object into the ecologically safe system and the complex of necessary measures have not been yet identified to achieve high level of «Shelter» nuclear safety that meets the Convention's requirements.

In view of that, Ukraine is unable within the short term to settle on its own this large-scale problem and relies on the IAEA's support as well as that of the international organisations and individual states in resolving scientific and technological problems of the «Shelter» safety. This also will contribute to achievement of the goals of the Nuclear Safety Convention.

2. The provisions of Article 3 of Convention shall not be applied to the «Shelter» object.

Pursuant to the above mentioned Ukrainian Laws this Report does not consider individual problems that are related to the «Shelter» object safety.

At the same time it should be mentioned that the Shelter Implementation Plan aimed at guaranteed «Shelter» safety assurance was developed by experts of Ukraine and «G-7» countries and approved by respective governments. This Shelter Implementation Plan while implemented has to result in and intended for:

- reduction of the risk of building structure collapse;
- minimisation of consequences of potential accident-induced breakdown;
- improvement of the nuclear safety;
- enhancement of the personnel working conditions;
- improvement of the ecological safety;
- development of the strategy for transforming the «Shelter» object into ecologically safe system, including the strategy for fuel-containing material removal.

In accordance with the MoU the developed specific measures aimed at implementing the Action Plan include the parties' commitments on its financing. The above plan covers all aspects of the «Shelter» object safety.

To date the first phase of the project implementation has been completed: possible stabilisation measures were identified, the data required for design initiation stage were obtained and integrated.

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

Safety problems that were identified in the previous report of Ukraine or appeared after submission of the previous report are as follows:

- necessity of more explicit functions and responsibilities distribution among the state regulatory bodies and strengthening of the nuclear regulatory body's independence (see Section III, it.3.2);

- provision of appropriate financial resources for improving the safety of Ukrainian NPPs (see Section IV, it. 4.2.1);

- continuation of work on safety assessment and implementation of safety improvements (see Section II, it.2.2);

- special attention to be paid to implementing the improved safety culture at all levels of nuclear power complex of Ukraine and in other industries interacting with the nuclear power sector (see Section IV, para.4.1);

- more explicit definition of functions and tasks of crisis centres of different ministries and departments, improvement of their activities' co-ordination (see Section IV, para. 4.6).

SECTION II. GENERAL PROVISIONS

2.1. Existing nuclear installation (Article 6 of the Convention)

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

Unit 3 of Chornobyl NPP, the last unit under operation, was finally shut-down on December 15, 2000, and Chornobyl NPP was transferred to the stage of decommissioning.

After closure of Chornobyl NPP in Ukraine the nuclear power plants with only WWER type reactors have continued operating. The number of WWER type reactors, which are under operation worldwide, is 51, and their total service life exceeds 500 reactor-years. For more than 30 years of operation these reactors proved their safety and reliability in operation.

Based on the design features the Ukrainian nuclear power units can be split into the tree following groups (Annex 1):

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

For each power unit of Ukraine the preliminary safety analysis reports (safety substantiation) have been developed at the designing stage. Such a report forms the basis for getting license for power units operation.

Safety substantiation includes the analysis of potential safety-important systems (components) failures. It also selects the failures affecting the safe operation of the reactor installation. The safety substantiations also include the list of initiating events and analysis of normal operation violations as well as the design accident analysis. The safety substantiation stipulates the fulfilment of standards and codes being effective at the safety substantiation development date.

Safety substantiation justifies and supports operating limits and conditions, safe operation limits and conditions as well as design limits stipulated for design accident.

Safety substantiation also includes the expert assessment of influence on the unit operational safety of deviations from the requirements of norms and standards on nuclear and radiation safety that became effective after the completion of construction and commissioning of power units. At that, special attention was paid to the aspects considering how these obvious deviations may affect the defence in-depth, specifically, safety substantiation analyses:

- deviation impact on prevention of initiating events of the normal operating and emergency conditions violations; mitigation of consequences; and ensuring of the steady-state post-accident condition;
- impact of deviations on barriers system preventing the spreading of the ionising radiation and radioactive materials to the environment.

For the last three years NNEGC Energoatom has achieved significant successes in re-assessing the safety of NPP under operation with using and applying new technologies and tools for evaluation and calculations.

The strategy of the safety re-assessment of NPPs under operation is focused on combining the periodical assessment at the end of certain period of operation with the in-depth safety assessment using the modern analysis techniques, such as probabilistic safety analysis, beyond -design basis accident analysis, including some transients without scram. At the first stage the safety analysis is conducted for the reference Unit 1 at Rivne, Unit 1 at SUNPP and Unit 5 at ZNPP that covers all WWER design reactors under operation in Ukraine. In accordance with the Regulation «Requirements for content of the safety analysis report for NPPs with WWER type reactors under operation in Ukraine» at this stage the safety analysis is limited to the development of:

- extended (supplemented) safety substantiation;
- additional materials on safety analysis;
- design accident analysis;
- probabilistic safety analysis, level 1, internal (on-site events).

At the second stage the level 1 probabilistic safety analysis would be additionally developed (external events and low power level) along with the level 2 probabilistic safety analysis (beyond-design basis accident) and the safety analysis report for all units based on the pilot project implementation.

The implementation of Stage 1 of the assessment will allow to identify the safety level of all type design NPPs under operation that allows the State Nuclear Regulatory Committee to take a decision on NPP operation license issuance for each site operation based on the safety level as well as to set up priorities for further NPP safety improvement.

The additional materials on safety analysis developed for the pilot units, namely: South-Ukraine

Unit 1 and Zaporizhzhya Unit 5 as well as additional materials on safety analysis for Rivne Unit 1 will be completed by the end of 2001.

Preparation of additional materials on safety analysis for other units (Units 1, 2, 3, 4, 6 of ZNPP; Unit 1 of KhNPP; Units 2 and 3 of SUNPP; Units 2 and 3 of Rivne NPP) will be completed in 2001 - 2002.

The PSAs were implemented for pilot units, namely: Unit 1 of RNPP, Unit 1 of SUNPP, Unit 5 of ZNPP. The PSA for Units 1, 2, 3, 4 and 6 of ZNPP, Units 2 and 3 of Rivne NPP, Units 2 and 3 of SUNPP, Unit 1 of KhNPP will be completed in 2002. Materials of developed PSA for Unit 5 of ZNPP, Unit 1 of Rivne NPP, Unit 1 of SUNPP, Unit 1 of KhNPP have to be subjected to the procedure of independent peer review and State Expertise on nuclear and radiation safety.

DBA analysis materials were developed for pilot units: Rivne -1 and SU-1. DBA analysis for Unit 5 of ZNPP will be completed in the first half of 2002.

At present, the materials on the beyond design basis accident analysis are under preparation and planned to be completed in 2002 – 2003.

Measures related to the development of safety analysis report are being implemented in accordance with «Summary time-schedule of development of the safety analysis report section for power units with of WWER-440/B-213, WWER-1000 «small series» and WWER-1000/B-320 reactor installations». This schedule was agreed upon with the nuclear regulatory body. The list of actions on the NPP safety improvement and their implementation status are given in Annex 2.

In 2000 based on comprehensive analysis of current safety problems related to the deviations from requirements of effective national norms, standards, rules on safety and from achieved world level of safety and operation regulation, the NNEGC Energoatom developed the «Comprehensive program on priority measures on upgrading and safety improvements of nuclear power units of Ukraine NPPs». This program is planned to be implemented in the 3 years period. The document was agreed upon with Regulatory Body and submitted for approval by he Cabinet of Ministers of Ukraine.

The «Program…» includes:

- Category 3 measures (in accordance with IAEA' s classification);
- individual, the most essential category 2 measures (in accordance with IAEA' s classification);
- measures related to the analysis and substantiation of the safety, which form an integral part of safety analysis report;

- individual measures aimed at avoiding deviations from the effective normative documents or measures that have serious impact on the operation reliability.

The measures included to the Program, are split into the 3 parts:

- measures for units with WWER -1000 reactor type installations;
- additional measures for power units with WWER -1000/B-302, B-338 (small series) reactor type installation,
- measures for power units with WWER-440/B-213 reactor type installation.

After developing the safety analysis report it is planned to update and adjust the program, specifically, the nomenclature and measures priority. These measures are postulated in the following documents:

«Problems of NPP safety with WWER-1000/320 type reactors and their categories» IAEA-EBR-WWER-05;

«Problems of NPP safety with WWER-440/213 type reactors and their categories» IAEA-EBR-WWER-03;

«Problems of safety and their prioritisation for NPPs with WWER-1000 (small series) reactors».

This works is conducted with taking into account the contribution of measures to the safety enhancement with considering financial costs for their implementation.

Implementation of priority tasks along with activity on support of current safety level ensures acceptable level of NPPs safety in Ukraine.

Based on the results obtained while analysing the NPP safety, the following general conclusions can be made:

1. Neither national nor international safety analysis projects have revealed any safety deficiencies requiring to shut down any operating unit.
2. Design safety concept of Ukrainian NPPs equipped with WWER type reactors meet requirements of the international approaches.
3. Implementation of developed program on operating power unit upgrading and improvements of operating practices would allow to increase their safety level. This supports the confidence that Ukrainian power units under operation are able to work successfully during their service life (30 years). That allows establishing the tasks on measures development aimed at extension of the WWER power units' service-life.

Thus Ukraine confirms the fulfilment of its commitments under Article 6 of the Convention.

SECTION III. LEGISLATION AND REGULATION

3.1. Legislative and regulatory framework (Article 7 of the Convention)

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 regulation.

Legislative and regulatory framework of Ukraine covers all the aspects of the requirements of Article 7 of the Convention on Nuclear Safety. (Annex 3).

The following laws of Ukraine were adopted since the last Review meeting:

«On Amendments to Law of Ukraine «On Civil Defence of Ukraine»(March 24,1999);

«On Permissive Activities in the Nuclear Energy Field»(January 11, 2000);

«On the Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation « (19 October, 2000);

«On Ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management « (April 20, 2000);

«On the Protection of Population and Territories against Man-Induced and Natural Emergencies» (June 8, 2000);

«On the Hazardous Facilities « (January 18, 2001).

The process of establishing and improvement of the system of norms, regulations and standards in order to assess safety and appropriate level of physical protection of nuclear installations, as well as to improve accounting, control and transportation of nuclear materials, has been on-going during the reporting period.

The norms and codes of nuclear and radiation safety were revised and developed on the basis of the best international approaches, results of scientific researches and feedback with the gained experience taking into account future prospects of the nuclear industry development and aiming at:

- bringing the effective norms and regulations in compliance with the national legislation;
- systematisation of existing and planned normative and legal acts based on the subject and hierarchical principle;
- bridging the gaps in the normative regulation.

From 1998 to 2001 16 Regulations have been drafted and put into force (see Annex 3).

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

A permissive principle of nuclear installation operation is one of the fundamentals of the Law of Ukraine «On Nuclear Energy Utilisation and Radiation Safety». Unless licensed by the nuclear safety regulatory authority, any activity related to operation of nuclear installation is prohibited.

The Law of Ukraine «On Permissive Activities in the Nuclear Energy Field» sets the legal and organisational principles of the permissive activity in the field of nuclear energy utilisation, and main provisions of regulating social relations which appear in the course of this activity.

The Law defines the permissive activity as a main part of the state regulation in the field of nuclear energy utilisation and provides for:

- licensing of individual activities in the field of nuclear energy utilisation;
- licensing of the operating body's activity in the specific stage of the nuclear installation lifetime and issuance to this body of the licenses for performance of specific works or operations on the stages of commissioning, operation and decommissioning;
- licensing of activities related to direct operation of the nuclear power plant reactor by the personnel;
- mandatory certification of the safety important elements of the nuclear installations, as well as of transport packaging for transfer of nuclear materials.

The Law establishes that receipt of the license by the operating body is a ground for commencement of activity, execution of works and operations relating to this stage of the lifetime of a reactor installation, including all existing on-site facilities.

Licensing process of the nuclear installation related activity begins long before the nuclear material's appearance on-site, and includes comprehensive assessment of all potential factors, which can have effect on the status of nuclear and radiation safety.

The Law brings into effect the licensing procedure of operating body activities at life stages of nuclear installation. This licensing procedure defines procedures of license issuance, refusal to issue a license, suspension and revocation of a license.

If the results of inspection and conclusions of the state experts show that the documents proving conformity of the nuclear installation safety, financial, material, other resources, organisational structure and personnel of the applicant with the statutory requirements are missing or insufficient, the issuance of the license may be turned down.

Starting from the commissioning stage, the requirements for getting individual written permissions

for performance of specific works and operations in the framework of the effective license are established. It is caused by the necessity to check whether the systems and equipment as well as organisational structure are ready for performance of such works and operations. First core loading, commissioning of the unit after the scheduled maintenance, etc. can serve as an example of such works and operations.

Specific types of activity in the field of nuclear energy utilisation are also subject to licensing:

- design of nuclear installation or radioactive waste storage facility or depository;
- uranium ore processing;
- radioactive material transportation;
- treatment, storage and disposal of radioactive waste;
- personnel training for nuclear installation operation.

Following the Law, the Cabinet of Ministers of Ukraine passed Decree # 1683 in November 2000. This Decree approved a list of jobs and specialities of nuclear installation operating personnel whose training is subject to licensing. Also, it establishes a list of jobs of the personnel directly operating reactor installation, which may act on the license basis only.

In compliance with the European approaches, refusal to license suppliers' goods and services in the field of nuclear power is accompanied by introduction of certification for specific types of equipment. The Law is based on the de-regulation principle that enables operating body to develop and implement procedures to assess suppliers' services.

3.1.3. A system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licenses.

The Law of Ukraine «On Nuclear Energy Utilisation and Radiation Safety»(Article 25) envisages state supervision over compliance with the nuclear and radiation safety requirements. The Law of Ukraine «On Permissive Activities in the Nuclear Energy Field» (Article 15) emphasises that nuclear safety regulatory body shall exercise control over compliance with the terms of licenses by means of inspections and analysis of nuclear and radiation safety based on the reporting documents submitted by the operating body.

Revision of one of the main regulations – General Provisions on Safety Assurance of Nuclear Power Plants **(ZPBU) -** was finalised. As a result, the document was made compliant with the legislation and recommendations of IAEA in the part of criteria and principles of safety assurance and permissive principle of utilisation of nuclear installations, their safety assessment and obligatory submission of the Safety Analysis Reports for licensing.

Thus, in compliance with Article 3.13 of ZPBU, «system of technical and organisational measures

aimed at nuclear power plants safety assurance is provided in the safety analysis report (for the operating nuclear power plans before the SAR is developed it shall be technical substantiation of NPP safety), which is submitted to the state regulatory bodies of nuclear and radiation safety as a part of documentation for getting the nuclear power plant construction license. Prior the commercial operation start-up the operating body shall submit for review the revised parts of NPP SAR with construction changes in the NPP design as well as results of pre-start-up adjustments, physical and energetic start-up been considered. The operating body shall maintain NPP SAR compliant with the existing conditions during the whole period of NPP lifetime».

3.1.4. The enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

The Law of Ukraine «On Permissive Activities in the Nuclear Energy Field» establishes that the license may be suspended, and on the nuclear installation design or construction stage it can be revoked under the following conditions:

- if the operating body submitted a respective application;
- violation of the terms of the licence;
- suspension of the effect of or actual non-compliance with the documents, which have been submitted in the application package, on which basis it has been concluded that the applicant is capable to act in compliance with the requirements set.

In case of license suspension the responsibility for nuclear installation safety rests with the operating body.

License for operation or decommissioning of the nuclear installation can be revoked only upon full withdrawal of the nuclear materials, or following issuance of the license for this installation to the other operating body.

To make the practice of compulsion and sanctions to the officials effective in case of their violation of the nuclear legislation there were developed «Methodical Guidelines on Bringing the Infringers of the Nuclear Legislation to Administrative Responsibility», which were approved by Order# 55 of the Ministry of Environment Protection and Radiation Safety dated March 17,1999. A draft Law of Ukraine «On Amendments to the Code of Ukraine on Administrative Infringements» was prepared to make the Ukraine's legislation on administrative infringements compliant with the nuclear legislation.

The legislative and regulatory framework existing in Ukraine is sufficient for assuring safety of the nuclear installations. Ukraine follows the provisions of Article 7 of the Convention.

3.2. Regulatory body (Article 8 of the Convention)

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.

Considering the results of the first meeting on review of the parties' compliance with the obligations regarding the Convention on Nuclear Safety and in view of Ukraine's undertakings resulting from ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive waste Management, the President of Ukraine, upon submission of the Cabinet of Ministers of Ukraine, made a decision to establish the State Nuclear Regulatory Committee as a central executive authority with the special status on the basis of the Department of Nuclear Regulation and Main State Inspectorate of the Ministry of Environment Protection and Natural Resources. In compliance with Decree # 1303 of the President of Ukraine «On State Nuclear and Radiation Safety Regulation» dated December 5, 2000, the newly established authority is entrusted with the following functions:

- set criteria, requirements and conditions of safety in nuclear energy utilisation;
- issue permits and licenses for carrying our activities in this field;
- exercise state supervision over compliance with the legislation, norms, regulations and standards on nuclear and radiation safety;
- exercise other functions of national regulatory body of nuclear and radiation safety as defined in the Convention on Nuclear Safety and Joint Convention on the Spent Fuel Management and on the Safety of Radioactive Waste Management.

The tasks, functions and mandates of the regulatory authority are defined in details in the Statute on the State Nuclear Regulatory Committee of Ukraine, which was approved by the Decree #155 of the President of Ukraine dated March 6, 2001 (see Annex 4). In addition to the above said, this Statute entrusts the State Nuclear Regulatory Committee (hereafter – Regulatory body) with the function of the central authority and contact point which is responsible for physical protection of nuclear material in compliance with the Convention on Physical Protection of Nuclear Material, and with the functions of the competent authority and contact point in charge of transmission and receipt of notifications in case of nuclear accident in accordance with the Convention on Early Notification of a Nuclear Accident. It is also responsible for organisation and performance of researches in the field of nuclear and radiation safety assurance, and for co-ordination of activities of the executive authorities as regards their performance of nuclear and radiation safety regulation.

The Statute provides for the mandates required for execution of the regulatory activity, in

particular: the right to access the territory of facilities and to obtain necessary information, mandates to apply financial sanctions and to limit or stop activities involving violations of safety conditions, mandates dealing with the orders to carry out activities required for maintaining the safety level, right to hear the reports of the officials and to pass the materials to law-enforcement authorities.

The President of Ukraine following the submission by the Prime Minister of Ukraine appoints by his decrees the Chairman of the regulatory body and his deputies.

Activity of the regulatory body is financed out of the state budget funds.

The structure of the State Nuclear Regulatory Committee of Ukraine is given in Annex 5. The total number of the employees at the time of the Committee's establishment was increased by 13, and the payment conditions of the engineers were improved by special increment according to the Resolution of the Cabinet of Ministers of Ukraine #313 «Some Issues Concerning the State Nuclear Regulatory Committee» dated April 2, 2001.

A system of technical support organisations for the nuclear safety regulatory body was established in Ukraine. It includes the following organisations:

- State Scientific and Technical Centre of Nuclear and Radiation Safety, an independent scientific and technical and expert organisation which provides support for the regulatory body's activities;
- Affiliates of the State Scientific and Technical Centre of Nuclear and Radiation Safety in Kharkiv, Odesa and Slavutich, which perform the functions of specific scientific and technical support to the regulatory body according to their specialisation. Today, it is planned to expand Slavutich affiliate and to provide jobs for the specialists of Chornobyl NPP dismissed due to the closure of the plant.

In its work the State Nuclear Regulatory Committee of Ukraine is guided by the principles of quality assurance, using a number of documents (procedure, plans, programs), which are the components of the quality assurance system. In order to build a QA formalised system it is planned now to take the measures as follows:

- by the end of 2001 — assess actual condition of the QA system, reveal missing components and areas for improvement;
- over 2002 — develop a document which would set the policy of the regulatory body in the field of quality assurance, selection of the model and development of the plan for implementation of the QA formalised system;
- in 2002 – 2004 — create QA formalised system based on the model selected.

