DEAR READERS!

You are holding the Annual Report on Nuclear and Radiation Safety in Ukraine, 2006. As previous annual reports, it will give you a lot of important and various information on nuclear and radiation safety problems in Ukraine, governmental authorities and nuclear industry enterprises activity.

The report materials give you the insights of the legal basis of activities in the area use of nuclear energy; the main areas of activity of control and regulatory Bodies in this area; activities, which have been performed throughout the reporting period to enhance the level of nuclear and radiation safety in Ukraine.

We are kindly appreciated for your proposals, comments and wishes about the Report content and structure improvement.

Looking forward that this year, thanks to your assistance, the Report information becomes more understandable and convenient.

If, after you have read the report, there would be more questions from you, do not hesitate to ask them during our telephone hotlines or during the visiting hours for citizens arranged by the management of the State Nuclear Regulatory Committee of Ukraine. The information on the time and place of these arrangements you may find at the web-site of the State Nuclear Regulatory Committee of Ukraine: www.snrc.gov.ua

CHAIRPERSON
of the State Nuclear
Regulatory Committee of Ukraine

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List of Abbreviations

ChNPP – Chernobyl NPP
CMU – Cabinet of Ministers of Ukraine
ETC – Emergency Technical Centre
FCM – Fuel-Containing Masses
FE – Fuel Element
FS – Feasibility Study
IAEA – International Atomic Energy Agency
IAMS – Shelter integrated automated monitoring system
ICSRM – Industrial Complex for Solid Radioactive Waste Management
IEC – Information/Emergency Center
INES – International Nuclear Events Scale
IRS – Ionizing Radiation Source
KhNPP – Khmelnitsky NPP
KNRI – Kyiv Nuclear Research Institute of the National Academy of Sciences of Ukraine
LRTP – Liquid Radwaste Treatment Plant
MFA – Ministry of Foreign Affairs
MFE – Ministry of Fuels and Energy
MHB – Multi-Place Hermetical Basket
MJU – Ministry of Justice of Ukraine
MUE – Ministry of Ukraine for Emergencies and Affairs of Population Protection from Consequences of the Chernobyl Catastrophe
NASU – National Academy of Sciences of Ukraine
NAEK "Energoatom" – National Nuclear Generating Company "Energoatom"
NI – Nuclear Installations
NM – Nuclear Materials
NNPT – Nuclear Non-Proliferation Treaty
NPU – Nuclear Power Unit
NPP – Nuclear Power Plant
NSC – New Safe Confinement
NSCKPI – National scientific centre "Kharkiv Physics/technical Institute"
PE – Public Enterprise
PPS – Physical Protection System
SO – Scheduled Outage
RA – Regulatory Act
Radwaste – Radioactive Waste
RIA – Risk-Informed Approaches
RNPP – Rovno NPP
RWDP – Radioactive Waste Disposal Point
SA – State Association
SAR – Safety Analysis Report
SE – Separate Entity
SEIAS – State emergencies informational and analytical system
SFA – Spent Fuel Assembly
SFSF – Storage Facility for Spent Nuclear Fuel
SINEI – Sevastopol Nuclear Energy and Industry Institute
SIP – "Shelter" Implementation Plan
SISP – State Interregional Specialised Plant
SNF – Spent Nuclear Fuel
PSA – Probabilistic Safety Analysis
SRW – Solid Radioactive Waste
ICSRM – Solid Radioactive Waste Management Industrial Complex
SSE – State Specialized Enterprise
SSTCNRS – State Science and Technical Centre For Nuclear and Radiation Safety
TACIS – Technical Assistance For The Commonwealth Of Independent States
URSS – Ukrainian Radiation Safety Standards
VSC – Ventilated Storage Cask
WWER – Water Cooled Power Reactor
SUNPP – South Ukraine NPP
ZNPP – Zaporizhzhya NPP

Introduction

In 2006 the nuclear and radiation safety remained the unchanging focus of mass media and the public, it was repeatedly referred to by governmental and political speakers.

The 20th anniversary of the Chornobyl accident provided a good occasion to objectively evaluate the current status of nuclear and radiation safety in Ukraine. Over two decades which passed after the Chornobyl disaster, the safety at operating nuclear plants has being improved, along with designing of new units having backup safety systems, solving problems of burying radioactive waste. All this, together with increased prices to be paid for conventional energy, someway helped to vindicate nuclear energy to the global and Ukrainian community.

Presently Ukraine appears as a state which does not only combat the consequences of the severe man-induced catastrophe, but also is optimistic about the future.

This is also reflected in the Energy Strategy of Ukraine until 2030 adopted by the resolution of the Cabinet of Ministers of Ukraine in March 2006. Similarly to nuclear energy development strategies of the United States, Russian Federation, Finland, France and other countries, the Energy Strategy of Ukraine is aimed at increasing generating capacities by constructing new power units.

Ukraine widely uses nuclear energy technologies, especially ionizing radiation. The use of these sources shows the most striking results in the medical sector. Presently, new diagnostic care centres are created to implement advanced technologies using ionizing radiation.

Such active development of nuclear energy in Ukraine demands more activity from state safety regulators in every area – to protect personnel, population, patients, environment.

In this Report the State Nuclear Regulation Committee of Ukraine (SNRCU) overviews the status of nuclear and radiation safety in all areas and sectors that use nuclear materials and ionizing radiation sources; provides information on activities carried out by authorities to reduce and prevent adverse effect of ionizing radiation on people and environment. While developing the Report, materials presented by the Ministry of Health, the Ministry of Fuel and Energy of Ukraine and the Ministry of Ukraine of Emergencies and Affairs of Population Protection from the consequences of Chornobyl Catastrophe, inspection results, licensees' reports, other information from public sources were compiled.

Legal Framework in the Area of Nuclear Energy

In 1991, having won the independence, Ukraine acquired a strong armoury of nuclear weapons and five nuclear power plants with 14 units under operation. From the Soviet Union it inherited some institutions and industrial works which used ionizing radiation sources; works which used some radioisotope devices; producers and processors of autunite. At the same time, there was practically no legal framework to regulate rights, duties, responsibilities of participants in the nuclear energy sector. And so newly independent Ukraine actively started to develop the national nuclear legislation.

As the first step in creating the legal framework in the area of nuclear energy, 25 January 1994 the Verkhovna Rada of Ukraine adopted the Concept of State Nuclear Safety Regulation and Nuclear Energy Management in Ukraine. It set the basis for the state safety regulation in the area of nuclear energy and basic principles of the nuclear legislation, as follows:

- *priority of people protection against impact of radiation;*
- *prohibition to conduct certain activities in the area of nuclear energy without a license;*
- *state supervision in the area of nuclear energy utilization.*

The next step was adopting by the Verkhovna Rada of Ukraine the Law of Ukraine "On Use of Nuclear Energy and Radiation Safety' of 8 February 1995, which was a basic law in regard to the safe use of nuclear energy and radiation safety. It was the first law to move forward the human and environmental safety, set forth rights and duties of citizens in the area of nuclear energy; regulate activities related to operation of nuclear installation and ionizing radiation sources, etc. Furthermore, the Law stated the rights of citizens and their associations to get information in the area of nuclear energy and radiation safety, participate in shaping policy in this area, socioeconomic conditions of living and working near producers of uranium ore, nuclear units and radioactive waste management facilities; citizens' rights to be recompensed for harm caused by adverse effect of ionizing radiation in the process of nuclear energy utilization. This Law also outlined the competences of authorities and regulators in the area of nuclear energy and radiation safety; established state safety regulation in the area of nuclear energy; determined the legal status of legal and natural persons carrying out activities in the area of nuclear energy and radiation safety; set requirements to the location, construction, commissioning and decommissioning of units and radioactive waste management facilities; applied a special control for sites where units and radioactive waste management facilities are located; regulated responsibility of an operator for nuclear damage and enforced the liability for violating laws in the area of nuclear energy and radiation safety, etc.

Arrival of this Law promoted further development of nuclear legislation of Ukraine, especially, the adoption of the laws of Ukraine "On Radioactive Waste Management" (30 June 1995), "On Mining and Milling of Uranium Ores" (19 November 1997), "On Protection of Peaple Against Ionizing Radiation" (14 January 1998), "On General Principles of Further Operation and Decommissioning of Chornobyl NPP and Transformation the Ruined Fourth Power Unit of This NPP into an Ecologically Safe System" (11 December 1998), "On Permit Activity in the Area of Nuclear Energy Use" (11 January 2000), 2000), "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Ionizing Radiation Sources" (19 October 2000), "On Civil Liability for Nuclear Damage and Its Financial Assurance" (13 December 2001), "On Settling the Issues Related to Enshuring Nuclear Safety" (4 June 2004), "On the Procedure for Decision-Making on Siting, Designing, Constructing Nuclear Installations and Radioactive Waste Management Facilities Having National Significance" (8 September 2005) and other laws.

A number of international treaties acceded to by Ukraine became a component of the national nuclear legislation. Primarily, it is the Nonproliferation Treaty acceded to by Ukraine as a nonnuclear weapon state in December 1994. Article 3 of the Treaty obliges each nonnuclear member-state to accept International Atomic Energy Agency (IAEA) safeguards on nonproliferation of nuclear material. 21 September 1995 Ukraine also has signed the treaty, and the Verkhovna Rada of Ukraine has ratified it 17 December 1997.

It also includes the Vienna Convention on Civil Liability for Nuclear Damage of 1963 which puts absolute liability for nuclear damage on the operator. The said Convention entered into force for Ukraine 12 July 1996.

Ukraine also obeys the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (26 September 1986), Convention on Early Notification of a Nuclear Accident (30 December 1986), Convention on the Physical Protection of Nuclear Material (5 September 1993), Nuclear Safety Convention (17 December 1997), Joint Convention on the Safety of Radioactive Waste Management (20 April 2000).

The system of the national nuclear legislation also includes: regulations of the Cabinet of Ministers of Ukraine establishing the mechanism for applying the laws; regulations of central executive bodies, including rules and standards establishing safety criteria and requirements which apply to nuclear facilities, ionizing radiation sources, as well as conditions and technical requirements regulating safety of operations and procedures in the area of nuclear energy. (The list of the mentioned regulations in force since 2006 is presented in Annex 1).

In this way, within a relatively short period Ukraine managed to create its own nuclear legislation, however, the number of regulations grows every year, as a result of streamlining relations in the area of nuclear energy. Legal regulation of relations in the area of nuclear energy still shows a lot of gaps, inconsistencies, overlaps between separate provisions in the area of nuclear energy, rules of adjacent legislation. All this complicates the application of laws, leads to ambiguous interpretation and slackens their effectiveness. Therefore, competent authorities continuously reshape regulations in the area of nuclear energy by reviewing the old and developing the new ones, including in the context of adapting the domestic legislation to EU laws.