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 utilisation of nuclear energy.

Clear separation between the functions of the regulatory body and those of other body or organisation concerned with the promotion or utilisation of nuclear energy is ensured in Ukraine.

In its activity the regulatory body is independent of any central bodies of the executive authority responsible for the nuclear energy utilisation. This provision is secured by Article 23 of the Law of Ukraine «On Nuclear Energy Utilisation and Radiation Safety».

Thus, Ukraine follows the provisions of Article 8 of the Convention.

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

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 each such licence holder meets its responsibility.

The time after the previous meeting was the period of formation of the operating body (NNEGC Energoatom): a structure of the operating body was finalised; in general, QA system of Energoatom has been established and is being implemented; qualified administrative personnel has been trained.

NNEGC Energoatom as a licence holder bears **full responsibility** for the radiological protection and safety of nuclear installations irrespective of the activity and responsibility of suppliers or state nuclear and radiation safety regulatory bodies.

In line with responsibilities laid by the Ukrainian law on the operating body, NNEGC Energoatom shall:

- assure nuclear and radiation safety;
- develop and take measures on safety improvement of nuclear installations. For instance, based on the previous analysis and assessment of the safety level of nuclear power plants the long-term measures for upgrading and safety improvement of Ukraine's nuclear power plants were developed (this aspect is detailed in Section 2, Article 2.1):
- provide for radiological protection of personnel, public and environment. The new radiation safety norms with stricter requirements were put in effect in 1998. The operating body has developed and is implementing the programme on bringing its activity in conformity with these requirements. The reference levels of external personal exposure, exposure dose limits of the public in the areas of NPP locations were revised and reduced. More stringent reference levels resulting from average actually achieved values for 5 years for each reference parameter were

introduced based the results of calculations of admissible levels of radioactive releases and effluents. (For more details see Section IV, Article 4.5);

– inform in proper time and in full scope of the violations in the nuclear installation operation. Dispatcher's and public relations services have established the system of early notification about violations in NPP operation of the central and local authorities, regulatory and administrative bodies, which, in turn, notify thereof the respective international organisations. The information on violations and changes in operation of NPPs is provided for news agencies and web-site of NNEGC Energoatom on a daily basis. Twice a month Energoatom issues press-releases on economic, financial situation and changes in operation (for more details see Section IV, Article 4.6);

– provide financial coverage of the liability for nuclear damage in the amount and on the conditions defined by the Ukrainian law. Financial coverage of the liability for nuclear damage is provided by means of insurance;

– set requirements for personnel's qualification depending on their responsibility for safe operation of nuclear installation. The training and qualification maintenance system for all staff, and, in first turn, for operating personnel, was established and functions in the company (for more details see Section IV, Article 4.2).

Today, NNEGC Energoatom holds licences by the regulatory body for activities as follows:

– construction of nuclear installations - 2 licences (Unit 4 of Rivne NPP, Unit 2 of Khmelnitsky NPP);

– operation of the «Shelter» Object;

– design of nuclear facility (spent fuel storage facility at Chornobyl NPP).

A system of annual temporary licences for power unit operation (one licence per each unit) issued by the regulatory body is and will be effective until the applicable system of the permissive activity is put in compliance with the Law of Ukraine «On Permissive Activities in the Nuclear Energy Field». This system is put into force by the resolution of the regulatory body until licensing issues are settled at the legislative level.

Thus, Ukraine follows the provisions of Article 9 of the Convention.

SECTION IV. GENERAL SAFETY CONSIDERATIONS

4.1. Priority to safety (Article 10 of the Convention)

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.

Priority to safety in design, construction and operation of nuclear installations is stipulated in the Law of Ukraine ***«On Nuclear Energy Utilisation and Radiation Safety»***. Article 5 of the Law reads that one of the major principles of the state policy in the field of nuclear energy utilisation is «to assure safety in the course of nuclear energy utilisation». Both legislative framework and practical activity are aimed at the achievement of this goal.

The Resolution of the Cabinet of Ministers #1553 «On Urgent Measures to Improve Safety and Reliability of Nuclear Power Operations» dated October 12, 2000 ordained that «to guarantee safety, reliability of nuclear power operations, comply with appropriate international obligations of Ukraine is a priority of the executive authority activity».

The above statement is confirmed by the regulatory body's reports to the Verkhovna Rada (Parliament) of Ukraine, to the President and the Cabinet of Ministers of Ukraine about the safety status in various aspects of nuclear energy utilisation. It is done by means of submission thereto of the annual report «On Nuclear and Radiation Safety Status in Ukraine».

Statements on the main principles of the activity by the regulatory body, NNEGC Energoatom and management of nuclear power plants are based on the principle of safety priority over any other objectives, including economic ones.

Nuclear and radiation safety status is subject to permanent review at the meetings of the Cabinet of Ministers, the Council on National Security and Defence of Ukraine. The President of Ukraine pays special attention to this issue. Nuclear power plant safety issue is reviewed at the board (collegium) meetings of the ministries and at the meetings of the interdepartmental commissions.

The operating body performs on a permanent basis the safety analysis of the power units of NPPs based on the experience of equipment upgrading and systems'operation. The Days of Safety, which agenda includes study of the safety reviews, are held at nuclear power plants monthly.

Approval by the Cabinet of Ministers of Ukraine of the «The Concept of State Scientific and Technical Programme of Priority Areas for Maintaining Safety of Nuclear Energy Facilities of Ukraine by the Year of 2010» and drawing up of the draft «Comprehensive Programme of Priority Measures on Upgrading and Safety Improvement of Nuclear Power Plants of Ukraine» is a practical step in establishment of the priority to safety in design, construction and operation of

nuclear installations. Implementation of measures of the Comprehensive Programme at the enterprises of both nuclear power and other branches of industry contributing to the qualitative manufacturing of equipment, timely delivery, installation, adjustment and commissioning of equipment will promote implementation of the priority tasks of Ukrainian NPP safety improvement.

Implementation of the above principles allows to state that Ukraine meets the norms set in Article 10 of the Convention.

4.2. FINANCIAL AND HUMAN RESOURCES (Article 11 of the Convention)

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.

In line with Article 33 of the Law of Ukraine «On Nuclear Energy Utilisation and radiation Safety» the net cost of the nuclear generated electricity includes, in addition to the production expenditures, the costs of:

- implementation of nuclear installation safety improvement programmes;
- provision of storage of spent nuclear fuel, treatment and disposal of radioactive waste;
- scientific and technical and design and process support for nuclear installation operation;
- staffing, training and re-training;
- insurance of personnel and public in case of nuclear damage;
- decommissioning and suspension of nuclear installations;
- social and economic development of the territories where nuclear installations are located.

Specific features of the transition period, which this country experiences, do not allow to include fully the above listed expenditures while calculating tariffs for the electricity generated (See Annex 6). Today, special attention is given to implementation of the programme of safety improvement of the nuclear installations and maintaining of the present level of safety. More than Hr.600M, which amounts to 18 % of total electricity production costs, was planned for this purpose in the framework of the production programmes implementation.

Now, the energy market of Ukraine remains the major source of funding of the programme of safety improvement of the nuclear installation operation. In summer 2000 there were adopted amendments to the Law of Ukraine «On Power Industry», and the government established requirements on payment for electricity in cash exclusively. NNEGC Energoatom receives in cash

about 44% of the cost of the total amount of electricity supplied to the Wholesale Market.

The issue of defining source of funding of the decommissioning and suspension of the nuclear installations is still unsolved, since financial situation in the industry in 1992-1999 prevented from the funds accumulation. Now the appropriate bills were introduced to solve this issue. The issue of funding out of the state budget on the legislative basis is solved for Chornobyl NPP only. It was done through the Law of Ukraine «On Amendments to Some Laws of Ukraine in View of Closure of Chornobyl Nuclear Power Plant»(April 26, 2001), which was adopted by the Verkhovna Rada of Ukraine. This Law provides for allocation of funds to finance in full the decommissioning work of Units 1,2 and 3 of Chornobyl NPP and Ukrainian contribution to the international projects, at least to the amount of Hr. 325M, as well as funds (at least Hr.50M) for social protection of the personnel of Chornobyl NPP dismissed due to the early decommissioning of Chornobyl NPP.

It is worth mentioning of the positive trends that appeared in 2000-2001. In 2000 the share of cash payments for the electricity supplied to the Wholesale Market increased more than four times. Safety improvement costs grew from Hr.440.00 million in 1999 up to Hr. 503.00 million in 2000. The actual expenditures for the other programs increased either.

4.2.2. Human Resources

Each Contracting Party shall take 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.

Analysis of needs of Ukrainian NPPs in staff proved the necessity of establishing the national system of training and developing the network of educational institutions for training specialists for enterprises and organisations of nuclear power and industry. It also allowed to set the ordered quantity for training of fledgling specialists in the higher educational institutions of the Ministry of Science and Education of Ukraine in the period untill the year of 2005.

The training system functions in co-operation with the organisations, enterprises, state administrative and regulatory bodies, and other systems in order to get advanced training, retraining, upgrading and maintaining of the staff qualification for the purpose of gaining and maintaining knowledge, capabilities and skills required for safe operation of nuclear power plants. The established system shall ensure fulfilment of the following tasks:

- Planning, co-ordination and improvement of the training system;
- Regulation, licensing of and supervision over training;
- Organisation of training and staffing with qualified personnel, provision with material, technical and financial resources, supplying with documentation;
- Personnel training and qualification maintaining.

Based on Articles 7 and 9 of the Law of Ukraine «On Permissive Activities in the Nuclear Energy Field» and Resolution of the Cabinet of Ministers of Ukraine # 1683 of November 8, 2000, a list of jobs of the personnel directly involved in the operation of the reactor installation and subject to licensing was defined.

The regulatory body on nuclear safety exercises licensing of training of NPP personnel in compliance with the normative document «Provisions on Licensing of Training of NPP Personnel of Ukraine». This document sets the list of requirements and procedures for assessment of capability of the participants of licensing action to perform it; regulates control procedures of licensing, as well as procedure for record and storage of licensing process related documentation.

The Requirements for licensee, training units of operating body are set in the normative document «Licensing Requirements for Training Personnel of Ukrainian NPPs».

NNEGC Energoatom has obtained licences for NPP personnel training in respective training centres of Zaporizhzhya, Khmelnitsky, South–Ukraine and Rivne NPPs.

NPP Training Centres development is on-going. At present there are 475 employees in training centres, 168 of them are instructors and teachers. Training is carried out in class-rooms, laboratories, shops and on working places in compliance with the individual training programmes based on the reference programmes. The training employs technical training aids, i.e. base principle simulators, functional and analytical simulators, full-scope simulators, computerised training systems.

Full-scope simulators are put in operation at Zaporizhzhya, Rivne, Khmelnitsky, two of them – at South Ukraine NPP. Functional and analytical simulators are commissioned at Chornobyl, Rivne, Khmelnitsky and South Ukraine NPP. The work on creation of full-scope simulators for WWER 440 is on-going.

Today all Ukrainian NPPs are staffed to full extent with trained and certified personnel (See Annex 7).

At the same time, comparison of the staff coefficients (the number of staff employed per unit of installed capacity of a power plant) at Ukrainian NPPs and foreign ones shows that this coefficient of the Ukrainian nuclear installations is much higher. On one hand, it can be explained by the fact, that, in addition to operators who directly carry out and control processes of electricity generation, production personnel includes personnel of the plant services, which maintain, repair, adjust and test equipment and process systems (Annex 7). On the other hand, this fact proves that some significant reserves are available for improvement of NPP organisational structure. Certain activities are carried out in this area at the moment, though traditional approaches and lack of jobs

in NPP satellite towns are evident.

This information allows to state that Ukraine meets the provisions of Article 11 of the Convention.

4.3. Human Factors (Article 12 of the Convention)

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.

To prevent or avoid the impact of the human factor as a NPP performance failure cause due to the lack of correspondence of psycho-physical condition and qualification of the personnel with applicable requirements, the operating body shall use an operating experience feedback system in the course of personnel training at the NPP training centres.

The assessment structure of the effectiveness of the training system of Ukrainian NPP personnel, taking into account human factor is as follows:

- Analysis of reports on violations comprising off-normal events due to the human errors;
- Inspections by the nuclear regulatory body of the training centres of NPPs aimed at study of the opportunity of issuing licence for training on specific job positions of the personnel;
- Analysis of reports on accidents due to the gaps in teaching industrial safety.

An indicator of unreadiness of operating personnel is calculated in order to assess technical level of operating personnel's preparedness to operate a power unit under various operating modes. The active fallacious actions of the personnel resulting in violation; wrong actions or inaction of the operating personnel during transients at violations in the NPP operation are taken into consideration.

In 1998 the annual number of these active fallacious actions was 15, in 1999 and 2000 - 10. Apparently, the decrease in number of fallacious activities is 30 % and is maintained on the same level as a result of the task-oriented work on operating personnel training.

In addition, based on the analysis of the factors (ergonomics, availability and quality of the documentation, working environment, etc.), which had impact on decision making process and performance of personnel, the following corrective measures had been implemented in the industry:

– Safety Parameter Display Systems were implemented at the control rooms of the power units, which are intended for improvement of ergonomics of the control room personnel and facilitation of the diagnostics of the power units condition;

– Emergency Symptom Oriented Instructions (Procedures) were implemented, which are aimed at increase of the staff's reliability at power unit operation in the course of elimination of the accident condition;

Above work was done by the Ukrainian organisation with assistance of the US and German experts.

A number of administrative activities having impact on the human factor is underway. They are as follows:

- a person is admitted to the work on nuclear installations and with nuclear materials only following a special examination;
- psychological and physical condition of the personnel is controlled;
- the internal departmental supervision over staffing and training of NPP personnel, improvement of safety culture is exercised;
- authorised persons who directly operate nuclear installation are subject to licensing.

Thus, Ukraine meets the provisions of Article 12 of the Convention.

4.4. Quality Assurance (Article 13 of the Convention)

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

In 1998 following the requirements of the normative document «Requirements for the Quality Assurance Programme at All Stages of the Nuclear Installation Lifetime», the operating body started implementation of the project «Improvement of Management and Implementation of the Quality Assurance System of NNEGC Energoatom». This project is intended for development of methodological and organisational principles of the QA system so that to improve performance indicators and operational safety of Ukraine's NPPs. In January 2000, the President of NNEGC Energoatom approved the project implementation plan, which comprises the list of tasks and activities on QA system implementation in the next 3 or 4 years.

The following steps were taken to formulate the policy and fundamental principles in the field of quality assurance:

- the statements on NNEGC Energoatom's Policy in the field of quality assurance (See Annex 8) and safety were published;
- the statements of the NPPs' administrations on the policy in the field of quality assurance were published;
- «General Manual on Quality Assurance of NNEGC Energoatom» had been published and put into effect. On its basis «General Manuals on Quality Assurance» were developed and approved at all NPPs;
- a set of standards of the facility «Requirements for the QA System» based on the IAEA's requirements regarding main components of QA system (10 standards) has been finalised and is now being implemented.

NNEGC Energoatom and Ukraine's NPPs established QA divisions (departments). There is a Working Committee on quality assurance comprising representatives of all NPPs at Energoatom. At its quarterly meetings the members of the Working Committee discuss draft documents (standards of the enterprise) developed for quality assurance system, topical issues on QA system implementation and functioning, and issues of training in the field of quality management.

The normative framework and procedures on QA system assessment of NNEGC Energoatom were formulated. Internal quality audits are organised on the regular basis at nuclear power plants, based on the following standards: «Management Self-assessment», «Independent Assessment « and «Procedure of Internal Quality Audit».

A standard audit programme for NPP QA system assessment was developed so that Energoatom could obtain licence for NPP operation and submit required materials on QA system assessment to the regulatory body.

Based on this standard programme the working program of QA systems audit at NPPs was developed.

According to the normative requirements, the operating body shall perform assessment of suppliers (it used to be a function of the nuclear regulatory body until the Law of Ukraine «On Permissive Activities in the Nuclear Energy Field» was put into force). For this purpose, NNEGC Energoatom elaborated a document, which specifies the procedure of supplier assessment. Besides, it is planned to carry out activities as follows:

- formulate the list of suppliers of products (services included) for safety important systems;
- form organisational structure on supplier assessment both at Energoatom and at NPPs, i.e. implement the functions related to assessment of supplier for the divisions involved in delivery of goods (i.e.Customer, Supplier, etc.);

– develop a standard (for all NPPs) schedule for supplier assessment, organise information exchange between NPPs to avoid unnecessary duplication in assessment of the same supplier by different NPPs.

To make the work efficient NNEGC Energoatom performs on continuous basis training and qualification upgrading of the personnel in all functional areas, including quality assurance. It is based on differential approach to training and depends on roles and functions of Energoatom's employees (management, employees of the QA departments, quality system auditors, representatives on QA). For this purpose:

– a training programme «Quality Management at NPPs» for division managers of NPPs was developed. In 1999 – 2000 managers of all NPPs (more than 300 persons) as well as of NNEGC Energoatom (ranging from section heads to directors of departments) were trained on this topic. Presentation and training materials (more than 100 sets), including those for training at the NPP training centres, were prepared and delivered to NPPs;

– the program on training QA system auditors was developed. Scientific and Training Centre of DerzhStandart (State Standardisation Organisation) trained employees of NPPs and Energoatom in the field of audit. Twenty trained auditors perform internal and external QA audits;

– in 1999 – 2000 there were workshops held on the following topics: «Organisation and Planning of Repair and Maintenance. Self-assessment of Activity», «Implementation of QA system at NPPs», «QA of Supplies», «Upgrading and Reconstruction». Experts of US Pacific Northwest National Laboratory and British Energy (UK) participated in the workshops.

To assure work in specific areas, the most cost consuming and, at the same time, safety important areas of activity (supply, reconstruction, nuclear fuel management, etc.) were selected for planning quality assessment measures.

Each of the area of activity comprises measures as follows:

– analysis of regulatory and industrial documentation;
– compilation of function classifier for certain area;
– quality assurance audit (as a rule, for one «pilot» NPP);
– development and implementation of corrective measures;
– compilation of the document system on each area.

The regulatory body continuously supervises Energoatom's activities in the field of implementation and improvement of QA system. Major documents on QA system (General Manual on QA, Statute of Operating Body, Standard Program on QA System Audit, etc.) were developed with participation of the regulatory body based on the requirements contained in its regulatory documents.

Thus, Ukraine meets provisions of Article 13 of Convention.

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

4.5.1. Each Contracting Party 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.

Safety upgrading of operating nuclear power units provides for detailed and comprehensive analysis of their safety taking into account their design features and operating practice. Legislative acts and regulatory documents require safety assessment and reassessment to be performed.

Activity of the operating body on safety assessment of operating units is aimed at development of the main document that substantiates safety of the power unit – ***Safety Analysis Report (SAR)*** – which should comprise the system of technical and organisational measures aimed at ensuring safety.

The regulatory body developed ***Requirements for the Contents of the Safety Analysis Reports of WWER-type NPPs on the Stage of Issuing Permits for Commissioning*** for power units which are on the final stage of construction. These requirements define structure and contents of the SAR.

SAR development is detailed in Section II.

In view of modern requirements, preparation of Preliminary Safety Analysis Report and Final Safety Analysis Report is planned for future power units. Preliminary Safety Analysis Report shall be developed on the basis of the design documentation, and is a main document for obtaining nuclear installation construction licence. According to the design, FSAR specifies safety classes of nuclear installation systems and components. Systems and components important to safety are subject to mandatory certification in keeping with applicable legislation.

Final (revised) Safety Analysis Report takes into account design modifications made during construction as well as results of commissioning work, physical and energy start-up of a unit.

The operating body is obliged to make safety re-assessment of nuclear power units and submit reports based on its results to the regulatory body on periodical basis, in terms stipulated by the nuclear regulatory body, at least once in 10 years. Future operational limits and conditions are defined based on the results of nuclear power unit re-assessment.

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.