In 2006 activities aimed at improving the nuclear legislation of Ukraine were amazingly brisk. Within the framework of its regulatory activity, only the SNRCU has drafted the Law "On Amending Article 11 of the Law of Ukraine "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Ionizing Radiation Sources' and the Law "On Amending the Law of Ukraine "On Permit Activity in the Area of Nuclear Energy Use".

The Verkhovna Rada of Ukraine met 29 November 2006 to adopt the draft Law "On Amending Article 11 of the Law of Ukraine "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Ionizing Radiation Sources' at the first reading.

Amendments to article 11 allow foreigners who duly went through the special examination, obtained authorisations of competent authorities allowing the foreigners to carry out special activities, and received instructions on staying in strict control area, nuclear, radiation and fire safety, etc. to carry out special activities and and stay in restricted areas without being accompanied by Ukrainian officials, based on an instruction of the central executive body that governs companies, institutions, organisations where the special activities are carried out.

Presently, in accordance with law in force, foreigners and stateless persons carry out special activities on Ukrainian units only with Ukrainian specialists at their side, which, in its turn, significantly complicates the flow chart of the process, leads to ineffective use of work time by foreign and domestic specialists.

The said legislative amendments will promote effectiveness of Ukraine's carrying out international treaties aimed at decommissioning of the Chornobyl NPP and transformation the Shelter Object into an ecologically safe system, improve the investment climate in Ukraine to attract foreign investments in the area of nuclear energy.

As regards the amendments to the Law of Ukraine "On Permit Activity in the Area of Nuclear Energy', they came from the need to eliminate shortcomings, resolve differences in the area of licensing activities revealed as applying current laws.

The adoption of the said draft law will render the license treatment existing in the area of nuclear energy stricter and more spacious. At the same time, the licensing procedures themselves will become predictable and more transparent.

The draft Law defines new terms in comparison with the applicable Law of Ukraine "On Permit Activity in the Area of Nuclear Energy'; the law states that the licensing system involves issuing certificates for transporting radioactive materials; establishes standards for issuing a duplicate of a license.

Also licensing activities were revised, especially, by implementing licensing of activities of the operator's officials who perform organisational and managerial functions related to nuclear and radiation safety. Furthermore, the draft law extends licensing to the personnel controlling not only power, but research reactors as well.

The Law applies to all relations arising as a result of using nuclear energy by military formations and institutions for non-military purposes. Thus, if military formations and institutions or their subordinated organizations (medical, constructing, etc.) use, for example, ionizing radiation sources (IRS), they will be governed by the provisions of the mentioned Law. This will strengthen control over these IRS, create an effective system to prevent their illegal trafficking.

The existing obligations of nuclear energy users were extended to include informing citizens and their associations about the status of safety as carrying out licensed activities.

It should be also noted that the proposed draft Law establishes the liability of nuclear energy users for violation of licensing procedures specified in the draft law, or non-performance or slack performance of conditions set for carrying out activities in the area of nuclear energy covered by the licensing procedures under the law. This covers a gap in the domestic legislation which previously imposed administrative sanctions on natural persons, and simultaneously meets the requirements of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and the Nuclear Safety Convention ratified by Ukraine.

In order to promote social protection of the population living in areas which may be exposed to radiation from a power unit and radioactive waste management facilities, establish mechanisms for creating the social infrastructure, types, scopes and sources of compensation for the risk to people living in the observation zones, the Law of Ukraine "On Amending Certain Laws on Social Protection of Population Living in Observation Zones' of 5 October 2006 was passed. Availability of the necessary social protection of the population, social infrastructure in an observation zone is one of factors improving security of operation of units, reducing the risk factor qualified as the "human" factor.

During 2006 the Cabinet of Ministers of Ukraine approved a series of regulations and instructions related to nuclear and radiation safety:

- *in order to regulate financing civil liability of operators of research reactors of Ukraine for possible nuclear damage, Cabinet of Ministers' regulation No. 996 of 19 July 2006 amended Cabinet of Ministers' regulations No. 953 of 23 June 2003 "On Compulsory Insurance for Nuclear Damage Liability' and "On Tariff Calculation Procedure for Liability Insurance' of 20 August 2003;*

- *Cabinet of Ministers' regulation No. 1829 of 27 December 2006 amended Cabinet of Ministers' regulations No. 1471 of 25 December 1997 "On Approving the Procedure for Special Inspection to Permit Individuals to Work on Nuclear Installations, with Nuclear Material, Radioactive Waste, Other Ionizing Radiation Sources' and No. 625 of 26 April 2003 "On Approving the Procedure for Determining the Level of Physical Protection of Nuclear Installations, Nuclear Material, Radioactive Waste, Other Ionizing Radiation Sources Based on Their Categories', which will facilitate the procedure of determining the level of physical protection of power units, nuclear material, radioactive waste, other ionizing radiation sources, as well as conducting the special inspection to permit individuals to carry out special activities on power units, with nuclear material, radioactive waste, other ionizing radiation sources';*

- *in late 2006 the Cabinet of Ministers' Regulation No. 1830 "On Approving the Provision On the State Nuclear Regulation Committee of Ukraine' was adopted. The said document brought the Provision in line with the Constitution of Ukraine which, as amended in 2004, requires approval of the Provision by the Cabinet of Ministers' regulation. Furthermore, the Provision is amended so as to specify functions of the state regulator in the area of nuclear energy in connection with adopting a series of regulations.*

In 2006 the development of nuclear and radiation safety standards and rules continued.

28 September 2006 "Nuclear and Radiation Safety Rules 2006 for Transport of Radioactive Material' entered into force.

A new edition was developed in order to bring national rules for safe transport of radioactive materials in line with the requirements of the newest version of the IAEA's Regulations for the Safe Transport of Radioactive Material. 2005. IAEA Safety Standards Series, No. TS-R-1. Another objective was to change the structure of rules in order to simpify their use. These rules also set the requirements for radioactive waste transport in the 30-km exclusion zone.

Previously, additionally to the rules a number of documents was developed and approved, specifically, on emergency planning in the case of accidents during transport of radioactive materials (2005), requirements to quality assurance for transport of radioactive materials (2006). In the future it is planned to develop regulatory documents setting requirements to the radiation protection programme for transport and reference materials to the rules.

In order to improve the regulatory framework in the area of nuclear and radiation safety related to transport of radioactive material and bring it in line with standards DSTU ISO 9001-20013 – Quality Management Systems. Requirements, DSTU 3815-98 – Quality Management. Quality Programming Guidelines and IAEA recommendations, the "Requirements to Radioactive Material Transport Quality Assurance Programmes' (306.6.127-2006) were developed and put in force 25 July 2006. The Requirements apply to legal and natural persons developing quality assurance programmes with respect to activities related to transport of radioactive material.

The "Provision on the Nuclear Material Measurement System' (NP 306.7.120-2006) of 13 February 2006 sets the general requirements to the nuclear material measurement system at the levels of the state and facilities, as well as its components. It should be noted that the nuclear material measurement system is an integral component of the state nuclear material accounting and control system and includes the relevant personnel, procedures and equipment used to determine quantities of nuclear material obtained, produced, shipped, lost or otherwise removed from the inventory. The Provision is binding on enterprises storing, using, producing nuclear material and registering the same.

The "Nuclear Material Accounting and Control Rules' (NP 306.7.122-2006) of 26 June 2006 set the requirements to accounting of nuclear material. Application of these rules is binding on nuclear energy users and ensures state registration of nuclear material and meeting Ukraine's international nonproliferation commitments.

The "Requirements to the Periodicity and Content of Reports Presented by Licensees in the Area of Nuclear Energy' put into force 16 October 2006 generalised and systematised the existing requirements to licensees' reports on adhering to the requirements of laws, rules and standards applying to nuclear and radiation safety and physical protection as carrying out licensed activities.

In order to improve the state registration of radioactive waste to ensure legal regulation in the area of radioactive waste management, 30 May 2006 amendments were made to the Regulation "Procedure for the State RAW Inventory" (NP 306.5.04/2.059-2002) developed in line with the Law of Ukraine "On Radioactive Waste Management'. State inventory of radioactive waste is carried out once in three years at all enterprises, institutions and organisations whose activities result in creation of radioactive waste or which carry out activities in the area of processing, storing and burying radioactive waste. State inventory is aimed at detecting radioactive waste, ensuring control over its accumulation and movement, timely removing it to enterprises specialising in radioactive waste management, planning storage and burial capacities, as well as ensuring continuous updating and timely amending the State Radioactive Waste Register, State Cadastre of Radioactive Waste Storage Facilities and Temporary Radioactive Waste Storage Sites.

The "Rules of Physical Protection of Nuclear Installations and Nuclear Materials' of 4 August 2006 developed in line with international physical protection requirements and in accordance with applicable laws lay the basis for organisation of physical protection; set the requirements to physical protection of power units and nuclear material against terrorist acts, theft or other unauthorised seizure; requirements to physical protection of nuclear materials as transporting; requirements to physical protection systems depending on a category of the power unit and nuclear material, as well as the procedure for warning about illegal acts. The rules apply to power units and nuclear material used for peaceful purposes and are binding on all executive authorities, legal and natural persons carrying out activities in the area of nuclear energy.

It should be noted that further improvement of the legislation in the area of nuclear energy requires not only adopting the new and amending applicable regulations, but also their systematisation. To this end, the Action Plan 2006-2010 implementing the Energy Strategy of Ukraine until 2030 approved by Cabinet of Ministers' decree No. 436-r of 27 July 2006 envisages development of the method for codification of the nuclear legislation and draft Nuclear Code of Ukraine. The codification, primarily, includes generalisation of applicable regulations in the area of nuclear energy by creating a single, legally and logically consistent, integral regulation. Furthermore, the codification process includes comprehensive analysis of the practice of applying the existing provisions, detecting inconsistencies and shortcomings adversely affecting their effectiveness. This makes it possible to use this regulation to establish the relevant improved provisions taking into account the modern tendencies in the development of the domestic legislation and international experience.

Activities aimed at developing the method of codification of the nuclear energy legislation are already launched. Specifically, in 2006 the draft Concept for Codification of the Nuclear Legislation of Ukraine was developed, whose provisions will be taken into account as codifying laws in the area of nuclear energy.

Detailed information on regulations, international conventions, provisions and rules regulating relations in the area of nuclear energy can be found at the SNRCU's site www.snrc.gov.ua under Regulations.

State Regulation in ihe Area of Nuclear Energy

As required by the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and the Nuclear Safety Convention, Ukraine created and maintains the state nuclear and radiation safety regulation system. In accordance with articles 19-20 of the Joint Convention and 7-8 of the Nuclear Safety Convention, Ukraine:

- *shall create and maintain the regulatory framework to promote safety in the area of nuclear energy, which calls for: the relevant national safety requirements and provisions regulating nuclear and radiation safety; nuclear energy users licensing system; system prohibiting non-licensed use of nuclear energy; the relevant departmental and regulating control system, as well as documentation and reports; compulsory activities enforcing applicable regulatory provisions and license conditions; clear allocation of duties among bodies controlling different stages of the use of nuclear energy, especially, different stages of managing spent fuel and radioactive waste;*
- *has established and appointed the regulator to undertake implementation of the regulatory framework, which receives the appropriate powers, competences, as well as financial and human resources to perform its duties;*
- *shall take the appropriate steps to ensure effective independence of regulation from other functions.*

Therefore, the nuclear regulation system has the following basic components:

- *legislative framework to regulate activities in the area of nuclear energy;*
- *state nuclear safety regulation infrastructure.*

The development and the present status of the legislative framework in the area of nuclear energy were dealt with in the foregoing section.

The main central executive authority regulating nuclear and radiation safety is the State Nuclear Regulation Committee of Ukraine established in December 2000 by the Decree of the President of Ukraine.

As a regulator, the SNRCU is independent of bodies and organisations carrying out activities in the area of nuclear energy. In accordance with international requirements, the SNRCU, as a regulator, is responsible for issuing official authorisations, carrying out regulatory activities, reviews and evaluations, conducting inspections and applying sanctions, as well as implementing principles, criteria, provisions and guidelines in the area of safety.

The main functions of the SNRCU in regulating nuclear safety are as follows:

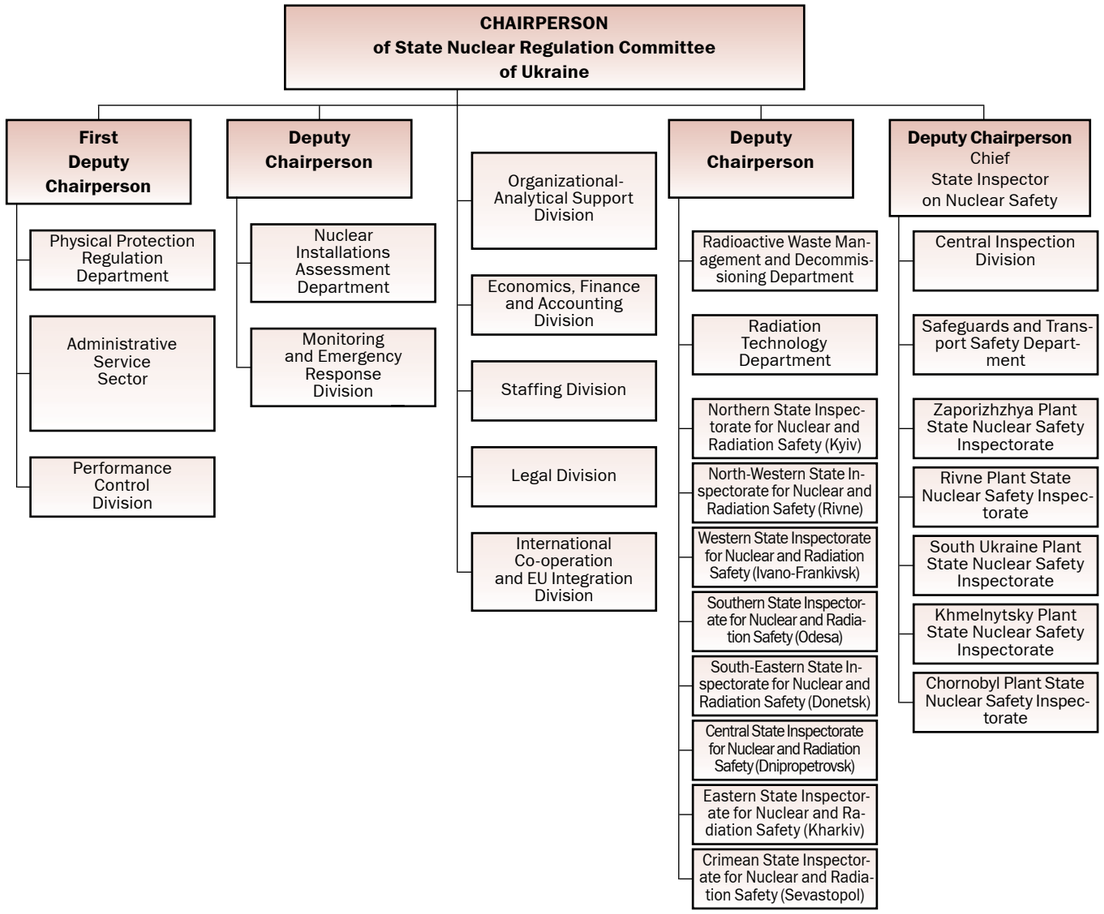
- *establishing criteria, requirements and conditions in the area of nuclear safety (regulation);*
- *issuing authorisations and licenses in the said area (licensing);*
- *carrying out state supervision over adhering to laws, provisions, rules and standards in the area of nuclear and radiation safety (supervision). The structure of the SNRCU is presented as Figure 2.1.*

Apart form the "vertical' structure which in the SNRCU consists of structural subdivisions responsible for state regulation in certain areas or of certain facilities, the Committee has the Board, the Research Council, the Working Commission for Regulation, the Licensing Commission.

In 2006 the Board met 13 times to consider proposals as to shaping and implementing the national policy in the area of nuclear and radiation safety regulation; analyse the status of carrying out activities aimed at implementing the national policy in all areas of activities of the SNRCU; study results of expert examination of safety and inspections of units and radioactive waste storage facilities as deciding on issuing licenses at a certain stage of their life cycle.

In 2006 the Research Council, as a consulting body destined to apply achievements of domestic and foreign science, technics, advanced technologies and promote the quality of works and activities within the competence of the SNRCU, ensured putting forth proposals as to mapping out the science-based policy in developing the state nuclear and radiation safety regulation system, applying scientific and technological achievements to improve the same.

Figure 2.1



The Working Commission for Regulation and the Licensing Commission ensured co-ordination of activities and joint and open decision-making in the relevant areas.

Lately steps aimed at capacity building and strengthening independence of the SNRCU have been actively taken. In 2005 the Committee's structure was updated, along with significant strengthening of internal and external co-ordination and implementing the quality system. However, it is the year 2006 which can be called the key one for the Committee.

Until recently Ukraine was faced with an acute problem of creating an effective system to supervise the safety of using ionizing radiation sources in the medical sector, industry, science, education. An important step towards strengthening the state regulation infrastructure was renewing activities of the Committee's State Inspectorates for Nuclear and Radiation Safety by the Cabinet of Ministers' regulation No. 796 of 7 June 2006.

In line with the said Cabinet of Ministers' regulation, 8 State Inspectorates were set up (regional coverage

of each inspectorate is shown in Figure 2.2.), which carry out their activities throughout the territory of Ukraine (contact information is contained in Annex 2). The inspectorates receive the appropriate legal and technical support, their staffing with qualified inspectors has been launched. As of late 2006, inspectorates employed 23 inspectors. In 2007 the number of inspectors in state inspectorates will reach 96. The SNRCU pays special attention to equipping the inspectorates, professional development of their employees.

nonproliferation safeguards, especially, state nuclear material accounting and control system, protecting ionizing radiation sources.

In 2006 an important step towards ensuring effective functioning of the IRS safety supervision system was taken by industrially applying the State Register for Ionizing Radiation Sources (hereinafter called the Register). The Register is an effective tool ensuring safety and protection of sources. The Register was created in 2004-

Figure 2.2

During the late 2006, State Inspectorates conducted 71 inspections. In all cases inspection reports or instructions were prepared. State Inspectorates paid special attention to preventing and combating illegal trafficking of IRS and nuclear material.

Creating the inspectorates will promote effective supervision over activities in the area of using ionizing radiation sources, radioactive waste transport, radioactive waste management, accepting

2006 and is a computerised registration and control system tracking radiation sources in the territory of Ukraine and ensures, especially, continuous control over their location and owner. Presently Ukraine has 8 operating registration centres (for contact information see Annex 3), for which advanced hardware and office equipment was purchased, along with developing software harmonised with the IAEA database, hiring and training personnel.

In 2006 the SNRCU actively applied the main state regulation tools: regulation, licensing and supervision over activities in the area of nuclear energy.

In 2006 the Personnel Licensing Commission also considered 228 sets of applications for licenses filed by NPP personnel to be able to directly control the reactor installation, as well as those for regular extension of effective licenses.

Information on issued licenses can be found at the SNRCU's site www.snrc.gov.ua under Activities.

Supervisory activity of the SNRCU is aimed at protecting the personnel, the population and environment against adverse effect of ionizing radiation and radioactive contamination caused by operation of units and facilities.

The state supervision is carried out by conducting planned and off-schedule inspections and inspectors' investigations.

Planned inspections are conducted based on yearly supervision plans. These inspections are aimed at establishing and evaluating conformance of licensees' activities in the area of nuclear energy with safety requirements. Depending on the aim and scope, planned inspections may be: comprehensive, special or operating.

Off-schedule inspections are conducted, if planned inspections detect shortcomings in the Licensee's activities which require more detailed or frequent check-ups. Off-schedule inspections are split into response and special inspections.

Inspectors' investigations are inspections of the applicant conducted before the issue of licenses or authorisations in the area of nuclear energy. Inspectors' investigations are aimed at establishing conformance of the information provided by the applicant to take out a license or authorisation with the State Nuclear Regulation Committee of Ukraine with the actual state of affairs, as well as verifying existence of conditions to carry out activities applied for.

In order to carry out supervision, inspection commissions are set up. The commissions are composed of state inspectors – a special category of qualified specialists of the relevant structures of the central apparatus of the SNRCU. If required, external technical experts can also be engaged in activities of the commissions. As carrying out inspectors' investigations of the newly constructed units at Rivne and Khmelnytsky NPPs, the commissions included both EU experts and national technical experts. During 2006 inspection commissions worked at NPP sites and other enterprises.

In order to ensure continuous day-to-day supervision over activities at the NPP, at each of five Ukrainian nuclear power plants State Inspectorates on Nuclear Safety are created as territorial subdivisions of the SNRCU. Their activities consist in carrying out day-to-day inspections of units, analysing and documenting the current status of the main operation parameters of NPPs and systems critical for the safety of units. At NPP sites state inspectorates conduct start-up inspections, participate in inspections and investigations carried out by central subdivisions of the SNRCU. Apart from day-to-day inspections, their duties also include planned, comprehensive, special and operating check-ups.

LICENSES ISSUED IN 2006

LICENSED ACTIVITY	Number of licenses issued
Operating of a nuclear installation or radioactive waste storage facility	1
Production, storage, maintenance of ionizing radiation sources	8
Usage of ionizing radiation sources	46
Processing, storage and burial of radioactive waste	7
Transport of radioactive materials	8
Design of nuclear installations or radioactive waste storage facilities	6
Training of the personnel for operation of a nuclear installation	1
Activities related to physical protection of nuclear material and nuclear installations	19

Tabl. 2.3.