The operating body performs safety analysis of power units in view of accumulated operating

experience, equipment and process system upgrading, new scientific and technical data.

Results of the analysis are included in the annual reports on current level of safety of the operating body. These annual reports contain the information as follows:

- general characteristics of power unit operation;
- list of violations of normal operation and equipment failures, analysis of their root causes, measures being implemented and planned to prevent such violations and failures in future;
- information on performance of scheduled and unscheduled equipment repairs;
- analysis of confinement barrier condition;
- assessment of factors having impact on power unit safety;
- information on implementation of scheduled measures on power unit safety improvement;
- assessment of availability and stability of the power unit operation;
- data on radiation effect on personnel and environment;
- information on accumulation and treatment of radioactive waste;
- data on physical and fire protection;
- information on training and qualification upgrading of personnel.

NPPs collect, process, analyse and store information on equipment failure and personnel errors. The operating body ensures systematisation and urgent transmission of the received information to the nuclear regulatory body and other organisations concerned. Information on all failures of equipment and human errors is included in the annual reports on current condition of power unit operation and is directed for respective suppliers.

Off-normal conditions, emergency situations and accidents that happened at NPP are investigated in compliance with the normative document «Statute on Procedure of Investigation and Record of Violations of Nuclear Power Plant Operation».

Annual summarised report on assessment of current operational safety level shall be prepared in compliance with the applicable requirements.

According to **ZPBU** requirements, «systems and components important to safety, as a rule, undergo direct and comprehensive verification for compliance with the design characteristics at commissioning, after repair and periodically throughout the life of NPP. The design provides for possibility of verification (diagnostics) of the systems important to safety, referred to Class 1 and 2, and for possibility of their testing under maximum simulation of the accident condition. On-line maintenance is performed in conformity with conditions and limits of safe operation specified at

safety analysis report and process regulation. Frequency and allowed time of maintenance and inspections are either set in compliance with applicable normative documents or substantiated in the design».

Specific inspection and verification measures, their scope and frequency are specified in the process regulations, special programmes and procedures applicable at NPP. Based on that, the operating body carries out:

- a number of verifications, tests and pilot operations of equipment and process systems;
- monitoring of the design lifetime of the major equipment;
- periodical non-destructive testing of the base metal and welds of equipment and pipelines;
- assessment of fuel rod cladding leaktightness;
- primary and secondary water chemistry control;
- control of reactor coolant circuit leaktightness;
- monitoring of radioactive releases and effluents and radiation situation in the NPP location, as well as other monitoring activities as envisaged by the special programmes and procedures.

Maintenance and repairs of systems and equipment are followed by the tests for operability and compliance with the design. Results of the tests are documented.

To carry out upgrading of system and component important to safety, the operating body needs to obtain appropriate permit of the nuclear regulatory body, which is issued on the basis of results of the state expert examination on nuclear and radiation safety of materials and documents, which substantiate NPP safety in case of implementation of the planned design modifications.

According to **ZPBU** (item 6.1.1.) the operating body shall exercise continuous control over all activities important to NPP safety.

A departmental supervision service has been established and is functioning at NNEGC Energoatom. The main task of this service is to control activity of the structural divisions of the company in terms of their compliance with requirements of applicable regulations, codes and standards on nuclear, radiation and industrial safety, and environment protection, satisfying conditions of the operating body's licences, operating documentation. .

All NPPs have plant services of departmental supervision, whose main task is to carry out day-by-day control of operating modes, condition of equipment and systems important to safety in terms of their compliance with requirements of operating documentation, norms and regulations on nuclear and radiation safety.

In line with «Regulations on Nuclear Safety of Reactor Installations of Nuclear Power Plants» (PBYa RU AS–89), each NPP holds annual internal check-ups of nuclear safety condition. The check-up certificates are submitted to the nuclear regulatory body.

At least once in two years, the operating body holds its own internal check-ups of nuclear safety condition according to the approved program. Check-ups of radiological protection and environment are regular. If necessary, the deficiency eliminating activities are developed based on the check-up results. Since 2000 new assessment method of NPP operating modes and equipment state has been introduced namely: principle of mutual check-ups by the main departments of NPP. The check-up programs cover operating modes, systems and equipment of reactor installations, turbine units, electrical part, etc.

The nuclear regulatory body inspects NPP safety in line with approved inspection programmes and schedules, which requirements are defined by the normative documents.

Peer reviews at Zaporizhzhya and Rivne NPP, technical support missions at South Ukraine and Zaporizhzhya NPP were held in the framework of co-operation with WANO–MC. Workshops and ASSET mission at South Ukraine and Chornobyl NPP, OSART mission on design safety – at Zaporizhzhya, OSART follow-up mission – at Khmelnitsky NPP were held in the framework of co-operation with the IAEA.

Summarising results of IAEA missions and WANO peer reviews, we may conclude that today there are no NPP operation safety issues which would not receive proper consideration of the operating body in view of their significance.

This information allows us to conclude that Ukraine meets provisions of Article 14 of the Convention.

4.6. Radiation Protection (Article 15 of the Convention)

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

The Law of Ukraine «On Human Protection against Ionising Radiation» dated January 14,1998 is aimed at protection of public life, health and property against adverse effects of ionising radiation. This Law defines practical ways for implementation of the provisions of the basic Law «On Nuclear Power Utilisation and Radiation Safety» and specifies main limits of the public and personnel exposure doses.

The Law also establishes powers and responsibilities of the state authorities engaged in radiation

protection.

In 2001 the Law of Ukraine «On Human Protection against Ionising Radiation» was amended in terms of making its provisions fully compliant with the recommendations of International Commission on Radiological Protection.

«Norms of Radiation Safety of Ukraine» (NRBU-97) and supplement thereto «Radiation Protection against Sources of Potential Irradiation» (NRBU-97/D -2000), which were developed by the Ministry of Health of Ukraine in order to implement general provisions of the Law of Ukraine «On Human Protection against Ionising Radiation» and are based on the international experience, reflect current trends and principal approaches to setting norms of and protection against irradiation in view of recommendations of international organisations such as IAEA and ICRP.

NRBU-97 specifies main principles of radiation with regard to the practical activities and situations of interference, sets system of radiological and sanitary regulations to ensure acceptable levels of irradiation both for an individual and for the society in the whole. In particular, the norms are set for the effective dose of the personnel of Category A (20 mSv/year) and for the public (1 mSv/year). Also, the norms are provided for equivalent dose limits of external irradiation of the lens, skin, hands and feet which satisfy recommendations ICRP Publication 60.

NRBU-97/D-2000 supplements and expands the scope of activity of NRBU-97 by means of inclusion of regulation of potential irradiation source into radiological and sanitary system. Based on modern achievements in the field of radiation protection against potential irradiation, the document introduces a number of new provisions, such as:

- concept of potential irradiation;
- groups of potential irradiation sources;
- system of regulations containing reference dose and risk levels and reference probabilities of the critical events;
- classification of radioactive waste according to the Law of Ukraine «On Radioactive Waste Management».

Implementation of main principles of radiation protection, and in particular, of the ALARA principle (optimisation) is carried out in Ukraine through development and implementation of regulatory provisions, codes and standards, and by means of elaboration and implementation of appropriate operation procedures. The Resolution of the Cabinet of Ministers # 379 of April 23, 2001 approved «The Procedure on Creation of the Uniform State Control and Accountancy System for Personal Exposure Doses of the Public». Formulation of the single procedure for personal monitoring, guarantee of the methodical generality and effectiveness of the quality

control of the measurements in the course of dosimetric control, ensuring of record, storage and access to the results of dosimetric control are the main tasks of the system.

A number of organisational and technical activities, which have been carried out at Ukrainian NPPs and aimed at reduction of personal and collective doses of personnel, minimisation of effluents, improvement of radiation monitoring systems, can be added to the activities on ALARA principle implementation.

From 1998 to 2000 each NPP developed programs on radiation safety level increase. During the program's development a detailed analysis of effectiveness of activity on ensuring radiation protection was done. The issues relating to ensuring radiation safety were detected and formulated. Also, a number of steps were planned to eliminate these issues.

In addition, as a part of the «Programme of Transition of Nuclear Power Facilities to Implementation of Requirements of «Norms of Radiation Safety of Ukraine (NRBU-97)», there was developed a list of measures on optimisation of radiation protection». Effectiveness of the radiation protection measures can be directly assessed by indicators of collective and personal doses, as well as by dynamics of their changes and level of effluents of nuclear installations.

Figure 1 (See Annex 9) gives dynamics of collective doses of personnel of the nuclear power plants of Ukraine from 1994 to 2000. Figure 2 (See Annex 9), respectively provides dynamics of average annual personal doses of the NPP employees for the same period. According to the diagrams, the trends of dose parameters reduction are traced.

Figure 3 (See Annex 9) shows distribution of personal doses of Ukrainian NPP personnel exposure in 2000. According to bar charts, personal doses of most of the persons monitored at all NPPs are lower than 2 mSv. The only exclusion is Chornobyl NPP, where personal doses of the majority of employees range from 0 to 5 mSv.

The State Sanitary and Epidemiological Service of Ukraine supervises observance of the radiation protection and sanitary norms.

Figures 4, 5 and 6 (Annex 9) show dynamics of airborne radiation releases of Ukrainian NPPs for the last five years.

The values of actual releases that are registered by the on-site radiation monitoring systems of Ukrainian NPPs are significantly lower that the admissible release levels, which are established taking into consideration respective shares of the exposure dose limits for individuals of the Category B (public). For instance, in 2000 emission of inert (noble) radioactive gases at Zaporizhzhya NPP was 0.12% of the admissible release levels, for iodine this value was 0.31%; for Rivne NPP the actual release of inert (noble) radioactive gases in 2000 was 1.35 % of the

admissible level, for iodine, respectively, 0.59 %.

Environmental conditions in the location of the nuclear installations are monitored by the regular radiation monitoring system based on the applicable Regulations of radiation monitoring. The regulations specify monitoring scope and techniques.

Several thousands samples that characterise conditions of surface air, surface water, ground and water ecosystems are selected annually at the surveillance sanitary and protection area. Analysis of the surface air on the NPP locations shows that nuclide composition is mainly conditioned by the following radionuclides: Cs-137, Cs-134, Co-60, Sr-90. Table 1 (See Annex 9) gives values of the maximum concentration of radionuclides in the surface air registered in 2000 at NPP locations, and their percentage compared to admissible levels of radiation established at NRBU-97 for the public.

It is evident from this table that maximum concentrations of the radionuclides in the surface air for all NPPs are significantly lower than admissible levels of these radionuclides. It is Chornobyl NPP, which has higher concentration levels compared to the other NPP locations.

In Ukraine, in addition to the regular plant monitoring systems, which monitor environment conditions in the nuclear installation locations, there is «GAMMA-1» radiation monitoring and early notification system described in Section 4.7.

Thus, Ukraine meets requirements of Article 15 of the Convention.

4.7. Emergency Preparedness (Article 16 of the Convention)

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.

The main documents which provide for implementation of emergency response provisions of the legislation of Ukraine are as follows: The Law of Ukraine «On Civil Defence of Ukraine»; Decree of the President of Ukraine #80 «On Measures Regarding Improvement of the Public Protection against Man-caused and Natural Emergency Situations» dated February 9, 2001; «Provisions on United State System of Notification of and Response to Man-caused and Natural Emergency Situations» which was put into effect by the Resolution # 1099 of the Cabinet of Ministers of Ukraine dated July 5,1998, «Plan of Comprehensive Activities Aimed at Efficient Implementation of Territory and Public Protection Against Man-caused and Natural Emergency Situations, Prevention of and Early Response to them for the Period Until 2005», which was put in force by Resolution #122 of the Cabinet of Ministers of Ukraine dated February 7, 2001.

NNEGC Energoatom ensures measures to prevent accidents at NPPs and mitigate their

consequences.

Among these technical and organisational measures is creation of the Ukrainian NPP Emergency Preparedness and Response System (EPRS). The main objectives of the EPRS relate to Level 4 (BDBA management) and Level 5 (planning of activities on personnel and public protection) of the in-depth defence in the part of BDBA evolution and mitigation of its consequences, preparation and implementation of protection measures for personnel and public.

The concept of emergency response adopted in EPRS of Energoatom, which is presented in the «Main Provisions of Ukrainian NPP Emergency Preparedness and Response System of Energoatom», is based on various levels of emergency response activities which are carried out depending on the severity of the accident, which happened (assumed). The structure of Energoatom is given in Annex 10.

The accidents and emergencies are divided into classes. The classes are specified in such a way that it is possible to make clear distinction between them, to urgently classify the accident and immediately trigger the emergency response plan of appropriate level.

The accident and emergency classifiers applicable in Ukraine are given in Annex 11.

Reduction of radiation effects on personnel, public and environment in case of an accident at NPP is achieved by development, initiation and ensuring of permanent preparedness for implementation:

- on-site – of the NPP's plan of accident and emergency response;
- at the territory adjacent to NPP and at the territories of potential radiation contamination in case of accidents at NPPs – of the territorial plan of public protection ;
- on the level of Energoatom – of Energoatom's response plan for accidents and emergencies at Ukrainian NPPs;
- on the branch level – of the united plan of the Ministry of Fuel and Energy of response to the threat of emergency;
- on the national level – of the Actions plan in the framework of the united state system, which is developed on the basis of the plans of interaction between central and local executive authorities, on-line action plans of the ministries and other central executive authorities. By the end of 2002, the State Nuclear Regulatory Committee together with other central authorities will develop, taking into account IAEA's recommendations, a plan of radiation accident response on the state level. It will be done so that to execute Decree of the President of Ukraine #80 «On Activities Relating to Improvement of Public Protection against Man-caused and Natural Emergencies» dated February 9, 2001 and «Plan of Comprehensive Activities Aimed at Efficient

Implementation of Territory and Public Protection Against Man-caused and Natural Emergency Situations, Prevention of and Early Response to them for the Period Until 2005» which was mentioned above.

All above mentioned emergency response plans were approved at all levels.

In addition to emergency response plans each NPP has developed special procedures, which specify the actions of the operating personnel.

4.7.2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, 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.

Based on requirements of «Regulations on Organisation of Emergency Notification and Communication», in Ukraine the notification system is integrated in the united national communication system, which is composed of centralised, local and special systems of notification and is organised as follows:

- national level – a system of centralised notification of central and local executive authorities and local governments;
- regional level - a system of centralised notification in the Autonomous Republic of Crimea, regions (oblasts), cities of Kyiv an Sevastopol, and in the cities and towns referred to the respective categories and groups of civil defence; notification systems of local executive authorities and public are being established;
- local level – system of the centralised notification is not established at this level. Notification on this level is exercised via notification systems of regional level and via local notification system;
- object (enterprise) level – system of the centralised notification of the potentially hazardous enterprises, which affected area in case of emergency will be confined with in their territory.

Notification procedure for all levels is given in Annex 12.

Each NPP has a Crisis Centre intended for implementation of emergency response plans. A crisis centre serves as a control centre for all activities on the accident confinement and elimination of its consequences on-site and in the sanitary protection zone.

Ministry for Emergency Situations and Protection of the Population from the Consequences of the Chornobyl Accident of Ukraine and its regional divisions also have the crisis centres established. They collect, summarise, process information and inform central and local executive authorities about radiological situation, performance of the appropriate actions regarding population

protection and co-ordination of actions of people involved in execution of these activities and other functions.

Emergency response training is held periodically on the plant, power unit, department level and on individual basis in order to prepare the personnel for acting under accident conditions, to improve knowledge and skills referred to accident confinement and elimination of the consequences.

Individual accident training is carried out for NPP shift supervisors, for fresh operating personnel after probation period on-job, in case of moving to the other job position after probation period on the new job, and for personnel, who failed for some reasons to participate in the planned training.

Operating body and NPP management hold annual full-scale emergency response field training with participation of the emergency response related organisational structures and external divisions and organisations involved in accident confinement. The results of this training are analysed and conveyed to all the participants. In addition, each NPP also hold annual training.

The operating body and NPPs develop the programmes of accident training. The programs are to be approved by the central and local executive authorities, local governments, establishments and organisations, which are involved in training both on the NPP level, and on the level of the operating body.

Based on the plans developed by the Ministry for Emergency Situations, annual training and field training on verification of the efficiency of the public protection plans in case of radiological accident at NPP are held on the territories of administrative units subject to potential radiological contamination.

Maintaining and improvement of personnel preparedness to actions related to accident prevention is also ensured through the system of information exchange on off-normal situations and NPP operating experience feedback.

Structural divisions on public information about events at NPPs are established both in Energoatom and at the state regulatory body. Emergency response plans provide for procedure and ways of early notification in case of accidents and emergencies at NPPs.

Ukraine is a party to «Convention on Early Notification of Nuclear Accident» (1986) and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency».

Ukraine has concluded bilateral treaties on notification of a nuclear accident and mutual assistance in case of a nuclear accident with Austria, Hungary, Germany, Norway, Poland, Slovakia, Turkey, Sweden, and Finland. The draft bilateral treaty with Republic of Belarus is being finalised.

According to Decree of the President of Ukraine # 155 dated March 6, 2001, the State Nuclear

Regulatory Committee of Ukraine serves as a competent authority and contact point in charge of transmission and provision of information in case of nuclear accident in compliance with Convention on Early Notification of Nuclear Accident and other international treaties of Ukraine.

According to Resolution of the Cabinet of Ministers of Ukraine #704 «On the Competent National Bodies on Implementation of the International Conventions in the Field of Nuclear Energy Utilisation» dated August 30,1995, the State Committee on Nuclear Energy Utilisation, legally succeeded by the Ministry of Fuel and Energy, was appointed competent national authority and contact point for provision and receipt of requests to provide assistance, and receive proposals as to assistance in case of a nuclear accident or radiological situation in the framework of Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

In 1998, following recommendations of the IAEA, the Information and Crisis Centre (ICC) was established to ensure compliance with requirements of Convention on Early Notification of Nuclear Accident and to perform other tasks in the field of emergency response.

To keep permanent emergency preparedness ICC provides for 24 hours' duty as required by Convention on Early Notification of Nuclear Accident. During the duty shift the on-line communication with the Ukraine's NPPs is maintained; the information on radiation incidents on and beyond the territory of Ukraine is analysed and recorded

According to «Regulation on Interaction of Central and Local Executive Authorities within Governmental Information and Analytical System on Emergency Situations (GIAS ES)», the information status report of Ukraine's NPP is submitted on a daily basis to the information analytical processing unit of GIAS ES of the Cabinet of Ministers of Ukraine and to the back-up unit of GIAS ES in the Ministry of Emergency Situations of Ukraine.

ICC has modern computer equipment, including process control systems operating in real time mode:

«GAMMA-1 Early Notification System of Radiological Accidents» allows to get information on environmental radiological situation in the 30–km zones of Zaporizhzhya and Rivne NPP. GAMMA-1 represents a chain of monitoring systems, which automatically transmit the data via radiocommunication channels to the local response centres. Local response centres of the system are located in the regional state departments of the Ministry of Environment Protection of Ukraine in the Cities of Zaporizhzhya and Rivne respectively. In turn, local centres transmit information by allocated telephone communication channels to the national response centre of the system located in ICC in Kyiv. If the gamma-exposure dose in the areas of monitoring exceeds applicable levels, the emergency alarm signals are initiated in the response centres. The Ministry of Emergency Situations in Kyiv and its divisions in Zaporizhzhya and Rivne have permanent access to

GAMMA-1 system in the real time mode.

The main functions of the NPP remote monitoring systems (RMS) are: transmission of process and radiation parameters of Ukraine's NPPs, parameters' certification in terms of acceptable values and assessment of critical safety function state, on-line parameters display in the form flow chart, display of the summarised parameters, accumulation and storage of the received information. At present, development and pilot commissioning of RDS for Unit 5 of Zaporizhzhya NPP and Units 1,2 and 3 of Rivne NPP is finalised.

The prototype system on international exchange with the radiological data and information in the real-time mode during a nuclear accident provides for data exchange: in Ukraine- between the National Data Processing Centre, which equipment will be installed in ICC, and Communication Centre (CC), which equipment will be installed in Ukrainian hydrometeorological centre. Beyond Ukraine, such exchange is organised between CC of Ukraine and CC of Republic of Belarus, CC of the Russian Federation. CC of the Russian Federation will supply its information to the Regional Data Processing Centre (hereafter RDC) in Obninsk, then to RDC at Budapest. RDC of Hungary suuplies the information to the prototype system accessible to other European monitoring centres.

RODOS, a system for support of real-time decision making, was designed as a system, which includes models and data, bases for submission, calculation and assessment of the accident consequences. RODOS calculates air dispersion and fallout in the NPP area and at the distance of hundreds of kilometres, spreading of radionuclides in water reservoirs, migration of radionuclides in the food chains, external and internal irradiation doses.

Ukraine has performed extensive work on establishing Emergency Preparedness and Response System. It follows provisions of Article 16 of the Convention.

SECTION V. SAFETY OF INSTALLATIONS

5.1. Siting (Article 17 of the Convention)

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

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

Regulatory and legislative documents of Ukraine, which establish requirements for siting, in the whole, meet the above requirements. Procedure for decision making and requirements for the materials related to nuclear installation siting are set in Article 37 of the Law of Ukraine «On Nuclear energy Utilisation and Radiation Safety».

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

Regulatory and legislation documents regulate performance of the assessment of the likely safety impact of a proposed nuclear installation on individuals, society and the environment.

Nuclear installation siting provides for examination of site characteristics both to define all factors of potential impact of nuclear installation on the public and the environment and to verify acceptability of the site for construction in terms of seismic zoning, physical and technical properties of soils, etc.

5.1.3. For evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation.

A number of siterelated factors were re-assessed in Ukraine in order to ensure continued safety acceptability of nuclear installations taking into account operating experience.

In particular, there were performed special surveys and predictions of potential evolution of suffosion and karst processes, which became more active after commissioning of Rivne NPP. The range of surveys covered karst surveys of industrial site of Rivne NPP, certification of the surface karst forms based on that statistical conclusions were made regarding assumed size of the sluggy; analysis of the chalk layer subject to karsting on the basis of drilling and geophysical activities; zoning according to conditions and stage of karsting on which basis the extent of potential karsting hazard is defined while designing any structure. It allowed to develop and perform antikarsting events: cementation of ground under structures and further transfer to pile foundation that ensured reliable stability of buildings and structures which guarantees safety. Based on the results of the surveys it was decided to change location of the site for Unit 4 of Rivne NPP in order to avoid karsting. In addition, Unit 4 of Rivne NPP is designed to be built on driven cast-in-place piles of

40 metres' long, which go through the chalk layer and rest on basalts (rock) that excludes impact of suffosion and karsting processes.

In the course of operation monitoring of collapse and listing of structures is performed along with hydrogeological monitoring. If required, engineering and geological and other types of monitoring are performed – they employ state-of-the-art techniques, including among the others, radioisotope logging monitoring of soil density and humidity along the perimeter of the structure.

Detailed seismic studies were performed at Chornobyl and South Ukraine NPP. Similar work was completed at Khmelnitsky and Rivne NPP and planned for Zaporizhzhya NPP. The conclusions are based on the materials of the comprehensive researches - seismotectonic, geomorphologic, neotectonic, tectonomagnetic, tectonic, isotopic and hydrochemical, seismic microzoning- based on instrumental surveillance and engineering and geological analogies. Current data prove that technical solutions selected for the design basis of the respective power units were correct. Seismic intensity of the site considered on the design stage was confirmed: maximum design basis earthquake (PZ) is 5 intensity points; maximum credible earthquake (MRZ) is 6 intensity points. A number of design accelerograms, which model PZ and MRZ of Vrancia zone and local seismic focus zones, were plotted. WWER reactors are designed to withstand PZ and MRZ respectively of 6 and 7 intensity points.

While formulating requirements for the scope and contents of safety assessment reports of operating units, the regulatory authority emphasised that in-depth and detailed analysis of man-caused and natural factors as well as their combination with equipment failures should be performed. Similar requirements are set for power units under construction.

At present the environmental impact analysis was updated for Zaporizhzhya and Khmelnitsky NPP. The results of assessments, which confirm compliance with normative requirements on environmental safety, were approved by the regulatory body.

Similar documents are being drawn up for Rivne NPP. They will be finalised in 2001. The Cabinet of Ministers of Ukraine by its Resolution # 1122 dated July 18, 1998 put into effect a procedure on public hearings regarding nuclear energy utilisation and radiation safety. The main objective of the public hearings is to realise the rights of citizens and their associations to participate in discussion of draft laws, including those related to nuclear installation siting.

Public hearings related to siting of Khmelnitsky NPP Unit 2 and Rivne NPP Unit 4 was held in October 1998 in the town of Netishin. The meetings with public were held in Rivne and Kyiv. Conclusions of the public hearings regarding impact of designated installations on environment and human health were discussed in mass-media.

5.1.4. For 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.

Ukraine observes its obligations to submit information regarding probabilistic safety impact on nuclear installation under construction to its neighbouring countries.

For instance, in August 1998 full sets of documents related to environmental impact assessment of the projects on completion of Unit 2 of Khmelnitsky and Unit 4 of Rivne NPP were provided to the embassies of the neighbouring countries.

The information on completion of Kh2/R4 was also submitted in 1998 to the Minister of Environment Protection of the Czech Republic, to the Minister of Housing, Territorial Planning and Environment of the Kingdom of the Netherlands, and to the attaché of the Embassy of Japan in Ukraine upon their request.

The information presented allows to declare that Ukraine complies with provisions of Article 17 of the Convention.

5.2. Design and Construction (Article 18 of the Convention)

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.

According to the Ukrainian legislation design of nuclear installations is subject to obligatory licensing. Design covers design of new installations, planning and development of the projects on modernisation and rehabilitation of nuclear installations. The regulatory body on nuclear safety issues appropriate licenses to the operating body and design organisations.

At present, Chornobyl NPP spent fuel storage is being designed, upgrading of all operating nuclear power units and units Kh2/R4 under construction is carried out in Ukraine.

New nuclear installations as well as upgrading and rehabilitation of the operating plants are designed according to requirements of «General Provisions of Safety Assurance of Nuclear Power Plants (**ZPBU**)», which was put into effect in 2000.

In the course of NPP designing the following main principles of safety assurance are observed:

– NPP complies with safety requirements provided its radiological impact on personnel, public and environment during normal operation, off-normal operation and accidents does not result in exceeding of applicable radiation dose limits for personnel and public, release and effluent, radioactive substance content in the environment, and is limited during beyond the design basis accident;

– NPP safety is ensured by means of consecutive implementation of «defence in-depth» concept which is based on implementation of physical (confinement) barriers on the way of ionising radiation and radioactive substances release to environment, and through the system of technical and organisational to protect the barriers and maintain their efficiency in view to protecting personnel, public and the environment;

– system of NPP physical barriers comprises fuel matrix, fuel rod cladding, primary boundaries, confinement and biological shield;

– barrier integrity during NPP operations shall be controlled throughout the path of radioactive substances distribution. All barriers and their protection means are operable under normal operation. Should failure to operate any of the barriers or their protection means envisaged in the plant design occur, it is prohibited to operate the NPP unit.

System of technical and organisational measures establishes 5 levels of defence in depth.

Level 1 - establish conditions to prevent violation of normal operation;

Level 2 – prevent design basis accidents using normal operation systems;

Level 3 - prevent accidents using safety systems;

Level 4 – manage beyond the design basis accidents;

Level 5 – plan measures to protect personnel and public.

Technical means and organisational measures relating to prevention of violation ofsafe operation limits and conditions envisaged in the project, and prevention of the design basis accidents and their consequence confinement shall ensure safety in case of any design initiating event.

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

Technical and organizational decisions approved for safety implementation of SNF storages of ChNPP, Unit 4 of Rivne NPP and Unit 2 of KhNPP take into account the achieved level of the science and technology and meet the requirements of normative documents. This approach applies towhile developing equipment, designing the nuclear power plants, during equipment manufacture, construction, operation, rehabilitation and repair of NPPs.

The NPP design, the safety important system and components operating documentation specify

conditions and means of:

- review of system and component operability (including devices located inside a reactor), replacement of equipment with the exhausted service life;
- testing of systems to check conformity to their design indicators;
- review of sequence of signals transfer and switch-on of equipment (including transfer to the emergency power supply);
- periodical and/or continuous monitoring of metal condition and welds of equipment and piping;
- review of metrological characteristics of instrumentation channels to check their conformity with the design requirements.

5.2.3. Design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface .

To ensure the NPP safety the design gives the preference to utilisation of passive devices in safety systems and internal self-protection of the reactor installation (self-control, thermal lag and other natural processes).

NPP design allows for means and tools that prevent personnel's errors or their consequenses mitigation including the condition of the maintenance and repair.

During unit control room design the issues related to the man-machine interface are resolved in the optimal manner. Parameters to be monitored in the unit control room are selected and displayed to provide operatively the operating personnel with unambiguous information on the current status of the reactor facility and the whole NPP, as well as to identify and inspect automatic actuation and functioning of the safety systems.

Design allows for the system of operator information support included into the NPP Unit monitoring and control system. It also foresees the system for on-line general data provision to the NPP personnel covering the current status of the reactor installation and NPP unit as a whole.

Unit Monitoring and Control system is designed for ensuring the most favourable condition for operating personnel and assists it in making a right decision on NPP control to minimise the number of incorrect decisions.

Implemented and scheduled actions allow stating that Ukraine is fulfilling Article 18's provisions of the Convention.

5.3. Operation (Article 19 of the Convention)

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

In accordance with Law of Ukraine «On Nuclear Power Utilisation and Radiation Safety» the Operating Body (Utility) shall get a license from the Nuclear Regulatory Body to put into operation and to operate a nuclear installation. The Law of Ukraine «On Permissive Activity in the Nuclear Power Field» amended and clarified the fundamental law in the area of licensed activities in the field of nuclear power utilisation. In accordance with Article 8 of the Law, the Nuclear Regulatory Body grants to the Nuclear Installation's Operating Body a license to perform activities related to individual stages of the reactor installation's lifecycle, that is, for stages of designing, construction, commissioning, operation, and decommissioning of nuclear installation.

Taking into account further expertise and other licensing procedure implementation the actual term for getting license for operation of running NPP units is the forth quarter of 2001 or the first quarter of 2002.

Commissioning of a nuclear power unit of NPP is conducted in accordance with the program agreed upon with the Nuclear Regulatory Body.

Operating Body develops, agrees upon with the Nuclear Regulatory Body and approves the commissioning works program for physical and energetic start-up.

Nuclear Regulatory Body issues permission for the Operating Body that allows to conduct the commissioning works, initial transportation of nuclear fuel to a site, power unit's physical and power start-up after checking the availability and readiness of NPP for commissioning stages. This also requires the approval by other State Regulatory Authorities and the special plans of actions to protect the personnel and public in case of accident at NPP and to ensure the physical protection within the necessary limits.

License for coming up to the full capacity of nuclear installation is issued on the basis of documents confirming completion of the design scheduled construction and installation works, the acts on systems and equipment availability along with the acts on required testing and inspections implementation.

Moreover, another document shall be submitted proving that the operating personnel is fully available, appropriately trained and qualified. The compulsory condition is to submit the materials supporting safety of nuclear installation (NI) and the whole power unit (NI safety substantiation,

NPP safety substantiation). Based on this scheme all running units were put into operation on NPP sites.

Documents regulating pre-start adjustment works, physical and energetic start-up, have a list of nuclear hazardous (unsafe) works, list of actions to prevent accident initiation and to ensure physical protection. While implementing the program on commissioning, in accordance with the testing programs the physical features are specified and documented for the safety important systems. The adjustment of equipment and systems performance is conducted. The limits and conditions of their safe operation along with operating procedures are refined to display more accurately physical features of equipment and systems.

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

In accordance with ZPBU the basic document specifying the safe operation is Technical Specification that includes the requirements and main methods of safe operation of NPP unit, and general procedure of operation performance related to the NPP safety as well as the limits and conditions of safe operation.

Limits and conditions of the safe operation are periodically adjusted based on the experience of twin units operation and new data, using the scientific and technical information. Data on safe conditions and limits monitoring are stored on site for the two campaign period between reloading or for two years period. Appropriate information is included into the periodical reports on the living safety assessment that are submitted by the Operating Body to the Nuclear Regulatory Body.

Based on the technical specification approved and operating documentation issued by the design organisations before starting pre-operational commissioning activities the Administration of NPP develops equipment and systems **Operating Procedures** that include instructions addressed the personnel concerning performance of works during normal operation, abnormal operation and during emergencies.

In accordance with Article 33 of the Ukrainian Law «On Nuclear Power Utilisation and Radiation Safety» the Operating Body is responsible for:

- establishing required organisation structure for NPP safe operation;
- providing NPPs with necessary financial, material and technical support, normative documents and scientific and technical support.
- organising NPP physical protection and fire protection;
- staffing and training of operating personnel;

- creation of infrastructure in which the safety is considered as vital issue and subject to personal responsibility of all personnel. The Operating Body also bears responsibility for continuous monitoring of the NPP safety.

Operating Body provides continuous monitoring of NPP activities. The results of the NPP safety inspections as well as annual current safety analysis reports are submitted by the Operating Body to the Nuclear Regulatory Body.

The Safety Parameters Display System (SPDS) is being implemented at Ukrainian NPP. These systems have been already implemented at Units 2, 3, 5 of Zaporizhzhya NPP; Units 1, 2 of South-Ukraine NPP; Unit 1 of Khmelnitsky NPP; Unit 3 of Rivne NPP. This allows us to reveal deviations of the Unit's safety parameters and to provide the personnel with additional information on the status of critical safety function and necessity for implementation of immediate recovery actions effecting the equipment status.

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

Ukraine is implementing necessary measures to establish procedures specifying appropriate recovery measures in case of possible events and accidents during operation. This item is considered in details in Section IV.

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

Operating Body and NPP Administration ensure collection, processing, analysis and storage of information on equipment failures and personnel's errors. Administration of NPP is responsible for timely collection of information and its appropriate qualitative analysis of information received. Operating Body provides systematisation and on-line information transfer to the State Nuclear Regulatory Body as well as to interested organisations. The organisation bears responsibility for this activity in a proper manner. The information on all failures of equipment and erroneous actions of the personnel are included into the annual reports on the current status of power units and submitted to the appropriate suppliers.

Failures of equipment and process systems, emergencies and accidents shall be obligatory reviewed by the Commission constituted by Operating Body. In special cases the State Nuclear Regulatory Body constitutes its own commission. Normal operation violation, emergencies and accidents that took place at NPPs have been investigated in accordance with specific normative enactment «Provision on investigation and accounting of events occurred in NPPs operation». This

document specifies the following:

- procedures for events classification;
- procedures for events investigation (identification of their direct and root causes, evaluation from the point of view of impact on safety, development of corrective measures);
- procedure for event recording and accounting;
- forms of notification about events that are submitted to the State Nuclear Regulatory Body.

Notifications about significant events are submitted on a regular basis to the IAEA and WANO Regional Centres within the frames of the bilateral information exchange.

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

The specific national infrastructure of scientific and technical support to the safe operation of NPPs was created.

The following participants are involved to settle engineering, scientific and technical problems:

- Kyiv Institute «Energoproject» (Chief Designer of Rivne, Khmelnitsky and Chornobyl NPPs);
- Kharkiv Institute «Atomenergoproject» (Chief Designer of ZNPP and SUNPP);
- NPP Operational Support Institute;
- Radiological Protection Institute, Academy of Medical Sciences of Ukraine;
- Nuclear Research Institute, National Academy of Sciences of Ukraine;
- Institute on Strength Problems, National Academy of Sciences of Ukraine;
- Scientific Centre of Radiological Medicine, Academy of Medical Sciences of Ukraine;
- Kharkiv Scientific Centre «Physics and Technology Institute»
- other academic institutes and engineering organisations.

Operating Body supports continuous relationships with organisations that have participated in NPP design and continue providing engineering support (OKB «Hydropress», NIKIET, VNII AES, Russian Scientific Centre «Kurchatov Institute»).

5.3.6. 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

At each NPP the specific process systems and facilities are foreseen by the design and intended for

collection, initial processing of solid and liquid radwaste directly on NPP site. Administration of NPP ensures quantification, transfer and location of all fissionable and radioactive material, fresh and spent nuclear fuel, dismantled equipment, contaminated tools, clothes, radioactive waste and other ionising irradiation sources. Each NPP site has the measures developed and being implemented to minimise radwaste generation. At present the active work is going on to provide the nuclear power plants with additional facilities for reprocessing and recovery of the radwaste above mentioned, including solidification and incineration facility. At each NPP there are programs under realisation to reduce the amount of radioactive waste with different activity levels and radionuclide content. Some data concerning amount of radwaste being accumulated at the Ukrainian NPP, are given in Annex 13.

Thus, Ukraine fulfils the provision of Article 19 of the Convention.

Annex 1

NPPs in Ukraine

1. Units in operation.

Name of NPP.	Number of the unit	Electric Output, MWe	Reactor Installation Type	Commissioning Date
Zaporizhzhya	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	September 1989.
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. Units under Construction.

Name of NPP.	Number of the Unit	Electric Output, Mwe	Reactor Installation Type	Degree of readiness, %
Khmelnitsky	2	1000	V-320	85
	3	1000	V-320	40
	4	1000	V-320	10
Rivne	4	1000	V-320	80

3. Units that have been shut down

Name of NPP Unit	Number of the Unit	Decommissioning Date
Chornobyl	1	November 1996.
	2	October 1991.
	3	December 2000.
	4	April 1986.

Annex 2

Implementation of measures on improving safety at NPP units under operation in Ukraine

1. NPP units with WWER-1000 reactor type (large series)

In accordance with classification given in the IAEA document IAEA-EBP-WWER-05 «Safety Issues and Their Prioritization for the NPPs with WWER-1000/320 Reactors» for units WWER-1000 reactor installation type there were found 22 problems of category I; 38 problems of category II and 11 problems of category III. Problems of category IV were not found. Measures on elimination of revealed problems shall be realized at all 11 WWER-1000 reactor installation type units operating in Ukraine.
Information on classification of measures in accordance with categories subject to their realization at 11 Ukrainian NPPs units is given in Table 1.

Table 1

Sphere	Category			
	I	II	III	IV
General issues	-	2	1	-
Reactor core	-	2	1	-
Integrity of internals	-	2	4	-
Systems	4		2	-
Instrumentation and control	4	6	1	-
Power supply	4	1	1	-
Containment	-	1	-	-
Internal hazard factors	1	6	1	-
External hazard factors	1	2	-	-
Accidents analysis	8	7	-	-
Together	***22***	***38***	***11***	***-***
Total measures for 11 units	***242***	***418***	***121***	

In table 2 systematized data on implementation of category III measures at Ukrainian NPP WWER-1000 reactor installation type units are given. Thus from 11 existing safety problems (121 measures):

- at least one problem is solved completely at each of 13 units, that is 10,7% of the total number of measures;
- 70 measures are now at the implementation stage i.e. organization- technical measures were introduced was commenced to solve corresponding safety problems, that is 57,8% of the total number of measures;
- 38 measures were not realized, that is 31,4% of the total number of measures;

Table 2

Items	Sphere	Code of problem	Problem description	Fulfilled	Fulfilled partially	Not fulfilled	Total
1	General Issues	G2	Qualification (certification) of the equipment	0	0	11	11
2	Reactor Core	RC2	Safety of CNP rods input /fuel assembly deformation	5	6	0	11
3	Integrity of components	Cl1	Embrittlement of reactor pressure vessel and its monitoring	0	11	0	11
4	Integrity of components	Cl2	Non-destructive testing.	0	11	0	11
5	Integrity of components	Cl4	Integrity of steam generator header.	2	8	1	11
6	Integrity of components	Cl6	Integrity of steam and feedwater piping	0	1	10	11
7	Systems	S5	Jamming of mesh elements of sump tank ECCS (emergency core cooling system).	0	7	4	11
8	Systems	S9	Qualification of SG safety valves and discharge valves for operation in the aqueous medium.	0	1	10	11
9	I &C	I.C8	Upper reactor unit leakage monitoring system.	5	6	0	11
10	Power supply	ER5	Discharging time of storage batteries.	1	9	1	11
11	Internal hazards	IH2	Fire prevention.	0	11	0	11
Total				**13**	**70**	**38**	**121**

2. NPP units with WWER-1000 reactor installation type (small series).

Status of the safety problems solution at small series units (South Ukraine NPP units 1 and 2) is given in the Table 2, section 1. At the same time, in accordance with IAEA classification, there is a number of specific safety problems for WWER–1000 reactor type units. Two of such problems were referred to category III (Table 3).