	Controled State Inspectorates					
	ДОБЯУ	ZNPP	RNPP	KhNPP	ChNPP	SUNPP
Considered applications	228	91	56	36	21	51
Granted licenses	30	12	7	5	1	5
Extended the term (in new position)	29	—	49	26	—	32
Extended the term (regular)	169	79	—		11	3
Suspended licenses	27	—	—	5	6	7
Canceled licenses	33	—	—	—	3	4

In general, the scope of supervisory activities at sites of operating NPPs meets the NPP safety requirements. In 2006 special attention was paid to radioactive waste management, especially, at the Chornobyl NPP site, and improving quality of licensees' activities. During 2006 there was a steady downward tendency in the number of violations which had been observed over the last years. As the number of inspections grew by 25% vs. 2005, the number of violations detected increased only by 16%.

In 2006, based on the results of inspections, the Chief State Inspector for Nuclear Safety of Ukraine and his deputies investigated 27 cases of administrative violations in the area of nuclear and radiation safety. Based on the results of investigation, 27 persons were made administratively liable. Penalties totalled UAH 8,347.

In order to hire promising and qualified inspectors, professionally develop the same, in 2006 the "Provision on Qualification Attestation of Officials of the State Nuclear Regulation Committee of Ukraine Directly Engaged in the State Regulation of Nuclear and Radiation Safety' was developed and put into force. With the participation of heads of different subdivisions, the attestation commission led by the Chief State Inspector for Nuclear Safety of Ukraine was set up. The qualification attestation is an additional tool to control and manage inspectors' qualification, whose application practically rules out any poor state supervision.

In general, as of 31 December 2006 the SNRCU's staff numbered 168 persons, including 85 men and 83 women. Seventy percent of employees have university degree in technics. As joining the regulator, most of them had the experience gained as working in industry, with research and development establishments.

In order to strengthen professional potential of the regulator, in 2006 heads of its structural subdivisions actively formed the backup staff, trained candidates to carry out their official duties in the future.

Employees of the SNRCU, as public servants, receive re-training at least once in 5 years, whose results are always taken into account in the process of attestation and subsequent promotion.

In 2006 68 employees of the SNRCU were professionally developed under different training programmes, especially, international ones.

INFORMATION ON THE NUMBER OF INSPECTIONS IN 2006

OBJECTS OF SUPERVISION	Inspections		Inspector's Investigations
	Planned	Off-schedule	
Operating NPPs	11	1	3
Research reactors	4	-	-
ChNPP, the Exclusion Zone RAW management objects	10	2	1
Uanium industry enterprises	3	1	-
RAW management enterprises	5	2	1
Ionizing radiation sources using and manufacturing enterprises	5	-	8

However, despite certain positive developments in 2006, the Committee's staffing and budget financing factor remains the lowest as compared with regulators of other countries.

INTERFACE WITH THE PUBLIC AND MASS MEDIA

Traditionally, the SNRCU has a strong interface with the public. This is caused by a number of factors. Activities of the Committee as a body expected to ensure meeting international requirements and standards in the area of nuclear and radiation safety are unchanging focus of the public and mass media. Therefore, an active, continuous dialogue with the public, close relations with the mass media are an integral component of the Committee's activities.

NUMBER OF INSPECTIONS CONDUCTED IN 2006 AT NPP SITES

SUBDIVISION	Inspections		Inspector's Investigations
	Planned	Off-schedule	
State inspection at Zaporizhzhya NPP site	25(-/25)	1	1
State inspection at Rivne NPP site	12(-/12)	3	1
State inspection at Khmelnytsky NPP site	31(-/31)	9	1
State inspection at Chornobyl NPP site	27(-/27)	7	1
State inspection at South Ukraine NPP site	16(-/16)	5	-
TOTAL	111	25	4

So an integrated communications strategy was developed, principally aimed at informing the community about responsible carrying out by the SNRCU its main mission – the strict supervision over meeting the requirements to safe functioning of nuclear facilities and use of ionizing radiation sources.

For example, the Committee's managers weekly answer questions of citizens during personal consultations. Consulting hours are published at the Committee's website.

Twice a month managers of the Committee are contactable over hot lines about nuclear and radiation safety regulation in Ukraine.

The SNRCU yearly prepares the Nuclear and Radiation Safety Status Report for Ukraine. This document highlights the results of the national policy in the area of peaceful use of nuclear energy and meeting requirements of nuclear and radiation safety in Ukraine.

One of sources of on-line information to citizens is the website of the SNRCU (www.snrc.gov.ua). It daily publishes information on the status of units of nuclear power plants of Ukraine and events; and weekly brief information about the status of operating safety of units. The site also offers specialised news, regulations, work plans and reports of the SNRCU, as well as participation in discussing draft regulations and burning aspects of nuclear and radiation safety. In order to improve functioning of the site, in 2006 its improvement was started using interactive technologies, within the framework of the National Informatisation Programme. Especially, it is planned to activate services, such as "Discussion of Drafts' and "Forum', which will enhance functionality of the regulatory search and ensure interactive communications.

In 2006 the SNRCU participated in the 7th International Adult Education Week in Ukraine marking the 20th anniversary of the Chornobyl disaster. Within the framework of the Adult Education Week the SNRCU held the Open-Door Day during which the public was presented with the results of the Committee's activities.

The SNRCU pays special attention to partnership with the public.

In order to ensure an effective dialogue with the public, in 2005 the Committee's Public College was created. Based on it in 2006 the Public Council was set up. Among 41 members of the Council there are representatives of mass media, scientists, people from all regions of Ukraine where nuclear facilities are located. The Public Council is chaired by leader of the Green Party of Ukraine Serhiy Kurykin.

In 2006 the Council met with the public and mass media to discuss the following: problems related to the management of radioactive waste and spent fuel in Ukraine, situation with radioactive tailing pits of the Dnieper Chemical Works, draft laws of Ukraine "On Amending the Law of Ukraine "On Licensing Activities in the Area of Nuclear Energy' and "On Openness and Transparency of the Executive Authority, Local Self-Government Body', etc.

Proposals and comments made by the Public Council were taken into account by the Committee. Members of the Council also actively participated in a series of activities carried out by the SNRCU, including meetings of the College and the Committee's research council.

Meeting of the College of the SNRCU

In order to find out to what extent the people's demand for information about nuclear and radiation safety was met, what aspects of this are of the greatest social interest, as well as in order to analyse the attitude to the further development of nuclear energy, the SNRCU jointly with the Socioconsulting Analytical Centre has conducted a poll (for the results visit www.snrc.gov.ua).

The results of the poll demonstrate that forms and methods of providing information about the status of nuclear and radiation safety require a lot of adjustments.

The population's demand for information about nuclear energy focuses on the effect of radiation on the environment and health of people. In this context the population worry about the aftermath of the Chornobyl accident, problems of nuclear waste and safety of operating NPPs.

The low level of social awareness leads to biased judgement about the status of nuclear and radiation safety and nuclear energy.

Intentions of the government to construct new units in Ukraine by 2030 are supported by only 16% of responders. About one half (46%) will never support the construction of new NPPs and will not respond to any arguments and promises. Almost one half of responders believe that the main precondition for deciding on the construction of new NPPs is conducting a regional referendum, and according to one third it is an all-Ukrainian one.

Work of the SNRCU's Public Council

Lack of information and a solid position among many citizens is also evidenced by the fact that around one third of responders were unable to answer most questions.

The results of this poll and recommendations of sociologists will be taken into account as mapping out the Committee's information plans. But already now it is obvious that it is time to qualitatively change approaches to informing the population about problems of nuclear and radiation safety and nuclear energy.

TECHNICAL SUPPORT TO STATE REGULATION IN THE AREA OF NUCLEAR ENERGY

Within the system of the State Nuclear Regulation Committee of Ukraine there are three public enterprises providing it with technical support in carrying out its activities. This allows the SNRCU to achieve its goals more effectively.

The State Scientific and Technical Centre on Nuclear and Radiation Safety has provided technical support to the SNRCU since foundation of the regulator. The Centre's activities are aimed at providing scientific, analytical, expert, engineering, methodological, information and consulting support in regulating activities.

The scientific contribution of the Centre in 2006 is 376 papers, 19 of which were destined to develop the nuclear and radiation safety regulation system. Specialists of the Centre conducted 228 state examinations in the area of nuclear and radiation safety – comprehensive evaluations and verifications of designs and technologies, safety materials, operating and technological documentation, reports on safety analysis and its periodic evaluation, as well as 72 expert opinions. This provided the basis for decisions of the SNRCU in carrying out licensing activities. Objects of expert activities and studies include: implementing alternative nuclear fuel, upgrading systems critical in terms of safety, constructing facilities to decommission the Chornobyl NPP, revising the life/resource, improving safety.

During 2006 the Centre carried out 53 researches.

Researches of the development of the state regulation strategy were aimed at studying and implementing advanced techniques, establishing and proving safety principles, criteria and objectives necessary to implement the policy and technical requirements of the regulator. New approaches were developed to classify NPP information and control systems and components belonging to systems critical in terms of safety. These approaches ensure harmonisation with international standards and are based on principles and criteria which are closer to functionality, special features and the role of these systems than classification criteria applicable in Ukraine. The up-to-date risk-based state regulation technique is implemented. In the safety analysis this means the combined and complementary use of deterministic and probabilistic methods used to test safety criteria as designing and operating NPPs, in the process of planning upgrades and evaluating operation. The risk-based approach is used to make decisions, establish safety priorities and relieve superfluous conservatism where effect on safety is insignificant.

The Information Technology Centre for Nuclear Energy (Infoatom) was founded in 1994. Its activities are mainly aimed at providing information and analytical support to the SNRCU, participate in informing the public about the status of nuclear and radiation safety, as well as designing, developing, implementing and maintaining computer networks and automated information databases in the area of nuclear and radiation safety necessary for the State Nuclear Regulation Committee of Ukraine to carry out its activities.

During 2006 Infoatom carried out activities under 12 contracts.

Activities aimed at Adapting RAIS Software to National Requirements and Maintaining and Upgrading Software of the Register Automated System promoted integrity and safety of data in the State Register for Ionizing Radiation Sources and smooth functioning of the automated Register system. Specialists from Infoatom developed a new Register software version for the Main Registration Centre, which is faster and more reliable. Furthermore, due to this the data layout used in Ukraine became compatible with the layout adopted by IAEA for member states.

Within the framework of the research Infoatom performed tasks directly related to carrying out by the SNRCU its competences. A single information system was created to register failures of nuclear power plants of Ukraine and preserve information in the database for the purpose of further statistical analysis of this information, along with developing the SNRCU's automated information and analytical system based on the existing hard- and software. In order to reduce the time it takes to process and search for documents, improve effectiveness of managerial decision-making, the process of carrying out the main paperwork procedures at the Committee's subdivisions was automated.

Infoatom also participated in developing documents for all levels of the quality management system of the State Nuclear Regulation Committee of Ukraine in line with the requirements of DSTU ISO 9000-2001.