Table 3

Items	Sphere	Code of problem	Problem description	Fullfilled	Fullfilled partially	Not fullfilled	Total
1	Systems	S16	Physical and functional distribution of ECCS.	0	2	0	2
2	I&C	I.C5	Reactor back-up protection system	0	2	0	2
Total				**0**	**4**	**0**	**4**

3. NPP units with WWER-440 reactor installation type.

In accordance with classification given in the IAEA document IAEA-EBP-WWER-05 "Safety Issues for the NPPs with WWER-440/213 Reactors and Their Categories» for units WWER-440 reactor installation type it 26 problems were found - of category I; 40 problems - of category II; and 8 problems - of category III. Problems of category IV were not found. Measures on elimination of revealed problems shall be realized at both (Rivne-1 and Rivne-2) WWER-440 reactor installation type operating in Ukraine.
Information on classification of measures in accordance with categories subject to their realization at 2 Ukrainian NPP units is given in table 4.

Table 4

Sphere	**Category**			
	I	**II**	**III**	**IV**
General	-	2	1	-
Reactor core	-	1	-	-
Integrity of internals	1	4	1	-
Systems	3	12	2	-
Instrumentation and Controls	3	8	-	-
Power supply	4	1	-	-
Containment	1	3	1	-
Internal hazards	3	3	2	-
External hazards	1	1	1	-
Accidents analysis	10	5	-	-
Together	***26***	***40***	***8***	**-**
Total measures for 2 units	***52***	***80***	***16***	

Table 5 shows data on realization of category III measures at Ukrainian NPPs WWER- 440 reactor installation type. Thus, from 8 existing safety problems (16 measures):

- 12 measures are at the implementation stage, in other words, organization-technical measures were introduced to solve corresponding safety problems, that is 75% of total number of measures;
- 4 measures were not realized, that is 25% of total number of measures.

Table 5

Items	Sphere	Code of Problem	Problem description	Full filled	Fullfilled partially	Not Full filled	Total
1	General part	G2	Qualification (certification) of the equipment.	0	0	2	2
2	Integrity of internals	Cl2	Non-destructive testing.	0	2	0	2
3	Systems	S5	Jamming of mesh elements of ECCS sump tank.	0	2	0	2
4	Systems	S13	Damage of feedwater system.	0	2	0	2
5	Containment	Cont1	Integrity of steam and feedwater piping.	0	2	0	2
6	Internal hazards	IH2	Fire prevention.	0	2	0	2
7	Internal hazards	IH7	Internal hazards caused by high energy piping break.	0	0	2	2
8	External hazards	EH1	Seismic design.	0	2	0	2
Total				**0**	**12**	**4**	**16**

Annex 3

Regulations and Legislative Acts developed in the period from 1998 to 2001

1. Law of Ukraine «On Nuclear Energy Utilisation and Radiation Safety» (#39/95).
2. Law of Ukraine «On Uranium Ore Mining and Processing» (#645/97).
3. Law of Ukraine «On Human Protection from Ionising Radiation» (#15/98).
4. Law of Ukraine «On Permissive Activities in the Nuclear Power Field» (#1370-14)».
5. Law of Ukraine «On Radioactive Waste Management» (255/95).
6. Law of Ukraine «On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation» (#2064-14).
7. Statement of the Cabinet of Ministers of Ukraine #551 «On Approval of the List of Jobs of Nuclear Installation Operating Personnel whose Training Requires Licensing of the Main State Inspectorate on Supervision of Nuclear Safety of the Ministry of Environment Protection and Nuclear Safety» dated May 21, 1996.
8. Resolution of the Cabinet of Ministers of Ukraine #708 «On Approval of Statement on Procedure to Define Amount of and Impose Penalties on the Enterprises, Establishments and Organisations, which Operate in the Field of Nuclear Energy Utilisation, in Case of their Breach of Norms, Codes and Standards of Safety or Conditions of Permits for Work Performance» dated June 29, 1996.
9. Resolution of the Cabinet of Ministers of Ukraine #997 «On Acknowledgement of Direct Operation of Reactor Installation a Separate Type of Activity» dated August 22, 1996.
10. Resolution of the Cabinet of Ministers of Ukraine #163 «On Approval of Procedure for Development and Approval of Norms, Codes and Standards on Nuclear and Radiation Safety» dated February 8, 1997.
11. Resolution of the Verkhovna Rada #49/94-VR «On Election of the Standing Commission of Verkhovna Rada of Ukraine on Nuclear Policy and Nuclear Safety» dated June 3, 1994.
12. Resolution of the Cabinet of Ministers of Ukraine #830 «On Appointment of Utility – an Operator of Nuclear Installations» dated June 8, 1998.
13. Resolution of the Cabinet of Ministers of Ukraine #1782 «On Approval of Licensing Procedure of Individual Activities in the Field of Nuclear Energy Utilisation» dated December 6, 2000.
14. Resolution of the Cabinet of Ministers of Ukraine #480 «On State Programme of Radioactive Waste Management» dated April 29, 1996.
15. Resolution of the Cabinet of Ministers of Ukraine #542 «On Comprehensive Programme of Radioactive Waste Management» dated April 5, 1999.
16. Resolution of the Cabinet of Ministers of Ukraine #1115 «List of Activities Related to Physical Protection of Nuclear Installations and Nuclear Materials Subject to Obligatory Licensing» dated July 12, 2000.
17. Resolution of the Cabinet of Ministers of Ukraine #1683 «List of Job Positions and Specialities of Nuclear Installation Operating Personnel Whose Training is Subject to Licensing, and List of Job Positions of Personnel Involved in Direct Control of Reactor Installation of Nuclear Power Plant and Who can Operate on the License Basis Only» dated November 8, 2000.

Regulations Developed in the Period from 1998 to 2001.

1. General Provisions of Safety Assurance in Decommissioning of Nuclear Power Plants and Research Reactors (NP 306.2.02/1.004-98).
2. Procedure for State Inventory Taking of Radioactive Materials (NP 306.2.04/3.005-98).
3. Procedure for Issuance Certificates for Safety during Radioactive Materials Transportation (NP 306.5.06/2.008-98).
4. Provisions on Licensing of Personnel Training at Ukrainian NPPs (NP 306.2.02/2.010-98).
5. Licensing Requirements to Personnel Training at Ukrainian NPPs (NP 306.5.02/3.011-98).
6. Regulations of Accounting and Control of Nuclear Materials at an Installation (NP 306.4.07.016-98).
7. Regulations of Treatment of Restricted Access Information Regarding Physical Protection of Nuclear Installations, Nuclear Materials, Other Sources of Ionising Radiation.
8. Regulations on Physical Protection of Nuclear Materials and Nuclear Installations.
9. Provisions on Determination of Characteristics of Potential Types and Levels of Attacks on Nuclear Installations and Nuclear Materials, and Use of These Characteristics in Physical Protection.
10. Rules of Accounting and Control of Nuclear Materials at Nuclear Installation.
11. Requirements to QA Programme at all Stages of Nuclear Installation Life-Time.
12. General Provisions of Nuclear Power Plants Safety Assurance (NP 306.1.02/1.034-2000).
13. List of and Requirements to Format and Contents of the Documents, which are submitted for the Purpose of Obtaining Licenses for Each Stage of Lifecycle of Radioactive Waste Storage Facilities.
14. Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposals of Radioactive Waste.
15. Requirements to Structure and Contents of Safety Analysis Reports on Decommissioning Stages of Nuclear Power Plant and Research Reactor.
16. Requirements to Structure and Contents of the Safety Analysis Reports on Radioactive Waste Treatment.
17. Norms of Radiation Safety of Ukraine/ Supplement: Radiation Protection from Potential Ionising Radiation Sources (NRBU-97/D-2000).

Annex 4

STATUTE
on the State Nuclear Regulatory Committee of Ukraine

Approved by Decree No.155/2001 of March 6, 2001 of the President of Ukraine
Amended by Decree #913/2001 of October 1, 2001

1. The State Nuclear Regulatory Committee of Ukraine (hereinafter referred to as the SNRCU) is the central executive authority with a special status the activity of which is directed and co-ordinated by the Cabinet of Ministers of Ukraine.
   The SNRCU within its competence shall implement the state policy in the area of nuclear energy utilisation, ensure compliance with requirements of nuclear and radiation safety.
2. The SNRCU in its activity shall follow the Constitution of Ukraine and laws of Ukraine, Acts of the President and the Cabinet of Ministers of Ukraine, and the present Statute. The SNRCU within its authorities shall arrange fulfilment of legislative acts and systematically control their implementation.

   The SNRCU shall generalise the practice for implementing nuclear legislation related to its competence, develop proposals to upgrade this legislation and submit to the President and the Cabinet of Ministers Ukraine for consideration in pursuance to the established procedure.

3. Main tasks of the SNRCU are as follows:

   To participate in establishment and ensuring the implementation of the state policy in the area of nuclear energy utilisation, the observance of nuclear and radiation safety requirements;
   To carry out within the limits of its competence the state safety regulation of nuclear energy utilisation, the observance of nuclear and radiation safety requirements;
   To carry out state supervision of the observance of the legislation, norms, rules and standards on nuclear energy utilisation, the observance of nuclear and radiation safety requirements;
   To co-ordinate central and local executive authorities discharging functions of the state regulation of nuclear and radiation safely in accordance with the legislation;

4. The SNRCU, pursuant to the tasks entrusted, shall:

1) develop proposals on establishment and implementation of the state policy in the area of nuclear energy utilisation, ensure the observance of nuclear and radiation safety requirements;
2) take part in drafting the State Budget of Ukraine, State Economy and Social Development Program of Ukraine, Action Program of the Cabinet of Ministers of Ukraine;
3) take part in prioritising directions for development of science and engineering, government work, development of state scientific and engineering programs; arrange scientific and engineering researches in the area of nuclear energy utilisation in pursuance to the legally established procedure, the observance of nuclear and radiation safety requirements;
4) develop and carry out measures on creation of safety culture in the area of nuclear energy utilisation;
5) define safety criteria, requirements and conditions during nuclear energy utilisation; develop and approve norms and rules of nuclear and radiation safety, physical protection of nuclear facilities, nuclear material, radioactive waste, other radiation sources within the limits of its competence; approve drafts of the state and branch industry standards within the limits of its competence;
6) define requirements to safety important systems and equipment of nuclear facilities and facilities designed for radioactive waste management, uranium facilities, requirements to safety

control of these facilities, and define the accountancy and registration procedure for the mentioned facilities and equipment, control the observance of this procedure;

7) define requirements to Quality Assurance at all life cycle stages of nuclear facilities, facilities designed for radioactive waste management, uranium facilities;
8) conduct safety level assessment and safety expertise of nuclear facilities and facilities designed for radioactive waste management, uranium facilities;
9) draw up conclusions on the observance of nuclear and radiation safety requirements during export, import and transit of radioactive material;
10) according to the legally established procedure carry out the licensing of:
    design of nuclear facilities or radioactive waste disposal facilities, uranium ore milling, transportation of radioactive material, reprocessing, storage and disposal of radioactive waste, production of radiation sources, personnel training to operate nuclear facilities according to List of positions and profession that is subject to approval by the Cabinet of Ministers of Ukraine;
    activity related to physical protection of nuclear material and nuclear facilities according to List of activity type that is subject to approval by the Cabinet of Ministers of Ukraine;
    activity of Operating organisation at certain life cycle stage of nuclear facility or radioactive waste disposal facility;
    activity related to personnel direct operation of reactor facility of Nuclear Power Plants;
11) according to the legislation issue permits to perform works or activity carried out at stages of commissioning, operation and decommissioning and at stages of operation and closure of radioactive waste disposal facilities, and issue permits to transport radioactive material and safety certificates for transportation packages of nuclear material as well;
12) according to the legislation of Ukraine, international agreements of Ukraine perform measures on arrangement and keeping the state accountancy, prevention of illicit trafficking, security of nuclear material, radioactive waste, other radiation sources;
13) supervise Operating organisations, enterprises, institutions, organisations performing works at nuclear facility sites, facilities designed for radioactive waste management, uranium facilities, in terms of their observance of nuclear and radiation safety requirements;
14) arrange and carry out the state supervision over the observance of the legislation, norms, rules and standards on nuclear energy utilisation, requirements of nuclear and radiation safety, physical protection of nuclear facilities, nuclear material, radioactive waste, other radiation sources;
15) exercise control over implementation of measures aimed at prevention of accidents at nuclear facilities, facilities designed for radioactive waste management, uranium facilities, and ensure preparedness of enterprises, institutions and organisations to mitigate accident consequences;
16) control the observance of the established procedure to submit information about violations in operation of nuclear facilities or radioactive waste disposal facilities, arrange finding out violation causes and circumstances of nuclear incidents and radiation accidents;
17) within its authority undertake enforcement to legal and physical entities in case of their breach of the legislation, norms, rules and standards of nuclear energy utilisation, requirements of nuclear and radiation safety, physical protection of nuclear facilities, nuclear material, radioactive waste, other radiation sources and license conditions as well;
18) develop annual report on the status of nuclear and radiation safety in Ukraine, reports and overviews on these issues and submit these papers to the President of Ukraine, the Verkhovna Rada (the Parliament) of Ukraine, other state authorities, and local authorities and public organisations as well;
19) provide via mass media early notification about radiation accidents occurred at the territory of Ukraine and beyond its borders in case of transboundary transfer of radioactive substances;
20) arrange and co-ordinate development of reports on measures undertaken by Ukraine to fulfil commitments in respect to the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management as

well as other international agreements of Ukraine within its competence, approve such reports and represent them in respective international organizations;

21) discharge functions of competent authority and a contact point being responsible for the transmission of information and notification in case of a nuclear accident in pursuance to the Convention on early notification of a nuclear accident and other international agreements of Ukraine;
22) within the legally established procedure carry out international co-operation in the area of nuclear energy utilisation and nuclear and radiation safety;
23) take part in development of international agreements of Ukraine on issues related to its competence, offer proposals to conclude, denounce such agreements, and conclude international agreements of Ukraine within the limits of its authority;
24) offer proposals on fulfilment of commitments undertaken under international agreements of Ukraine concerning issues of nuclear and radiation safety, analyse the status of their fulfilment, co-ordinate measures related to implementation of the Agreement between Ukraine and the International Atomic Energy Agency for the «Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons»;
25) co-ordinate within its competence an interaction of executive authorities, enterprises, institutions and organisations with the International Atomic Energy Agency, other international organisations and authorities of foreign countries performing activity in the area of nuclear energy utilisation, ensure the observance of nuclear and radiation safety requirements, including the issues on combating the illicit trafficking of nuclear material, other radiation sources;
26) discharge functions of central authority and a contact point being in charge of physical protection of nuclear material in accordance with the Convention on Physical Protection of nuclear material;
27) discharge functions to manage state owned facilities which are subject to its management in accordance with the legislation;
28) review, within the legally established procedure, public inquiries concerning issues that are subject to its competence and within the limits of its authorities undertake measures to settle problems arisen in these inquiries;
29) implement, within its authority defined by the legislation, the state policy on the state secret; exercise, within the established procedure, control over keeping the state secret at Headquarters of the SNRCU and at enterprises, institutions and organisations that are subject to its authority;
30) ensure, within its authority defined by the legislation, the fulfilment of tasks on training mobilisation and the state mobilisation preparedness;
31) discharge other functions that are required to fulfil the entrusted tasks.

5. The SNRCU has the right:

to receive, within the legally established procedure, information, documents and records from central and local executive authorities, local authorities, that are necessary to fulfil of the entrusted tasks;

to involve specialists of central and local executive authorities, enterprises, institutions and organisations (upon approval of their Senior Management) to review issues related to the competence of the SNRCU;

to call meetings on issues related to the competence of the SNRCU within the established procedure;

to establish interagency commissions, expert and consultative boards, work groups upon approval of other central executive authorities;

to represent the Cabinet of Ministers of Ukraine, upon its commission, at international organisations and during signing process of international agreements of Ukraine;

to send out mandatory direction note (prescriptive reports) aimed to resolve revealed violations and drawbacks in the area of nuclear energy utilisation and concerning the observance of nuclear and radiation safety requirements to Licensees and their officers, Senior Managers of central and local executive authorities, local authorities;

to apply, according to the established procedure, financial sanctions to enterprises, institutions, organisations, businessmen in fault for breach of the legislation, norms, rules and standards on nuclear and radiation safety and permit conditions;

to limit, suspend and stop operation of enterprises, institutions, organisations, and facilities in case of their violation of nuclear and radiation safety requirements;

to hear reports of officials of central and local executive authorities and enterprises, institutions and organisations on nuclear and radiation safety, to receive required explanatory notes, materials and information on these issues from a Licensee or an owner;

to institute, within the established procedure, disciplinary proceedings to individuals in fault for breach of the legislation on nuclear and radiation safety;
to send out a notice on position inadequacy of some individuals to Licensees, owners or managers of enterprises;

to submit records on violations of requirements established by laws and other normative and regulatory acts on nuclear and radiation safety to law enforcement authorities;

to posses special vehicles to respond emergency situations;

Employees of the State Nuclear Regulatory Committee of Ukraine that are in charge of state supervision of the observance of laws, norms, rules and standards on nuclear energy utilisation, nuclear and radiation safety requirements have the right to have free clearance at any time to enterprises, institutions and organisations of all types of property to carry out, within the limits of their competence, relevant inspections and use other rights envisaged by the legislation.

6. The SNRCU, whilst discharging the entrusted tasks, shall interact with other central and local executive authorities, local authorities and relevant authorities of foreign countries.

7. The SNRCU shall carry authorities directly and through its territorial authorities (state inspection on nuclear safety) that are created in accordance with the established procedure.

8. The SNRCU, within the limits of its authority, basing on and meeting the legislation acts of Ukraine shall issue orders, arrange and control its fulfilment.
   The SNRCU shall issue Joint Acts together with other central and local executive authorities, if necessary.
   Normative and legal acts of the SNRCU shall be subject to state registration according to the legally established procedure.

In cases envisaged by the legislation decisions of the SNRCU shall be mandatory to central and local executive authorities, local authorities, enterprises, institutions and organisations of all forms of property and the citizens.

9. The SNRCU is headed by Chairman who shall be subject to appointment and dismissal by the President of Ukraine in accordance with the established legal procedure.
   The Chairman of the SNRCU shall bear personal responsibility for the entrusted tasks to Derzhatomreguluvannya of Ukraine and fulfilment of its functions to the President, the Cabinet of Ministers of Ukraine.
   The Chairman has Deputies which shall be subject to appointment and dismissal in pursuance to the legislation of Ukraine. One of the Deputies of the Chairman holds a position of Main State Inspector on nuclear safety of Ukraine.
   The Chairman shall perform the management of the SNRCU, distribute the duties among the Deputies, define the level of responsibility for the Chairman Deputies and Heads of Departments of the SNRCU.

10. With the purpose of proper co-ordination in settling issues that are subject to the competence of the SNRCU, discussion of primary important directions of its activity, a Collegium comprising of the Chairman (Chairman of the Collegium), his Deputies, other senior officials of the SNRCU shall be established within the SNRCU.
    Senior Managers of other central executive authorities and enterprises, institutions and organisations that are subject to the management of the SNRCU, representatives of public can be members of a Collegium as well.
    Members of a Collegium shall be subject to approval and dismissal from their duties by the Cabinet of Ministers of Ukraine upon a submission of the Chairman of the SNRCU.
    Decisions of a Collegium shall be put into effect by Orders of the SNRCU.

11. In order to consider scientific recommendations and proposals related to main directions for development of the activity of the SNRCU, to discuss priority issues on application of science and engineering achievements in the area of nuclear energy utilisation, ensure the observance of nuclear and radiation safety requirements, a scientific and engineering board, other consultative and advisory bodies can be established within the SNRCU.
    The Chairman of the SNRCU shall approve a composition of a board, other mentioned authorities and their Provisions.

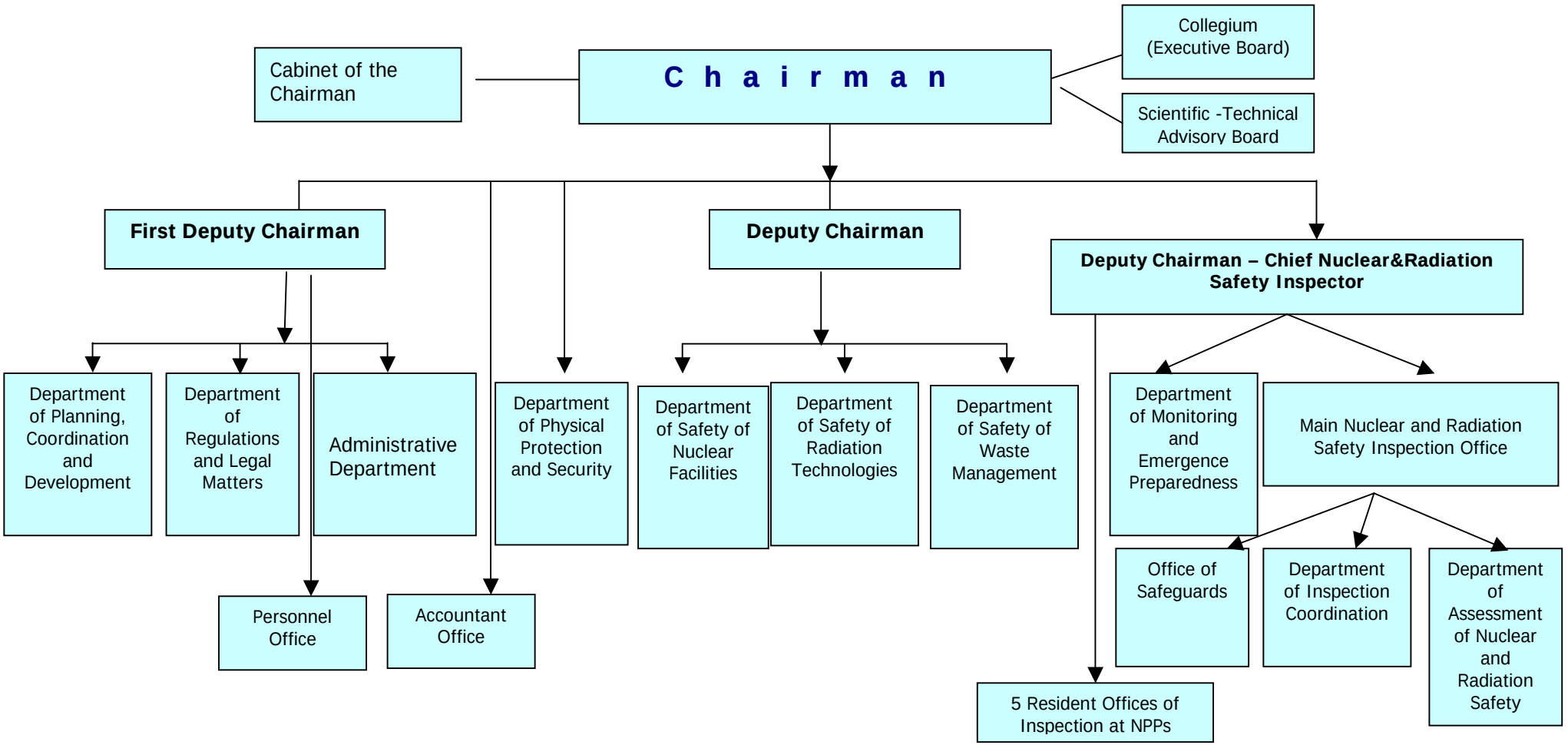
12. The Cabinet of Ministers of Ukraine can establish governmental state authorities (Departments, Services, Inspections) within the structure of the SNRCU.

13. The Cabinet of Ministers of Ukraine shall approve a limit of staff positions of employees of the SNRCU.
    The Chairman shall approve structure of the SNRCU.
    The Chairman upon approval by the Ministry of Finance of Ukraine shall approve staff positions and cost estimate of expenditures of the SNRCU.
    The Chairman of the SNRCU shall approve Provision on structural departments of the SNRCU.

14. The Committee is a legal entity, has independent balance and the seal representing both the National Emblem of Ukraine and its name.

Annex 5

Organizational Chart of the State Nuclear Regulatory Committee of Ukraine



Annex 6

NNEGC Energoatom's Electricity Tariff Estimate

Indicator	Unit	Amount	%
Number of Units		14	
Planned electricity delivery	M kWh	61974	
Production services	UAH (million)	588.5	11.2
Including			0
SNF removal (export)	UAH	443.5	8.5
Raw and materials	UAH	104.4	2
Fuel	UAH	1000	19.1
Energy delivered by the «side» organizations	UAH	3	0.1
Labor cost	UAH.	197.1	3.8
Payment to the Pension Fund	UAH.	63.1	1.2
Payment to the Social Insurance Fund	UAH	7.8	0.1
Payment to the Social Insurance Fund for Unemployment	UAH	2.9	0.1
Depreciation charges	UAH	619.6	11.8
Maintenance and repair costs	UAH	451.5	8.6
Including			0
Wages (labor cost)	UAH	58.1	1.1
Social Insurance Costs	UAH	21.9	0.4
Miscellaneous	UAH	200.9	3.8
Payment to the State Innovation Fund	UAH	52.5	1
Insurance of the NI operators' and personnel's civil liability	UAH	61.2	1.2
Prime cost	UAH	3352.5	63.9
Return	UAH	1128.1	21.5
Return being at the enterprise's disposal	UAH	789.7	15.1
Including	UAH		
- current disbursement from the return	UAH	491	9.4
Of them:	UAH		
Material incentive fund	UAH.	77.1	1.5
Social development fund	UAH	183.4	3.5
Production development fund	UAH	230.5	4.4
- capital investments	UAH	114	2.2
- centralized equipment and spare part stock	UAH	164.8	3.1
- increment (gains) (fuel)	UAH	19.9	0.4
Income tax	UAH	338.4	6.5
Commercial output	UAH	4480.7	
Electric power tariff	UAH /kWh	0.0723	0.001
Electric power tariff	cent/kWh	1.15	0
Target allocations for Kh-1, R-4 completion	UAH	595	11.3
Target allocations for Tashlyk Hydro Accumulative Power Station completion	UAH	167.3	3.2
Target price differential for completion of Kh-2, R-4.	UAH /kWh	0.0096	

Indicator	Unit	Amount	%
Target price differential for TPS completion	UAH /kWh	0.0027	
Commercial output	UAH	5243	100
Tariffs with price differential	UAH /kWh	0.0846	
Electricity tariff	cent/kWh	1.34	
Profitability	%	33.6	
Hr. /USD Exchange rate		6.3	

Annex 7

Number of NPP staff

(as of the 1st of January 2001)

No	Separate Entity - NPP	Industrial staff		Training of personnel for units under construction
		Operating personnel	Other personnel	
1.	Zaporizhzhya NPP	1403	7578	-
2.	South-Ukraine NPP	948	5466	-
3.	Rivne NPP	994	4557	669
4.	Khmelnitsky NPP	501	2763	453
5.	Chornobyl NPP	835	4826	-
Total		4681	25190	1122

Annex 8

Statement of the NNEGC Energoatom's policy in the field of Quality Assurance

The National Nuclear Energy Generating Company Energoatom, the operating utility of the Ukrainian nuclear power plants, considers its activity quality assurance as the most important mean of implementation safety tasks of the nuclear power plants.

NNEGC Energoatom understands that quality assurance is directly related to the confidence that requirements of safety codes and standards as well as conditions of the issued licenses are met and plans a set of interrelated, elaborate and economically feasible measures to assure quality of its activity.

The company formulates its quality assurance policy using the best practices of the other organizations which operate in the nuclear power utilization, takes into account working experience of the companies subdivisions and other actual aspects such as performance, available resources, external factors.

NNEGC Energoatom takes formulation and implementation of the QA policy as its direct responsibility and considers this activity a continuous process which involves appropriate efforts and resources and is based on assessment of the results and effectiveness of the activity.

The utility recognizes its responsibility for the quality systems effectiveness and undertakes to prove it through quality planning, quality management and improvement of the quality of its safety related activity.

NNEGC Energoatom sees the quality management as a common industrial function inherent in all structural subdivisions of the company and requiring efforts of all company's personnel to implement it**.** At that:

- All administrative managers of the NNEGC Energoatom shall be responsible for QA of their subordinate subdivisions' work.
- Every employee of the NNEGC Energoatom shall follow the policy applied in the industry by means of the conscious performance of his respective responsibilities, meeting appropriate quality requirements in his/her daily performance and achieving quality in his personal work, demonstrating his/her adherence to the QA policy.

NNEGC Energoatom will provide comprehensive support to the quality assurance, to the efforts of the personnel aimed at gaining high quality criteria of its performance in every possible way.

M.P. Dudchenko
President

Radiological Protection

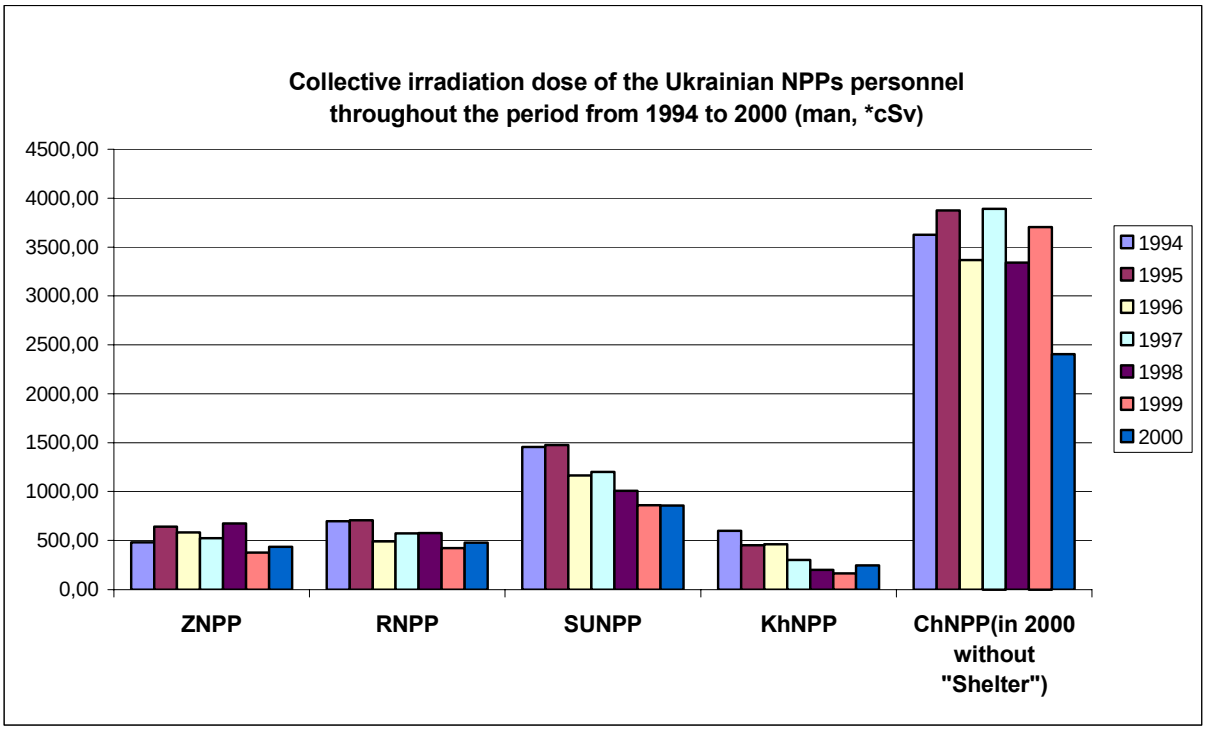


Fig.1. Trends of collective irradiation dose of the Ukrainian NPP personnel

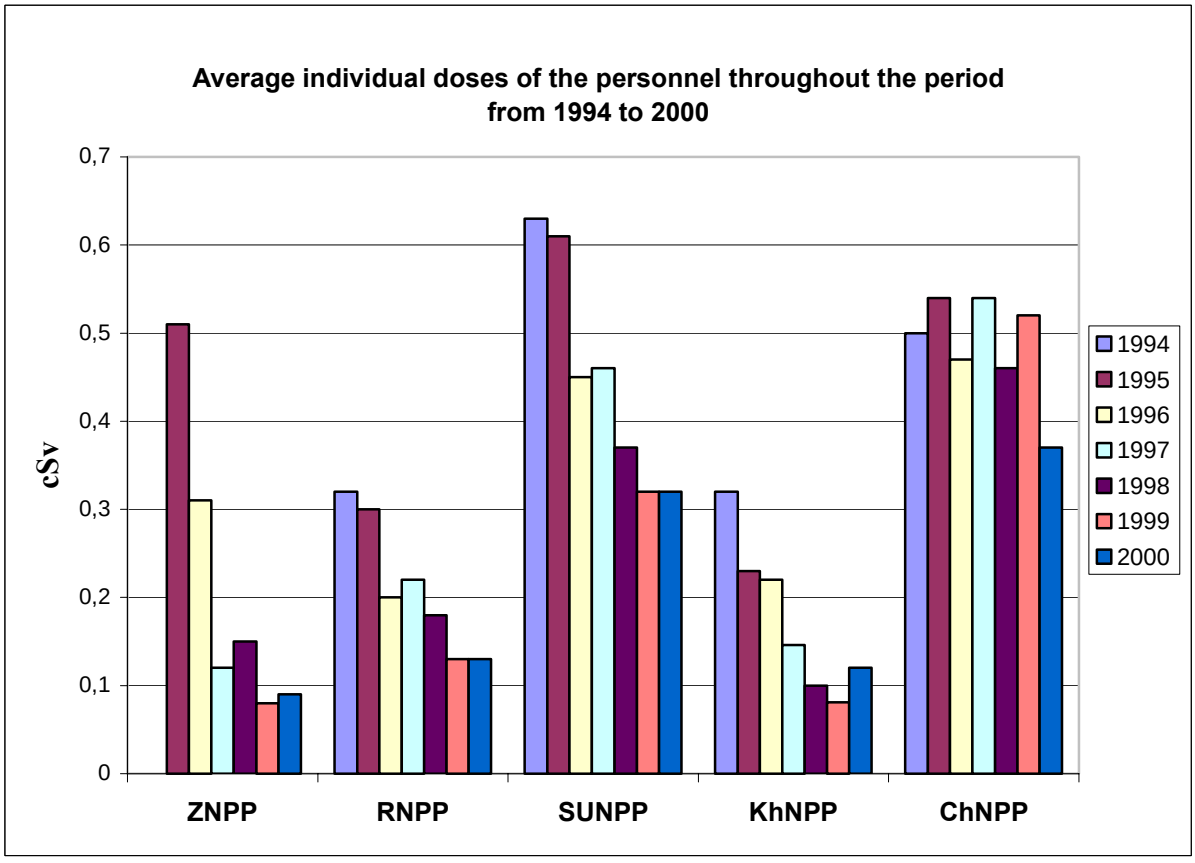


Fig.2. Trend of average annual individual dose of the personnel of the Ukrainian NPPs

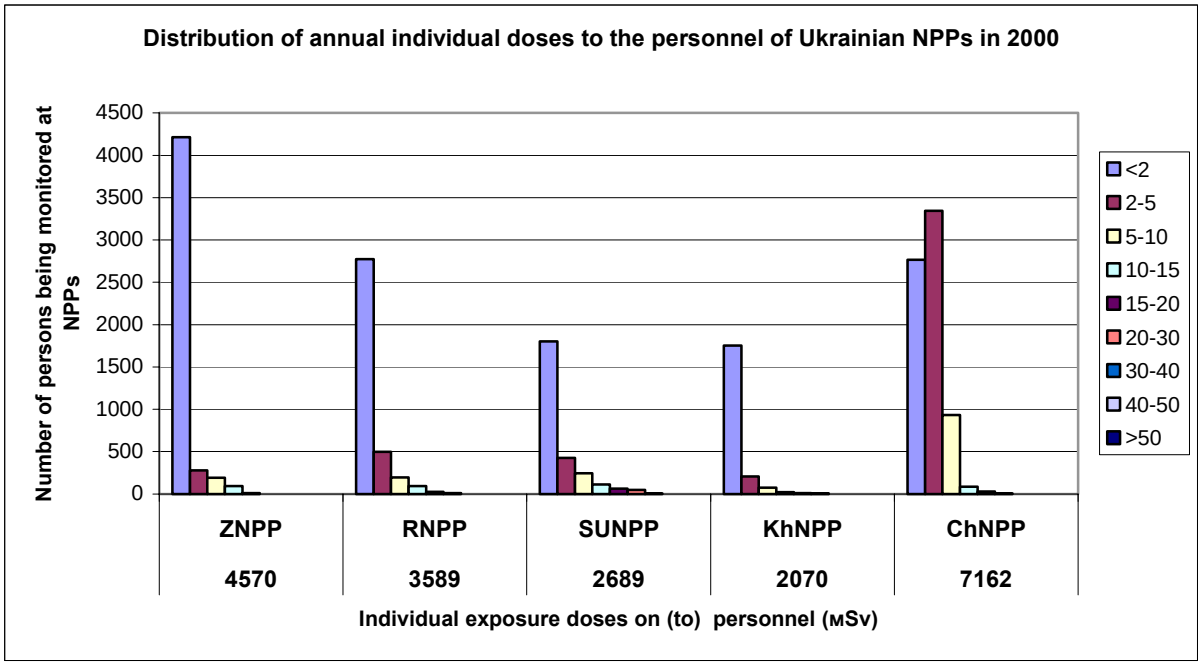


Fig.3. Distribution of annual individual doses of the personnel of the Ukrainian NPPs

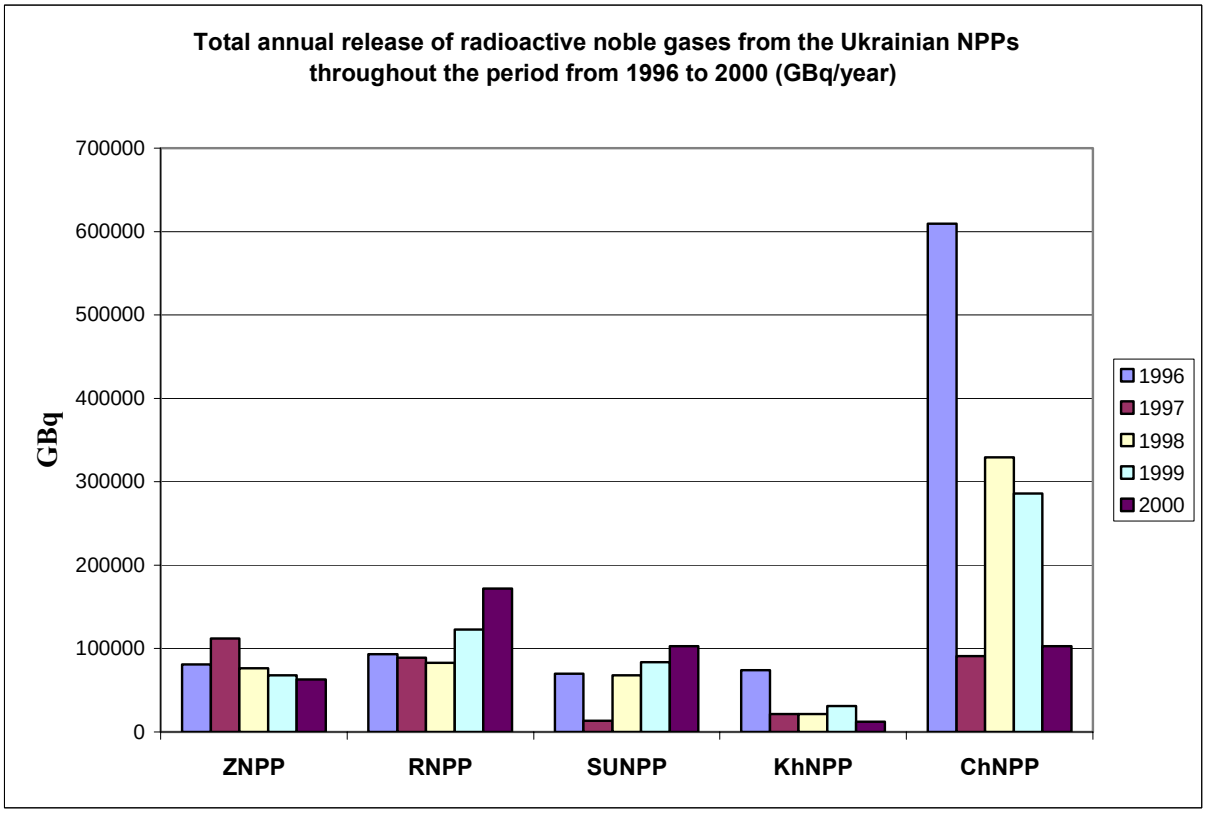


Fig 4. Trend of radioactive noble gase releases from the Ukrainian NPPs.