As providing information and technical support to the SNRCU, Infoatom maintained the automated information and analytical system of the regulator and the soft- and hardware system of the Committee's Emergency Information Centre, provided consultations as to functioning of the Centre, conducted the workshop to train the personnel of the State Register for Ionizing Radiation Sources.

In 2006 Infoatom was accredited with the Verkhovna Rada of Ukraine's committee for fuel and energy complex, nuclear policy and nuclear safety. Specialists of the enterprise provide consultations to members of the committee in developing regulations in the area of nuclear and radiation safety.

In 1992 within the system of state regulation in the area of nuclear and radiation safety, the State Centre for Regulation of Quality of Supplies and Services was set up.

The Centre provides services by verifying the conformity of the equipment and components used in systems critical for the safety of nuclear facilities (operators, suppliers).

The main aim of the Centre in the state technical regulation system is to properly confirm that the products meet the established national provisions, rules and standards in the area of nuclear and radiation safety.

Since 1997 the enterprise has been accredited as SERTATOM, a products certification body, which since 2001 also is the certifier of quality systems within the UkrSEPRO national system.

Confirming that the products meet the requirements of the nuclear sector allows the regulator and operator to make objective and sound decisions on possible use of the equipment and components in systems critical in terms of safety.

The Centre has 5 specialised regional subdivisions: Ivano-Frankivsk, Lviv, Nikopol, Sumy and Kharkiv.

The Centre's quality management system is certified by TUV CERT – TUV Rheinland as meeting ISO 9001:2000. By the order of the Head of the State Nuclear Regulation Committee of Ukraine, since 2002 the Centre is the base organisation of the TK 79 Atomic Energy technical standardisation committee. The Centre is the authorised organisation of the State Nuclear Supervision Agency (Rostehnadzor) of Russia and Jiangsu Nuclear Power Corporation (JNPC, China) in supervising the production and accepting products of Ukrainian enterprises for the Tianwan NPP (China).

Nuclear Safety in Ukraine

3.1. NUCLEAR POWER AS A COMPONENT OF THE FUEL AND ENERGY COMPLEX OF UKRAINE

In 2006 nuclear power plants of Ukraine generated 90,266 million kW, or 47.9% of the total electricity generated in the country.

Presently Ukraine has 4 operating nuclear power plants: Zaporizhzhya, South Ukraine, Khmelnytsky and Rivne. In total, 15 units have installed capacity 13,835 MW. Since 1996 they have been operated by the National Nuclear Energy Generating Company Energoatom (Energoatom).

Since 2002, in accordance with applicable laws of Ukraine and based on the comprehensive evaluation of unit safety and the evaluation of the operator's ability to carry out all safety related activities, the SNRCU licensed Energoatom to operate units at sites of the South Ukraine NPP, Zaporizhzhya NPP, Rivne NPP, and Khmelnytsky NPP.

The licenses establish conditions of and restrictions on the said activities, specify technological systems and boundaries of sites they apply to. According to the licenses, Energoatom has the right to carry out all operations related to operating units on its own or jointly with contractors. At the same time, in accordance with the Law of Ukraine "On Nuclear and Radiation Safety', the operator is fully responsible for safety of units under Operation.

The licenses specify works or operations whose carrying out is possible only subject to availability of a separate written authorisation of the SNRCU. Authorisations to start up units after planned outages with the overload of the core are issued to Energoatom subject to carrying out all activities specified by the previous authorisation and conditions of effective licenses, especially, activities aimed at improving safety.

Adherence to license conditions and separate written authorisations is supervised by State Nuclear Safety Inspectorates at NPP sites, as well as during planned inspection by the specialists of other structural subdivisions of the SNRCU. Furthermore, the completeness of carrying out license conditions and separate written authorisations is discussed at joint meetings of the SNRCU and Energoatom before finishing planned outage with the overload of the core of each operating unit.

General characteristics of operating nuclear power plants of Ukraine

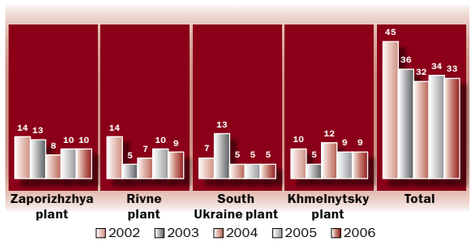
NPP	Unit	Reactor type	Installed capacity	Start-up date	Year of the end of design life
ZAPORIZHZHYA	1	VVER-1000/V-320	1000 MW	Dec 1984	2014
	2	VVER-1000/V-320	1000 MW	Jul 1985	2015
	3	VVER-1000/V-320	1000 MW	Dec 1986	2016
	4	VVER-1000/V-320	1000 MW	Dec 1987	2017
	5	VVER-1000/V-320	1000 MW	Aug 1989	2019
	6	VVER-1000/V-320	1000 MW	Oct 1995	2025
RIVNE	1	VVER-440/V-213	420 MW	Dec 1980	2010
	2	VVER-440/V-213	415 MW	Dec 1981	2011
	3	VVER-1000/V-320	1000 MW	Dec 1986	2016
	4	VVER-1000/V-320	1000 MW	Oct 2004	2034
SOUTH UKRAINE	1	VVER-1000/V-302	1000 MW	Dec 1982	2012
	2	VVER-1000/V-338	1000 MW	Jan 1985	2015
	3	VVER-1000/V-320	1000 MW	Sep 1989	2019
KHMELNYTSKY	1	VVER-1000/V-320	1000 MW	Dec 1987	2017
	2	VVER-1000/V-320	1000 MW	Aug 2004	2034

3.2. EVENTS AT NUCLEAR POWER PLANTS

(Events at the Chornobyl NPP see section 6.3. – Decommissioning of the Chornobyl NPP)

One of the main tools to maintain the appropriate level of operational safety is the system for event accounting and investigation, that reveals event causes and sets corrective actions needed to eliminate shortcomings and prevent repeating of the similar events at other units. The relevant procedure is set by the "Provision on the Procedure of Registration and Investigation into Failures at Nuclear Power Plants'.

Table 3.1. Number of events at nuclear power plants during 2002-2006



In 2006 at operating NPPs in Ukraine occurred 33 reported events, 10 of which – at Zaporizhzhya NPP, 9 – at Rivne NPP, 9 – at Khmelnytsky NPP and 5 – at South Ukraine NPP.

For supervision over cause identification and chose of corrective measures, SNRCU analyses NPP event investigation reports. Based on the results of the analysis, SNRCU returned reports for reinvestigation in 8 cases.

Depending on symptoms and consequences, NPP events are rated under one of categories presented in Table 3.1.

NPP events registered during 2006 were classified under categories E05, E06, E07, E08, E10.

As a result of investigation of 33 reported events at nuclear power plants of Ukraine, 41 additional abnormal events were revealed. Abnormal events (deviations from normal operation which may be caused by equipment failures, faults of the personnel or procedural shortcomings) were analysed in order to identify causes and undertaking appropriate actions.

Depending on symptoms and consequences, NPP events are rated under one of categories presented

ACCIDENTS

Category A01
Radioactive release to the environment radiologically equivalent to more than 10^{16} Bq I^{131}, that may result in acute health effects to NPP personnel and population. Transboundery release is possible. There is a long-lasting effect on the environment.

Category A02
Radioactive release to the environment radiologically equivalent to 10^{15} to 10^{16} Bq I^{131}. The effective exposure dose received by the population during up to two weeks can reach 50 mSv. Implementation of the off-site emergency plan to protect population; temporary evacuation at some locations.

Category A03
Radioactive release to the environment radiologically equivalent to 10^{14} to 10^{15} Bq I^{131}. The expected aggregate effective radiation dose received by the population during the first two weeks after the accident may exceed 5 mSv. The expected radiation dose absorbed by the thyroid gland may exceed 50 mGy. Partial implementation of the off-site emergency plan; iodine prophylaxis and/or sheltering. Evacuation of people is possible. Damage to the reactor core exceeding the maximal limit set for damaged fuel elements by nuclear and radiation safety standards and rules or by design.

Category A04
On-site release to the environment exceeds limits for releases and/or effluents, but radiation situation outside the NPP sanitary and protection zone does not require carrying out any special measures to protect population. Exposure of individuals may exceed the total quota of the dose limit for NPPs, resulting from air and water contributors to dose (80 microsieverts). Damage to the core exceeding safe operation limit by the number and size of defects of fuel elements: over 1% of fuel elements having defects of a "gas leakage' type and over 0.1% of fuel elements with direct contact of the coolant and nuclear fuel. Exposure of the NPP personnel resulting in acute health effects.

EVENTS

Category E01/1
One occasional release to the environment not exceeding annual release limit and/or effluents, that results in contamination of the NPP site and sanitary and protection zone and increase in effective dose rate above 1.1 μSv/h. Exposure of individuals of the NPP staff to doses reaching the dose limit.

Category E01/2
One occasional release to the environment exceeding by the five times the permitted daily release. Increase of activity concentration of radionuclides in air of serviced premises, contamination control area over and above the allowed concentration for the personnel (PC_A^{inhal}). No impact to the radiation situation outside the NPP site.

Category E02
Violation of limits and/or safe operation conditions that did not turn into an accident, except events under categories E03, E04.

Category E03
Inoperability of safety systems or safety system channels in a number which exhausts their redundancy.

Category E04
Inoperability of individual safety system channels with maintaining reserve or non-redundant elements of safety systems for a time exceeding period permitted by the Technical Specifications.

Category E05
Shutdown of the reactor or disconnection of the unit from the grid in the process of operation of the unit caused by: failures of equipment (elements); faults of the personnel and/or wrong decisions; external man-induced or natural factors.

Category E06
Drop of and/or damage of fuel assemblies, fuel elements, absorbing elements during transporting and other technical manipulations with fresh and spent fuel, which did not lead to accidents or events under categories E01-E02.

Category E07
Failures of the equipment and pipelines important for safety, which belong to groups A and B, elements of safety classes 1 and 2**, controls of the control and protection system equipped with a drive(s), which did not lead to accidents and events categorised under A01-E06, E08-E10.*

Category E08
Decrease of power of NPP unit by 25% $N_{el.}$ of the previous capacity level and more caused by: failures of equipment (elements); faults of the personnel and/or wrong decisions; external man-caused or natural factors (except events referred to in section 4.4 of this Provision).

Category E09
Activation of any safety system or safety system channel, which performs functions other than safety ones.

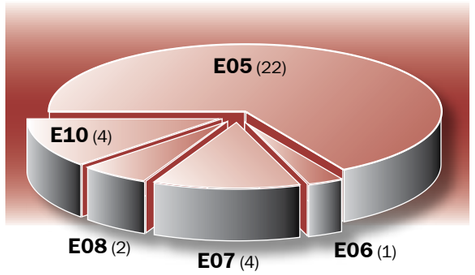
Category E10
Inoperability of a safety system channel(s) for a period not exceeding that permitted by the Technical specifications (except when checking up or conducting routine maintenance of separate safety system channels).