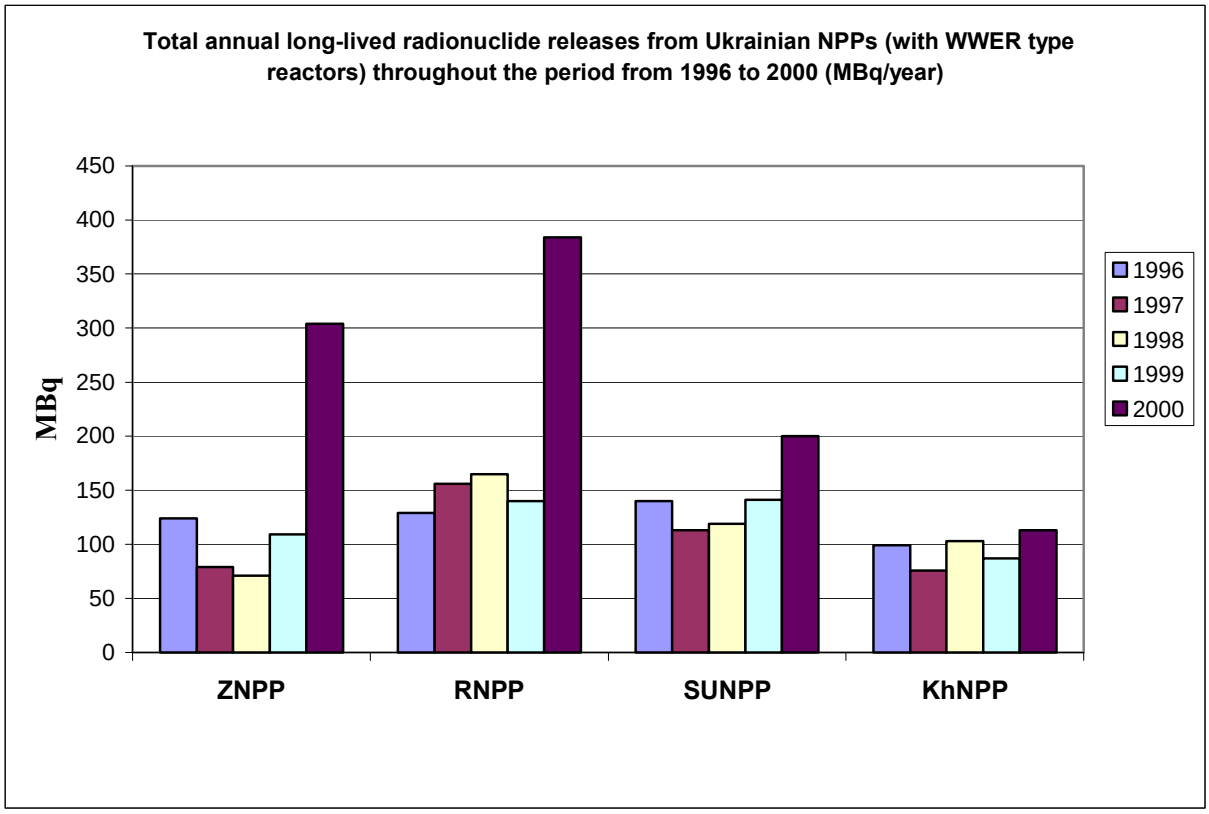


Fig. 5. Trend of long-lived radionuclide releases from the Ukrainian NPPs

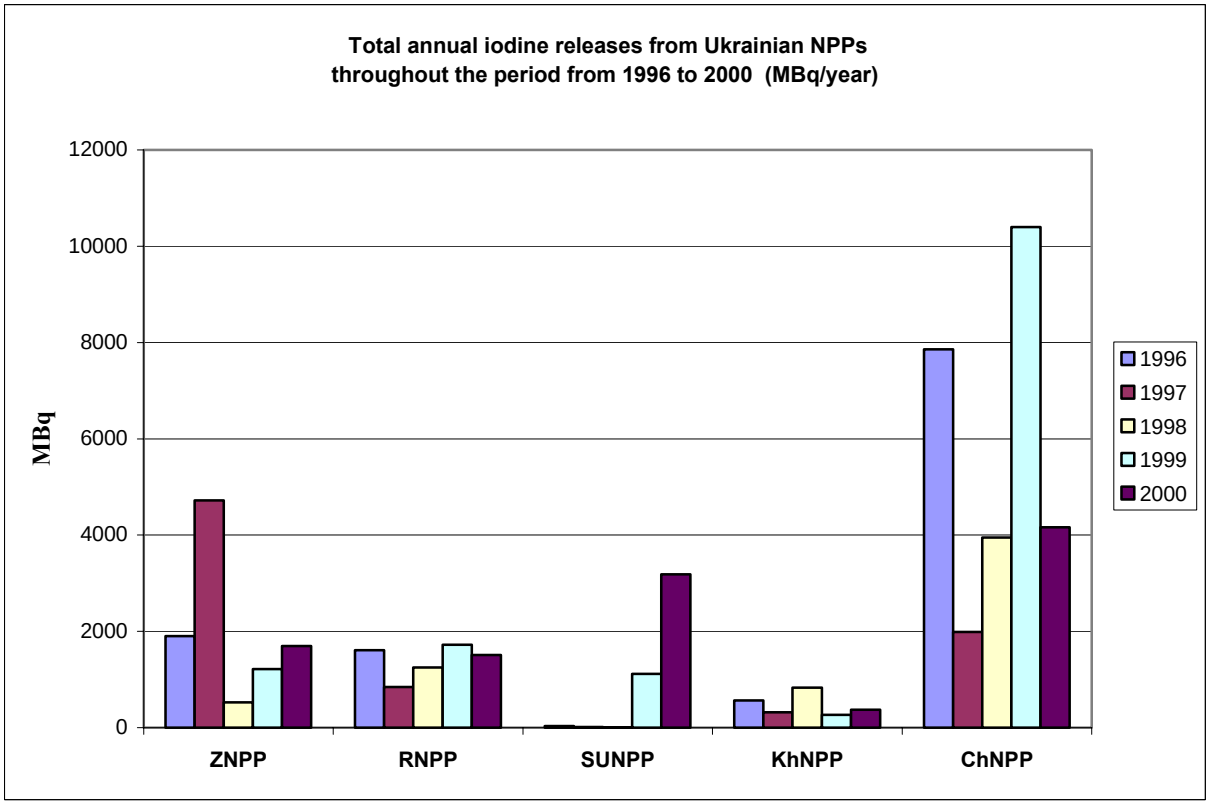
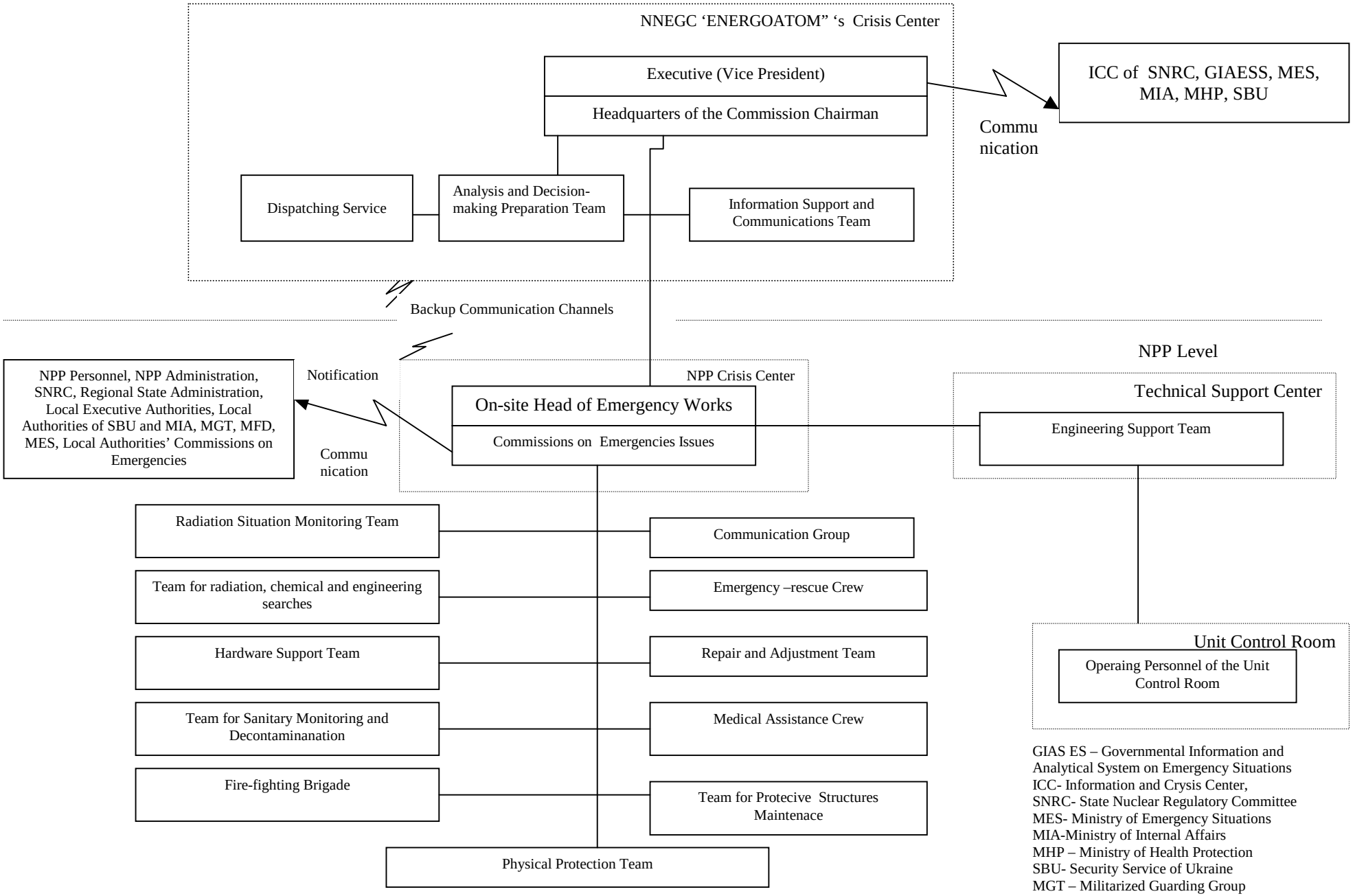


Fig.6. Trends of radioactive iodine releases from the Ukrainian NPPs

Table 1

NPP	**Cs-137**		**Cs-134**		**Co-60**		**Sr-90**	
	Maximum radionuclide content Bq/m^3	% of permissible concetration according to NRBU-97	Maximum radionuclide content Bq/m^3	% of permissible concentration according to NRBU-97	Maximum radionuclide content Bq/m^3	% of permissible concentration according to NRBU-97	Maximum radionuclide content Bq/m^3	% of permissible concentration according to NRBU-97
ZNPP	6.80×10^{-6}	8.50×10^{-4}	1.1×10^{-6}	1.10×10^{-4}	7.70×10^{-6}	7.70×10^{-4}	5.00×10^{-7}	2.50×10^{-4}
RNPP	1.45×10^{-5}	1.81×10^{-3}	2.20×10^{-6}	2.20×10^{-4}	2.20×10^{-6}	2.20×10^{-4}	No data	
SUNPP	3.00×10^{-4}	3.75×10^{-2}	1.72×10^{-5}	1.72×10^{-3}	2.58×10^{-5}	2.58×10^{-3}	1.6×10^{-6}	8.00×10^{-4}
KhNPP	5.33×10^{-6}	6.66×10^{-4}	4.37×10^{-7}	4.37×10^{-6}	3.66×10^{-6}	3.66×10^{-4}	2.82×10^{-6}	1.41×10^{-3}
ChNPP	2.92×10^{-3}	3.65×10^{-1}	1.26×10^{-4}	1.26×10^{-2}	1.07×10^{-4}	1.07×10^{-2}	3.26×10^{-4}	1.63×10^{-1}

Structure of the Emergency Response and Preparedness System of the NNEGC "Energoatom"



GIAS ES – Governmental Information and Analytical System on Emergency Situations
ICC- Information and Crysis Center,
SNRC- State Nuclear Regulatory Committee
MES- Ministry of Emergency Situations
MIA-Ministry of Internal Affairs
MHP – Ministry of Health Protection
SBU- Security Service of Ukraine
MGT – Militarized Guarding Group
MFD – Militarized Fire Department

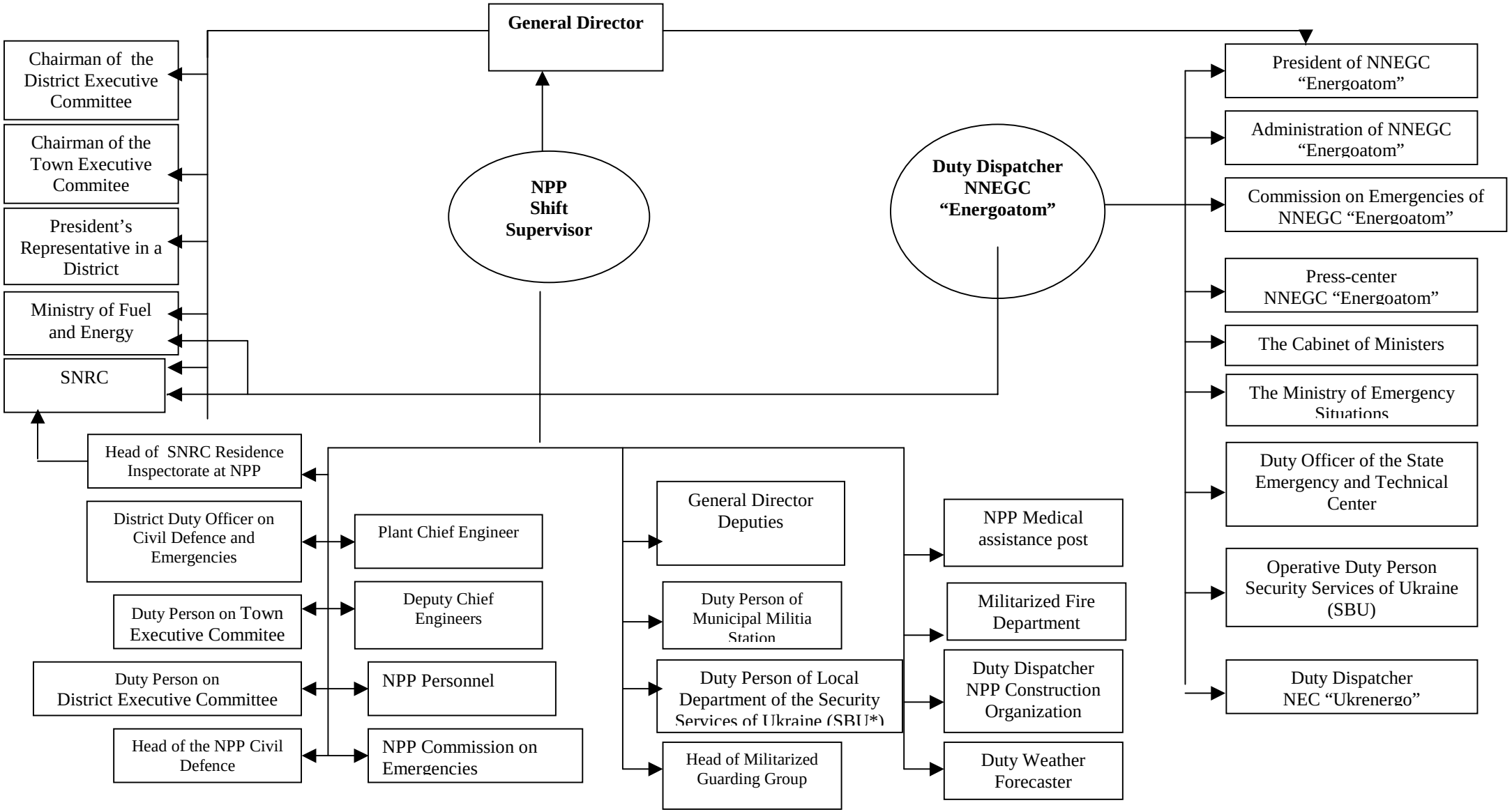
SUMMARY TABLE OF ACCIDENT AND EMERGENCIES CLASSIFICATION

Category of Accidents (Events) within the Emergency Response System	Conformity to the Classification Systems		
	Normative document (ND 306.205-96[1]) on Violation Categories	Ministry of Emergency Situations Emergency Level, Emergency Code (Identification Code)	IAEA Accident Categories
Non-radiological Accident	P02-P10	On-site	Preparedness
Accident on Site	P01/2		Local Accident
General Accident	P01/1, A03, A04	Local	General Accident
	A02, A03	Regional	
	A01	National	

[1] This should be revised and needs to be brought it into accord with NRBU-97 (*Ukrainian Norms of Radiological Safety –97)*

Annex 12

Diagram of Notification in Case of Accident and Emergencies at NPPs



Dynamics of radioactive waste storages filling

South-Ukraine NPP

Table 1

Dynamics of the Liquid Radwaste Storages Filling at SUNPP for the last 6 Years

Years of Operation	1995	1996	1997	1998	1999	2000
Liquid Radwaste Storage Filling, m^3	2731	2142	2150.5	2658.8	2696	2860