** – groups A and B specified in the "Rules of Installation and Safe Operation of Equipment and Pipelines of Power Units', (PNAE G-7-008-89) approved by the State Nuclear Supervision Committee of the USSR in 1989.*

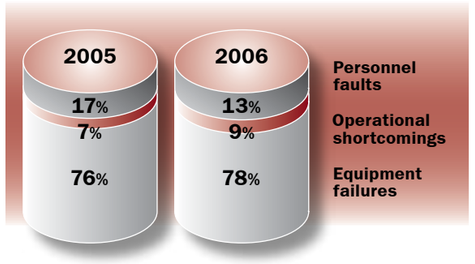
*** – safety classes specified in the General Provisions on Nuclear Power Plant Safety approved by decree of the State Nuclear Regulation Administration of Ukraine No. 63 of 9 December 1999 registered with the Ministry of Justice of Ukraine 6 March 2000, reg. No. 132/4353.*

In order to evaluate significance of an event from the safety viewpoint, the world nuclear community widely uses the International Nuclear Event Scale or INES scale designed specially as a tool to inform public. All evens which occurred at nuclear power plants in Ukraine in 2006 were classified on INES as "anomalies', "deviations' or "out-of-scale'. The latter level includes events which have no relevance to nuclear and radiation safety and thus are outside the scale. Distribution of events at operating NPPs on INES is presented in the table below.

Distribution of events at Ukrainian NPPs by categories



Distribution of abnormal events by factors



3.3. UPGRADING AND IMPROVING SAFETY OF NPP UNITS

After the Chornobyl accident, far back in the time of the former USSR, approaches to evaluating the safety level of all operating units were revised. Based on the results, in 1988 the so-called "combined measures' were mapped out aimed at improving the safety level of NPP units by eliminating the existing safety deficits. In the end, these issues were addressed already in independent Ukraine.

During 1992-1998 all NPPs of Ukraine were tested by international missions for how safety levels of operating units meet international standards. Based on the results of activities of IAEA missions, the relevant recommendations were developed.

In order to carry out the IAEA recommendations and Ukraine's commitments under the Nuclear Safety Convention, the Ministry of Fuel and Energy of Ukraine and Energoatom have developed the "Comprehensive Power Unit Modernisation and Safety Improvement Programme' approved by the Cabinet of Minister of Ukraine's resolution No. 504-r of 29 July 2002. In line with the Programme, safety improvement activities were planned to be carried out by the end of 2005.

Study of the results of carrying out the Programme at the meeting of the SNRCU Board on 19 January 2006 showed that failure to implement it within the set deadlines was caused by objective factors, especially, by the impossibility of carrying out certain activities because of their technical complexity and unavailability of adequate technical solutions. At the same time, feasibility studies and unit safety analysis conducted during implementation of the Programme revealed previously unknown shortcomings in designs and operation of units, which required correction of the Programme, both by supplementing it with the top-priority activities and removing from it completed or minor activities. At this meeting the Board stated that, in general, as of 31 December 2005 the Programme was completed at nuclear power plants only by 33.42%.

INES event rating occurred at Ukrainian NPPs in 2006

NPP	EVENT LEVEL ON INES					
	Out-of-scale (-)	Deviation (0)	Anomaly (1)	Incident (2)	Serious incident (3)	Accidents (4-7)
Zaporizhzhya	5	5	–	–	–	–
Rivne	3	6	–	–	–	–
South Ukraine	2	2	1	–	–	–
Khmelnytsky	–	8	1	–	–	–
Total:	**10**	**21**	**2**	**–**	**–**	**–**

In order to further carry out activities aimed at improving safety and carrying out Ukraine's commitments to bring target parameters of unit safety in line with internationally recognised provisions, rules and standards in the area of nuclear and radiation safety, by its resolution No. 515-r of 13 December 2005 the Cabinet of Ministers of Ukraine approved the Concept for Improving Safety of Operating Units (hereinafter called the Concept) envisaging the completion of all safety improvement activities by 2010. At the same time, by 2008 it is planned to implement 244 pilot projects, with at least 31 to be carried out in 2006, at least 74 in 2007, and the rest in 2008.

Energoatom agreed the Schedule of Technical Activities in 2006 to Implement the Concept for Improving Safety of Operating Units (hereinafter called the Schedule) with the SNRCU. In 2006 it was planned to carry out 34 activities aimed at attaining "Design Safety', as well as 19 activities aimed at "Deepening Analysis and Feasibility Study of Nuclear Plant Safety'.

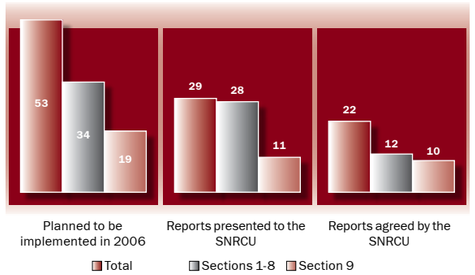
In late 2006 Energoatom provided the SNRCU with a large number of reporting materials requiring comprehensive analysis. Below the information on implementing the Concept as of the end of the first quarter of 2007 is presented (Figure 3.3.1).

In general, by the end of the year Energoatom presented the SNRCU with reports on completing 39 of 53 activities planned to be carried out in 2006. Twenty-two reports are agreed by the SNRCU, that is, the activities are deemed completed.

In the first quarter of 2007 the SNRCU held a college meeting to analyse causes of Energoatom's nonperformance of the Schedule. Based on the results of the meeting, Energoatom was invited to take appropriate actions:

- *to improve effectiveness of the existing control and engineering support system;*
- *to implement personified responsibility among managers of structural subdivisions of the Energoatom Board for carrying out their functions;*
- *to develop safety culture of each employee of the company.*

Figure 3.3.1. Carrying out the Schedule of Technical Activities in 2006 to Implement the Concept for Improving Safety of Operating Units as of 30 March 2007.



Carrying out activities aimed at modernisation of Khmelnytsky Unit 2 and Rivne Unit 4 "after start-up'

After making in 1993 the decision to lift the moratorium on constructing nuclear power plants, the Government of Ukraine reaffirmed its intention to complete Khmelnytsky Unit 2 and Rivne Unit 4 and modernise the units to bring their safety level in line with the requirements of applicable laws, provisions, rules and standards in the area of nuclear and radiation safety, as well as international recommendations and practice. In order to achieve this, the operator developed the Modernisation Programme, which was analysed by domestic and western experts and agreed by the state regulator. This programme contains 147 activities. Based on experts' conclusions, carrying out activities aimed at improving safety will make it possible to bring the safety level of units in line with international standards and eliminate a series of deviations from effective safety requirements.

Implementation of the Programme was split into two phases: "before start-up' and "after start-up'. On Khmelnytsky Unit 2 and Rivne Unit 4 "before start-up' of units 67 and 66 activities were carried out respectively.

In the "after start-up' phase, on Khmelnytsky Unit 2 and Rivne Unit 4 80 and 81 activities were to be carried out respectively.

In accordance with the Law of Ukraine on ratifying the safeguards agreement between Ukraine and the European Atomic Energy Community (No. 2818-IV of 7 September 2005), activities aimed at modernising Khmelnytsky Unit 2 and Rivne Unit 4 "after start-up' in order to improve their safety and reliability shall be carried out during three fuel campaigns.

As required by licenses permitting commissioning of Khmelnytsky Unit 2 and Rivne Unit 4, in order to guarantee carrying out the rest of Modernisation Programme activities, Energoatom has developed and agreed with the SNRCU the action schedule. As scheduled, on Khmelnytsky Unit 2 it is planned to carry out 16 activities before completing the first repairs, 20 activities before completing the second repairs, and 44 activities before completing the third repairs. On Rivne Unit 4 it is planned to carry out 17 activities before completing the first repairs, 16 activities before completing the second repairs, and 48 activities before completing the third repairs.

In order to ensure appropriate control over the status of carrying out activities aimed at improving safety, the SNRCU set a series of requirements to reporting by Energoatom, Rivne and Khmelnytsky nuclear power plants on implementing the activities.

As of May 2007, the status of carrying out the Modernisation Programme is as follows:

Khmelnytsky Unit 2:

- *during the first fuel campaign 16 activities are implemented;*
- *during the second fuel campaign 20 activities are implemented;*
- *during the third fuel campaign 1 activity was implemented; the campaign still continues.*

Experts are studying 9 reports.

Rivne Unit 4:

- *during the first fuel campaign 21 activities are implemented;*
- *during the second fuel campaign 8 activities are implemented; the campaign still continues.*

Experts are studying 1 report.

In 2006 the SNRCU, jointly with western experts, inspected the preparedness of Energoatom as the operator to carry out activities during "operation of Rivne Unit 4'.

Given the results of the comprehensive evaluation of the safety level of Rivne Unit 4 and taking into account the results of inspecting and completing the Commissioning Programme, in April 2006 the SNRCU licensed the operator to operate Rivne Unit 4.

3.4. UNIT SAFETY ANALYSIS

The scope of unit safety analysis which was at all times conducted in the former USSR was limited as compared with the current requirements of effective provisions and rules meeting international standards.

The nuclear legislation of Ukraine permits only operation of nuclear installations whose safety level meets the current standards in the area of nuclear and radiation safety. Furthermore, confirming that the safety level of units of nuclear power plants of Ukraine meets internationally recognised standards is one of preconditions for European integration and close co-operation in the area of nuclear energy.

The comprehensive unit safety analysis is conducted using advanced analytical methods (deterministic and probabilistic) and codes. The results of the analysis of safety of NPP units are presented in the Safety Analysis Report (hereinafter called SAR).

It should be noted that SAR's for NPP units (except Khmelnytsky Unit 2 and Rivne Unit 4 whose SAR's are prepared in the first place) in Ukraine are drawn up in two stages:

Developing SAR's for "pilot' units – Zaporizhzhya Unit 5, South Ukraine Unit 1, Rivne Unit 1 (units of each type operating in Ukraine);

Adapting SAR's for "pilot' units to the rest of units ("nonpilot').

It should be noted that in November 2006 the SNRCU adopted a sectoral document regulating adaptation aspects.

Preparation of SAR's became a separate activity within the Concept for Improving Safety of Operating Units. In accordance with Concept Schedules, materials of SAR's for "pilot' units shall be developed by 2007, and materials of SAR's for "nonpilot' ones by 2009.

In 2006 activities of the SNRCU related to the safety analysis focused on the following:

1. *Conducting examination of SAR's by state experts.*
2. *Control over meeting agreed deadlines for developing SAR's.*

The main outcomes of the evaluation of separate SAR's carried out by the SNRCU in 2006:

- *SAR for Rivne Unit 4 presented as a component of the package of documents the operator needs to take out the license to carry out activities at the stage of the life cycle "operating nuclear installation of Rivne Unit 4' confirmed that the unit safety level meets requirements of the nuclear legislation, provisions, rules and standards in the area of nuclear and radiation safety;*
- *positive decisions are considered and made with respect to the following SAR sections: "Additional Safety Evaluation Materials' for Rivne Unit 1 and South Ukraine Unit 1, "Probabilistic Safety Analysis' for Zaporizhzhya Unit 5, "Design Accident Analysis' for South Ukraine Unit 1;*
- *materials of SAR sections "Safety Rationale' for Rivne Units 2 and 3 and "Design Accident Analysis' for Rivne Unit 1.*

As regards 2006 activities in general, they were marked by more active safety analysis and the operator's interest in confirming that safety level of units of nuclear powers plants of Ukraine meets internationally recognised standards.

3.5. UNITS SERVICE LIFE EXTENTION

Further operation of units after the end of their service life is envisaged by the Energy Strategy of Ukraine until 2030 planning to continue operating 12 of 15 units until 2018. Pilot units are Rivne Units 1 and 2 and South Ukraine Unit 1.

As designed, reactor installations of VVER type were to be operated for thirty years, without any periodic safety evaluations.

But presently, in accordance with current regulatory documents, the operator shall evaluate unit safety at least once in 10 years, as it is practised in most countries operating power units.

The decision on units service life extension is also made based on the results of safety reassessment.

Units are being prepared for service life extension in line with the Action Plan of Energoatom (hereinafter called the Action Plan) aimed at implementing the Integrated Action Programme Aimed at Continuing Operation of Operating Units of Nuclear Power Plants approved by decree of the Cabinet of Ministers of Ukraine No. 263-r of 29 April 2004 (hereinafter called the Integrated Programme).

Both in 2005 and in 2006 there was a tendency to ignore activities envisaged by the Action Plan aimed at continuing operation of Rivne units.

In order to correct the situation, it is necessary to urgently take the following steps:

- *to evaluate the technical condition and reallocate resource characteristics of critical elements, primarily, the reactor vessel and its internal devices, structures;*
- *to qualify the equipment;*
- *to implement the deterioration management system;*
- *to ensure tightness of the confinement in order to lower the probability of limit emergency discharge to the level set by current standards and rules in the area of nuclear and radiation safety;*
- *to implement the Programme of reference specimens of reactor vessels after the end of design life;*

Fig. 3.6.1. Levels of emissions of long-lived radionuclides at nuclear power plants of Ukraine in 2006

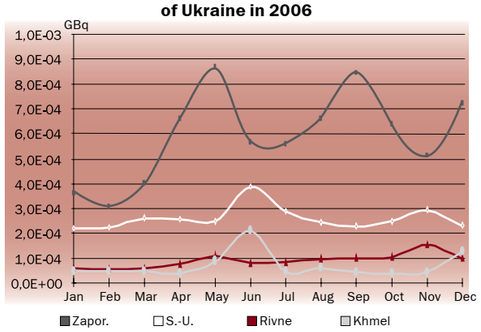
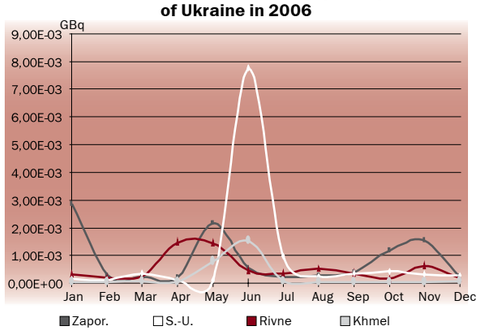


Fig. 3.6.2. Levels of emissions of iodine radionuclides at nuclear power plants of Ukraine in 2006



- *to bring cabling in line with the requirements of provisions, rules and standards in the area of nuclear and radiation safety;*
- *to carry out activities aimed at improving safety envisaged by the Concept for Improving Safety of Operating Units, contained in the IAEA's report on "Problems of Safety of Nuclear Power Plants Powered by Reactors 213 of VVER-440 Design and Their Categories' and safety improvement activities to be mapped out in the Safety Analysis Report;*
- *to conduct periodic safety evaluation;*
- *to re-register the mechanical equipment and pipelines.*

3.6. RADIATION SAFETY AND RADIATION PROTECTION OF NPP PERSONNEL

One of criteria of safe operation of nuclear power plants is non-overstepping set and duly agreed control levels of emissions and discharges of radioactive substances by the following parameters:

- *inert radioactive gases (xenon, krypton, argon);*
- *long-lived nuclides;*
- *radioiodines.*

Furthermore, monthly control is in place:

- *of Cs^{134}, Cs^{137} as reference radionuclides formed as a result of disintegration of nuclear fuel;*
- *of Co^{60}, Mn^{54}, Zr^{95}, Fe^{59} as products of activation of metal of the technological equipment.*

The said radionuclides are the main dose-forming nuclides at nuclear power plants.

The dynamics of emission levels of the said groups are presented in Figures 3.6.1.- 3.6.3. below.

Based on the results of the analysis it can be stated that emission levels of the above groups of radionuclides in 2006 amounted to 3-10% of control levels and 0.5-1% of allowed ones.

Emission values are controlled for 15 radionuclides. During 2006 no overstepping of allowed and control discharges was registered. Actual levels of discharges are 7-17% of the control level and 0.08-1% of the allowed one.

Radiation control in the buffer and control area at nuclear power plants of Ukraine is carried out at fixed control stations located in population aggregates and at special sampling points. Control objects are soil, agricultural products, water reservoirs, precipitations, etc. Analysis of samples showed that the content of radionuclides does not exceed hygienic standards and equals background values.

In 2006 carrying out the Programme for Rehabilitation of Radiation Control Systems at Nuclear Power Plants of Ukraine continued.

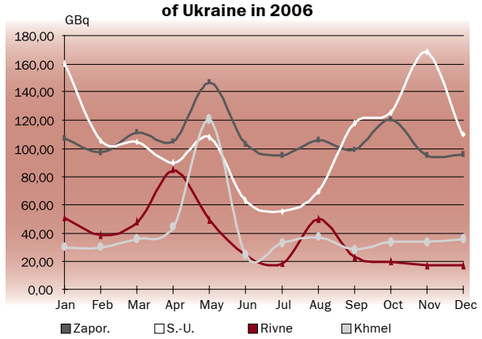
Some activities aimed at extending functionality of radiation control systems for Khmelnytsky Unit 2 and Rivne Units 3 and 4 were carried out; assembly of automated emission control systems at South Ukraine Units 1 and 2 was launched; the necessary equipment for Zaporizhzhya Units 2-4 was supplied.

At nuclear power plants of Ukraine individual radiation survey is conducted, specifically, the control and registration of the equivalent dose of external exposure of the personnel, as well as radionuclides content control.

The table below shows the distribution of individual doses of exposure of NPP personnel as of 1 January 2007.

In 2006 most members of the staff of nuclear power plants received a radiation dose less than 2 mSv. No overstepping of the basic individual radiation dose limit – 20 mSv/year (median dose is 0.97 mSv) – was registered.

Fig. 3.6.3. Levels of emissions of inert radioactive gases at nuclear power plants of Ukraine in 2006



Distribution of individual doses of exposure of NPP personnel as of 1 January 2007

NPP	Number of controlled members of staff	Number of exposed persons (mSv/year) in 2006									Radiation dose in 2006	
		< 2	2-5	5-10	10-15	15-20	20-30	30-40	40-50	>50	collective, man·mSv	median individual, mSv/year
Zaporizhzhya	4731	3970	353	280	96	32	0	0	0	0	5346,95	1,13
including external personnel	475	397	35	36	7	0	0	0	0	0	541,81	1,14
Rivne	4004	3494	309	145	35	21	0	0	0	0	3591,45	0,9
including external personnel	682	630	49	3	0	0	0	0	0	0	294,75	0,43
South Ukraine	3184	2674	281	160	69	0	0	0	0	0	3605,24	1,13
including external personnel	899	792	45	37	25	0	0	0	0	0	875,33	0,97
Khmelnytsky	2717	2413	238	61	6	0	0	0	0	0	1615,5	0,59
including external personnel	693	622	58	11	0	0	0	0	0	0	318,6	0,46
TOTAL	14636	12551	1181	646	206	53	0	0	0	0	14159,14	0,97

Radioactive Waste Management

Radioactive waste* results from generating electricity at nuclear power plants and operation of nuclear research reactors, using radioactive ionizing radiation sources in science, medicine, industry and agriculture. Large amounts of radioactive waste were generated as a consequence of the Chornobyl accident. There also is radioactive waste resulting from implementing military programmes.

Public policy in the area of radioactive waste management is carried out by implementing the Integrated Radioactive Waste Management Programme 2002-2005 and until 2010 (hereinafter called the Integrated Programme) approved by the Cabinet of Ministers of Ukraine's resolution No. 2015 of 25 December 2003.

Unfortunately, as a consequence of systematic lack of the Programme financing from the State Budget of Ukraine, the envisaged activities are carried out slowly, with significant delays.

The single effective state radioactive waste management system can be created only subject to functioning of the State Radioactive Waste Management Fund to be formed of special allocations by enterprises, institutions and organisations whose activities result in generation of radioactive waste. By his Decree No. 1863 of 27 December 2005 On the Decision of the National Security and Defence Council of Ukraine of 9 December 2005 "On the Status of Power Security of Ukraine and Basic Principles of Public Policy in This Area', the President of Ukraine assigned the Cabinet of Ministers of Ukraine with drafting the law on the State Radioactive Waste Management Fund and presenting it to the Verkhovna Rada of Ukraine to be studied. By the Power Security Action Plan for Ukraine it is envisaged to develop the National Radioactive Waste Management Programme by 1 January 2007.

Developing and carrying out the unified technical policy in the area of radioactive waste management in Ukraine is within the competence of the Ministry of Ukraine for Emergencies and Protection of the Population Against Chornobyl Aftermath. During 2006 the Ministry, jointly with other executive bodies concerned, drafted the Radioactive Waste Management Concept and the National Radioactive Waste Management Programme, as well as the Law of Ukraine on amending certain Laws of Ukraine in order to create the financial mechanism of the Radioactive Waste Management Fund. However, in the process of agreeing these documents, essential comments were made, which hindered their adoption and approval within the set deadlines.

During 2006 specialist from the Ministry and NNGC Energoatom, jointly with western partners, developed the national radioactive waste management strategy. The project shall be completed by the end of 2007.

Fig. 4.1.1. Generation of liquid radioactive waste at NPPs (m³)

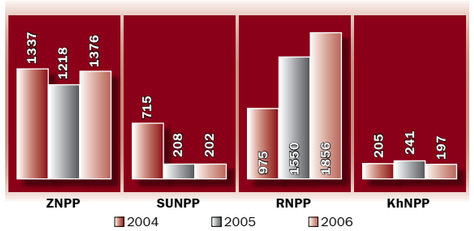
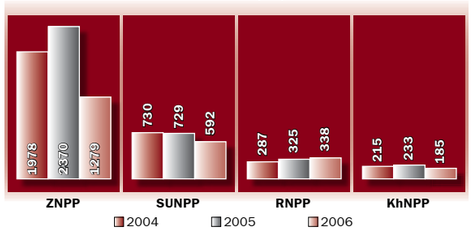


Fig. 4.1.2. Generation of solid radioactive waste at NPPs (m³)



4.1. RADIOACTIVE WASTE MANAGEMENT AT OPERATING NPPS

Operating units, repairing the process equipment, processing radioactive water generates solid and liquid radioactive waste.