Design capacity of the Liquid Radwaste Storages - 4351 m^3

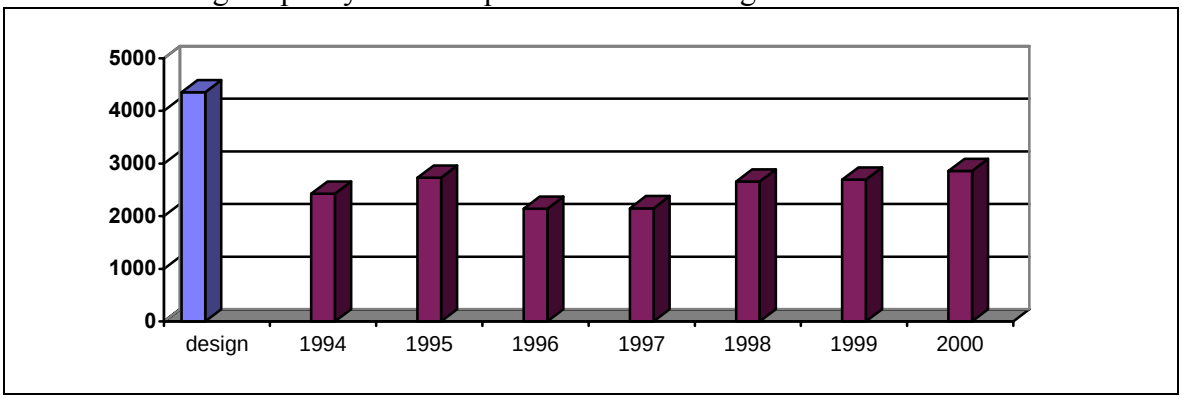


Fig.1 - Dynamics of the Liquid Radwaste Storage Filling at SUNPP

Table 2

Solid Radwaste Storage Filling at SUNPP for the last 6 Years

Years of operation	1995	1996	1997	1998	1999	2000
Solid Radwaste Storage Filling, m^3	11324	12455	12828	13583.9	14062.5	14201

Design capacity of the Solid Radwaste Storages - 16825 m^3

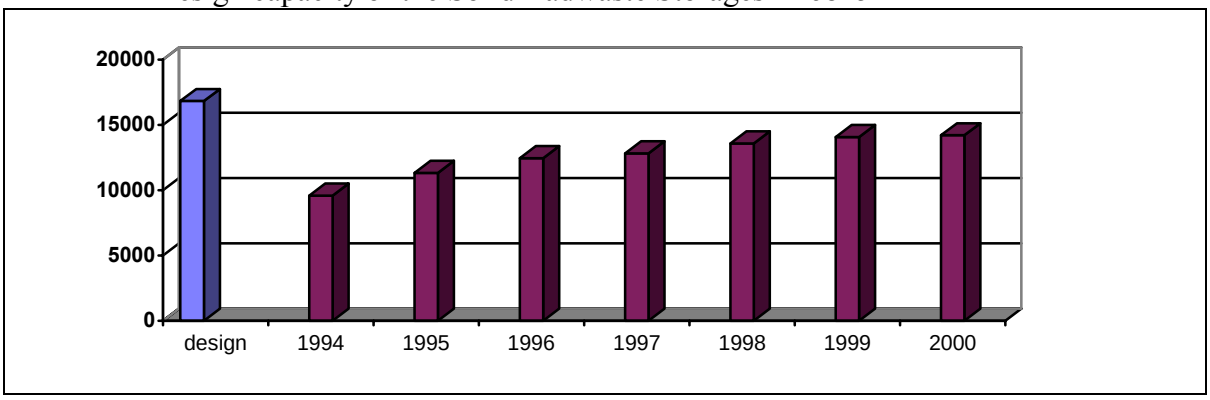


Fig. 2 – Dynamics of the Solid Radwaste Storage Filling at SUNPP

Khmelnitsky NPP

Table 3

Dynamics of the Liquid Radwaste Storages Filling at KhNPP for the last 6 Years

Years of Operation	1995	1996	1997	1998	1999	2000
Liquid Radwaste Storage Filling, m^3	486	609.5	605.6	606.4	625.6	604

Design capacity of the Liquid Radwaste Storages - 800 m^3

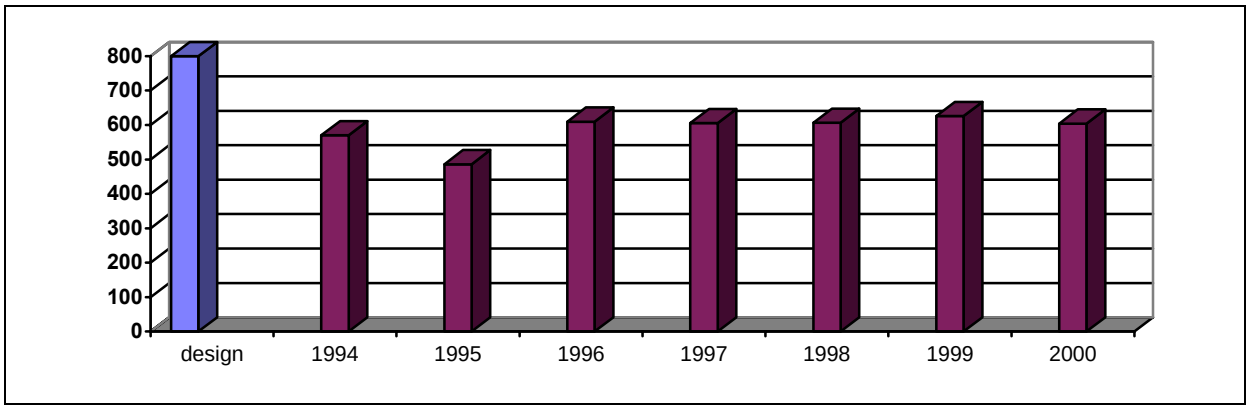


Fig. 3 - Dynamics of the Liquid Radwaste Storage Filling at KhNPP

Table 4

Solid Radwaste Storage Filling at KhNPP for the last 6 Years

Years of operation	1995	1996	1997	1998	1999	2000
Solid Radwaste Storage Filling, m^3	1494.4	1606	1954.7	2309	2426.6	2484

Design capacity of the Solid Radwaste Storages - 6371,1 m^3

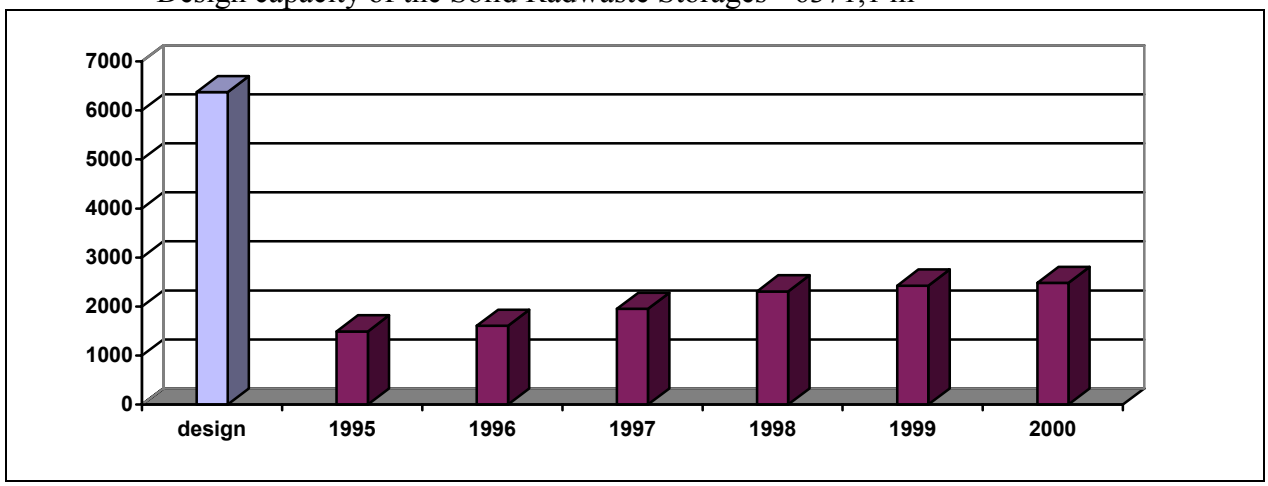


Fig. 4 - Dynamics of the Solid Radwaste Storage Filling at KhNPP

Chornobyl NPP

Table 5

Dynamics of the Liquid Radwaste Storages Filling at ChNPP for the last 6 Years

Years of Operation	1995	1996	1997	1998	1999	2000
Liquid Radwaste Storage Filling, m^3	11950	12354	12982	18602.1	18837.9	18974

Design capacity of the Liquid Radwaste Storages - 37000 m^3

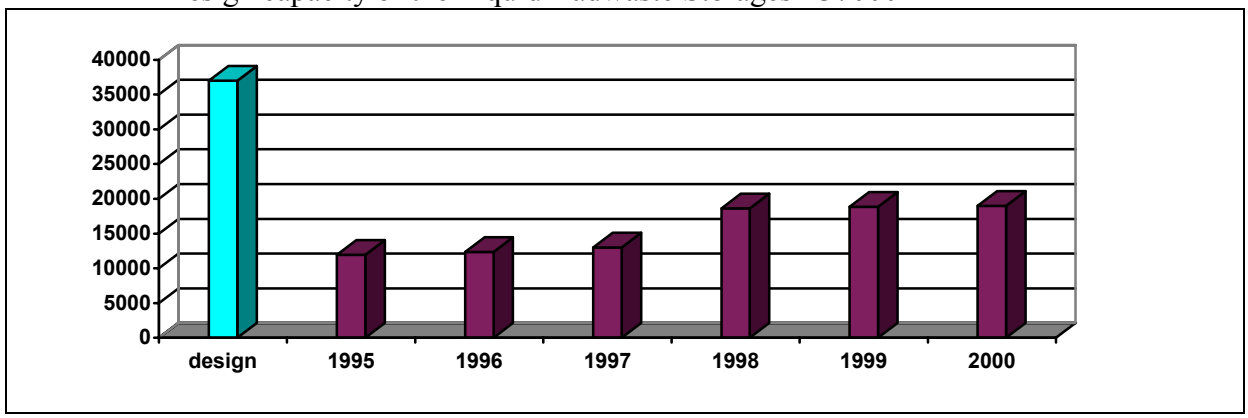


Fig. 5 - Dynamics of the Liquid Radwaste Storage Filling at ChNPP

Table 6

Solid Radwaste Storage Filling at ChNPP for the last 6 Years

Years of operation	1995	1996	1997	1998	1999	2000
Solid Radwaste Storage Filling, m^3	2352	2373	2413	2461	2485	2492

Design capacity of the Solid Radwaste Storages - 3976 m^3

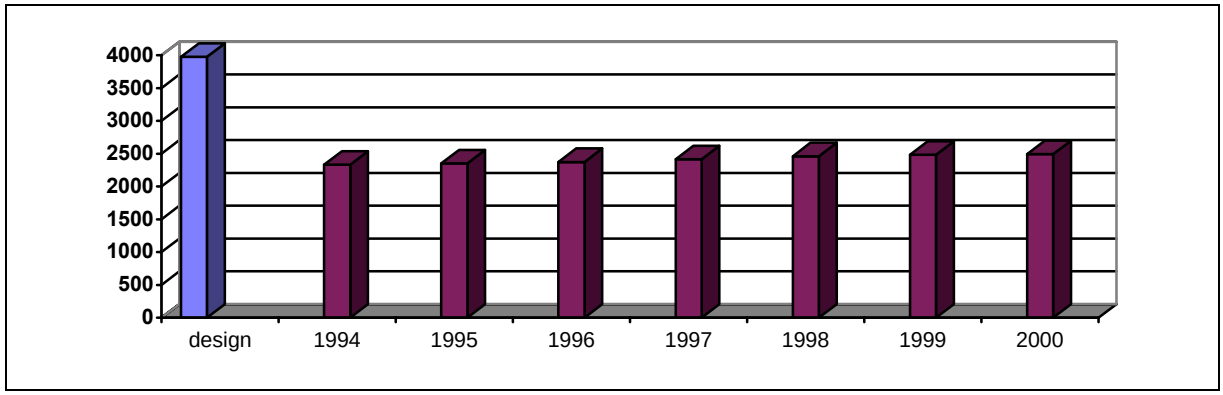


Fig. 6 - Dynamics of the Solid Radwaste Storage Filling at ChNPP

At Chernobyl NPP the available or empty capacities of the solid radwaste storages are maintained at the 40 % level owing to the solid radwaste transfer to the radwaste disposal (burial) area («Buriakivka») due to the lack of the solid radwaste treatment facilities at Chernobyl NPP.

Zaporizhzhya NPP

Table 7

Dynamics of the Liquid Radwaste Storages Filling at ZNPP for the last 6 Years

Years of Operation	1995	1996	1997	1998	1999	2000
Liquid Radwaste Storage Filling, m^3	2600	2806	2525	3335	2060	3420

Design capacity of the Liquid Radwaste Storages - 4800 m^3

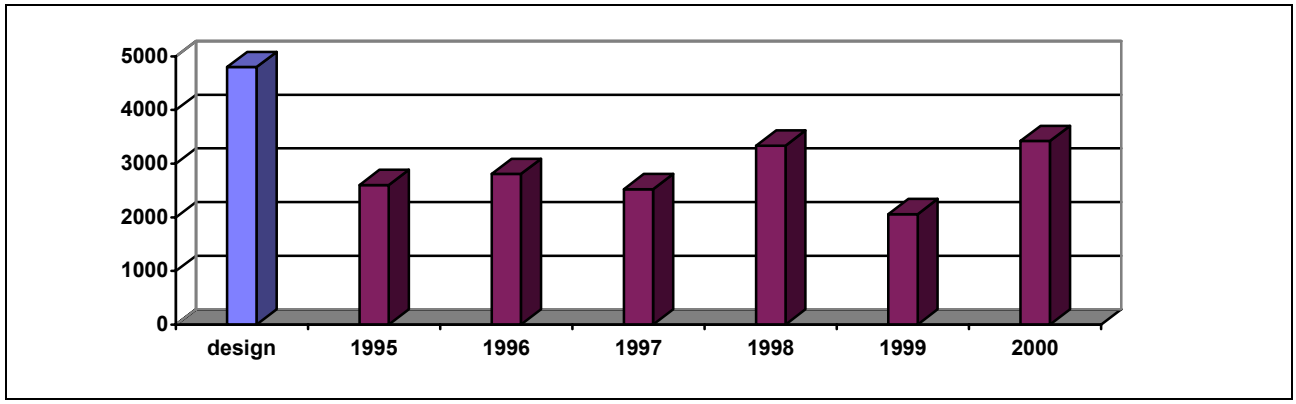


Fig. 7 - Dynamics of the Liquid Radwaste Storage Filling at ZNPP

Significant increase in liquid radwaste volume located at the interim LRW disposal facility on Zaporizhzhya site (60% - 1999, 71% - 2000) was related to the deep evaporator down time because of the lack of casks in 2000.

Table 8

Solid Radwaste Storage Filling at ZNPP for last 6 Years

Years of operation	1995	1996	1997	1998	1999	2000
Solid Radwaste Storage Filling, m^3	10731	6483	6012.4	6528.5	6974.2	7208

Design capacity of the Solid Radwaste Storages – 19522.1 m^3

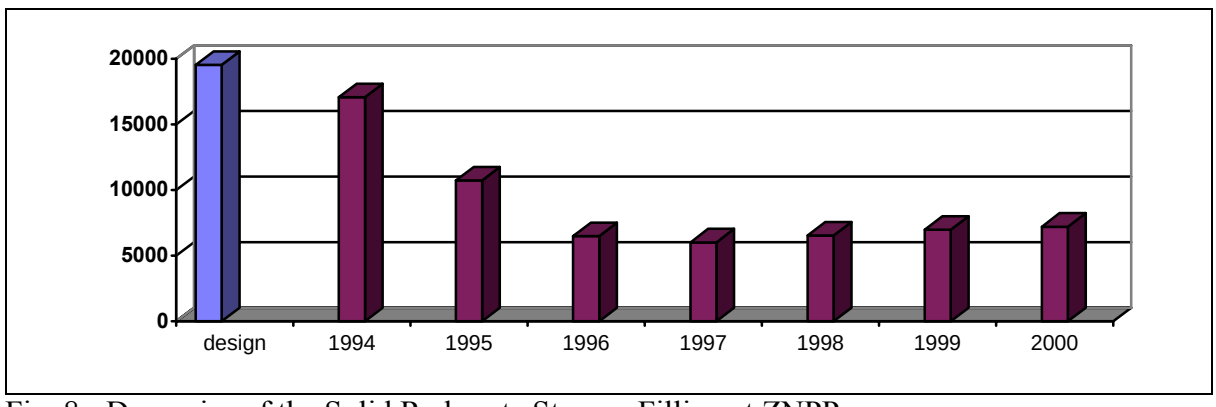


Fig. 8 - Dynamics of the Solid Radwaste Storage Filling at ZNPP

Rivne NPP

Table 9

Dynamics of the Liquid Radwaste Storages Filling at RNPP for the last 6 Years

Years of Operation	1995	1996	1997	1998	1999	2000
Liquid Radwaste Storage Filling, m^3	6302	6118	6091	6454	6214	6114

Design capacity of the Liquid Radwaste Storages - 8180 $м^3$

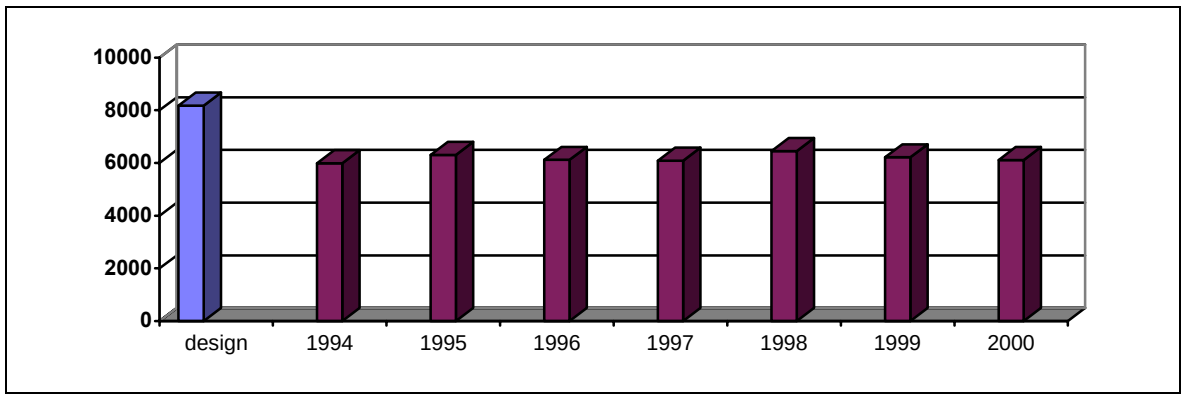


Fig. 9- Dynamics of the Liquid Radwaste Storage Filling at RNPP

Table 10

Solid Radwaste Storage Filling at RNPP for the last 6 Years

Years of operation	1995	1996	1997	1998	1999	2000
Solid Radwaste Storage Filling, m^3	1517.3	2616.3	2918	3195.2	3457	3560

Design capacity of the Solid Radwaste Storages – 10309.6 m^3

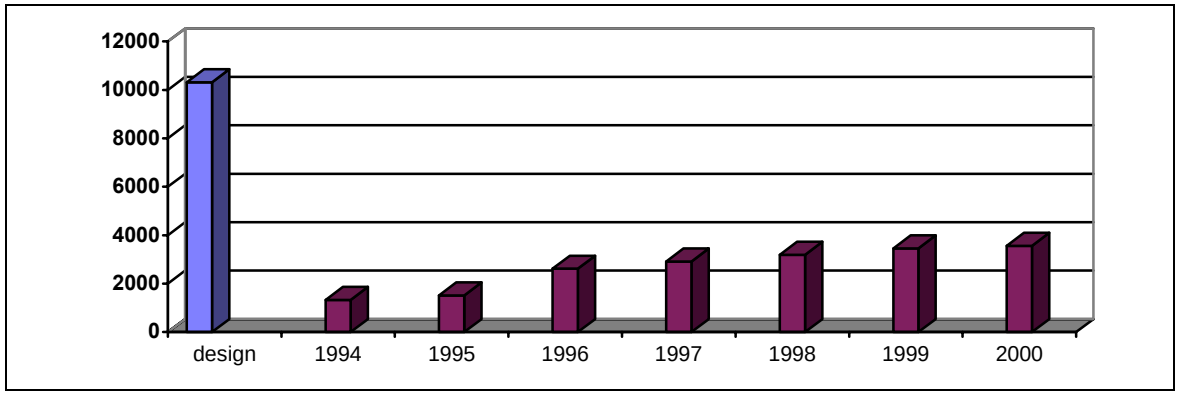


Fig. 10 - Dynamics of the Solid Radwaste Storage Filling at RNPP