Liquid radioactive waste includes:

- *primary coolant water;*
- *concentrated salt mixtures from trap water, water from special wash houses;*
- *used ion-exchange resins of special water treatment filters;*
- *slurry.*

Liquid radioactive substances are to be collected and processed before reuse.

The main sources of solid radioactive waste at a nuclear NPP are:

- *operation of NPP equipment, buildings and structures;*
- *equipment reconstruction and modernisation;*
- *decommissioning of the equipment;*
- *decontamination;*
- *replacing deteriorated elements;*
- *replacing worn garments of the personnel, individual protection outfits, etc.*

The dynamics of generation of radioactive waste during 2004-2006 are shown as Figures 4.1.1.- 4.1.2.

NPP designs envisage the necessary systems destined to treat liquid radioactive waste (so-called special water treatment systems) whose operation results in generation of "secondary' radioactive waste: vat residue, used sorbents, slurries, etc.

In order to decrease volumes, the vat residue is re-evaporated (to obtain liquid radioactive waste such as salt cake), and slurries are removed to centrifuging systems (these systems are implemented at the Khmelnytsky and Rivne NPPs).

In order to minimise volumes, solid radioactive waste is removed to the incineration (Zaporizhzhya NPP) and pressing unit (Zaporizhzhya NPP, South Ukraine NPP).

Radioactive waste processing volumes at nuclear power plants of Ukraine are presented as Figures 4.1.3.-4.1.4.

Lack of activities in processing liquid radioactive waste at the South Ukraine NPP and in processing solid radioactive waste at the Rivne and Khmelnytsky NPPs can be explained by unavailability of the corresponding units. Reduction in processing of solid radioactive waste at the Zaporizhzhya NPP and liquid radioactive waste at the Rivne NPP is associated with repairing incineration and pressing units, and the centrifuging unit respectively.

In order to take and temporarily store liquid radioactive waste, each NPP has the appropriate storage facilities – 100 to 750 cubic meters flat bottomed cylindrical reservoirs located in reinforced concrete parts of special blocks.

To collect and store radioactive waste generated in the process of operating units, there are special storage facilities also located in special blocks. The facilities are of a cell type. The cells have lockable hatches to prevent spreading of radioactive contamination and limit exposure of the personnel.

The dynamics of accumulation of radioactive waste in NPP storage facilities are shown as Figures 4.1.5.-4.1.6. Reduced processing of radioactive waste is associated with repairing incineration and pressing units at the Zaporizhzhya NPP, and the centrifuging unit at the Rivne NPP.

As required by safety regulations, there is a separate Radioactive Waste Management Programme at each NPP, whose carrying out is continuously monitored by the SNRCU.

The Programmes envisage organisational and technical activities aimed at minimising radioactive waste levels and improving the radioactive waste management system. Some activities are aimed at reducing trap waters mainly contributing to the total volume of "primary' liquid radioactive waste.

Fig. 4.1.3. Liquid radioactive waste processing volumes (m³)

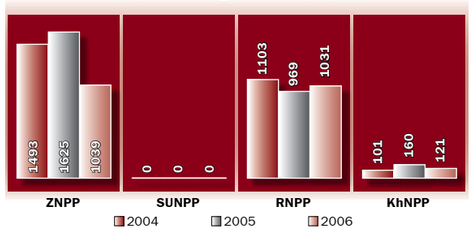


Fig. 4.1.4. Solid radioactive waste processing volumes (m³)

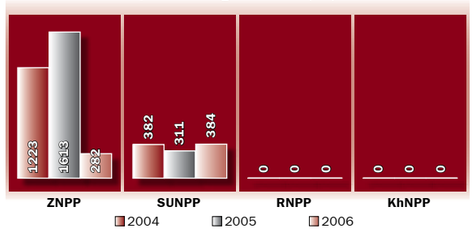


Fig. 4.1.5. Dynamics of accumulation of liquid radioactive waste at NPPs (m³)

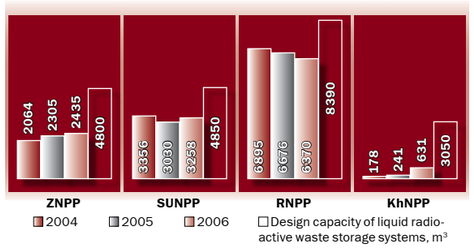
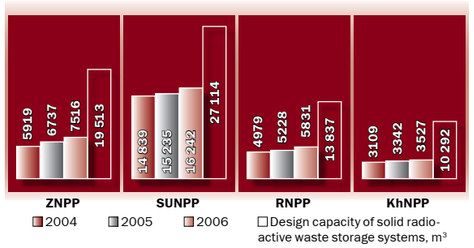


Fig. 4.1.6. Dynamics of accumulation of solid radioactive waste at NPPs (m³)



* – *As termed by the Law of Ukraine "On Radioactive Waste Management', the "radioactive waste' means material objects and substances characterised by radionuclide activity or radioactive contamination that oversteps limits set by applicable standards, unless these objects and substances are critical..*

It should be noted that storage facilities are filled by 40-70%.

Special attention is paid to activities aimed at constructing and commissioning units to process liquid and solid radioactive waste to reduce levels of both accumulated and generated radioactive waste. As part of regulatory activities, design materials were studied, that relate to commissioning:

- *liquid radioactive waste deep evaporating unit at the South Ukraine NPP;*
- *centrifuging unit at the Khmelnytsky NPP;*
- *solid radioactive waste processing unit at the Rivne NPP.*

In 2006 the SNRCU conducted three special inspections of these activities.

4.2. MANAGEMENT OF RADIOACTIVE WASTE RESULTING FROM THE USE OF IONIZING RADIATION SOURCES

Specialised economic activities in managing radioactive waste resulting from the use of ionizing radiation sources are carried out by the "Radon" Association joining 6 State Interregional Specialised Enterprises: Kyiv, Donetsk, Odesa, Kharkiv, Dnipropetrovsk, Lviv.

Kharkiv, Lviv, Odesa, Dnipropetrovsk and Kyiv specialised enterprises take low- and medium-active radioactive waste. Donetsk specialised enterprise operates only the radioactive waste decontamination and transport station.

The specialised enterprises receive solid radioactive waste, biological waste contaminated by radioactive substances, as well as used ionizing radiation sources (IRS).

Biological radioactive waste is stored separately from solid radioactive waste at special facilities, using the layered cementing technique.

Biologically protected IRS are stored at solid radioactive waste storage facilities like ordinary radioactive waste, or in a special pit to store unprotected IRS.

Presently, the specialised enterprises do not receive liquid radioactive waste. It arrives solidified and is stored as solid radioactive waste. Internal liquid radioactive waste is stored using special facilities.

The specialised enterprises have:

- *45 reservoirs to store solid radioactive waste: 29 operating, 16 mothballed;*
- *3 reservoirs to store biological radioactive waste: 2 operating, 1 mothballed;*
- *11 reservoirs to temporarily store liquid radioactive waste: 10 operating, 1 mothballed;*
- *14 reservoirs to store used IRS: 11 operating, 3 mothballed;*

Furthermore:

- *Kyiv specialised enterprise operates the solid radioactive waste shed;*
- *Odesa specialised enterprise has an equipped site to store RTEGs, as well as sites to store solid radioactive waste in containers of UUK-3 and KTZ-3 types.*

In accordance with the law, "Radon" specialised enterprises carry out their activities in the area of radioactive waste management based on licenses issued by the SNRCU. The licenses determine both the scope of permitted activities and special conditions of their carrying out.

During 2006, at all specialised enterprises the SNRCU's nuclear and radiation safety inspectors conducted inspections: from 20 to 23 June at Kyiv specialised enterprise, from 26 to 28 July at Odesa specialised enterprise, from 7 to 10 August at Lviv specialised enterprise, from 15 to 18 August at Dnipropetrovsk specialised enterprise, from 17 to 18 August at Donetsk specialised enterprise, from 11 to 14 September at Kharkiv specialised enterprise. Based on the inspection results, prescriptions were given to eliminate the revealed violations with regard to long-term storage of liquid radioactive waste (at Kyiv, Odesa and Dnipropetrovsk specialised enterprises), strontium 90 metering attestation (at Odesa and Lviv specialised enterprises), commissioning perimeter warning system at the radioactive waste site (at Lviv specialised enterprise), etc.

In order to assess the status of nuclear and radiation safety and single out critical actions to be taken by enterprises, regulators and radioactive waste management body to improve safety, the SNRCU's Board met 5 October 2006 to address the issue of safe radioactive waste management at "Radon" enterprises.

As a result, the Board stated that, as a consequence of extremely deteriorated equipment, obsolete technologies, degradation of protective structures, large volume and high total activity of radioactive waste, the technical level of radioactive waste management safety at "Radon" enterprises is poor.

Primary activities to be carried out by "Radon" are as follows:

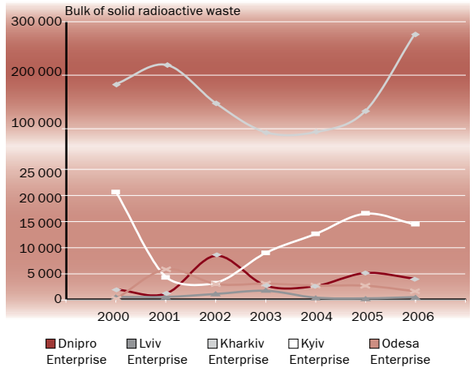
- *removing radioactive waste from the mothballed emergency storage facility located at the Donetsk State Chemical Works and safely storing it in temporary containers;*
- *eliminating aftermath of radiation accident at storage facilities 5, 6, 7 of Kyiv specialised enterprise;*
- *setting deadlines for transition to temporary storage of used IRS in containers, as well as planning methods and time frames for mothballing (immobilising) pits and presenting documents proving safety of the proposed activities to the SNRCU.*

Primary aspects to be addressed are:

- *developing and implementing the Action Plan implementing sorting, conditioning, processing and storage of waste before their centralised burial;*
- *carrying out activities aimed at relocating works' radioactive waste at "Vektor", along with setting a time frame for presenting documents to be studied by state nuclear and radiation safety experts;*
- *purchasing sufficient number of certified containers to transport and store radioactive waste taking into account the dynamics of the removal of radioactive waste and the need to implement the planned projects aimed at removing radioactive waste from emergency storage facilities;*
- *processing liquid radioactive waste, especially, at Odesa and Kyiv specialised enterprises, after agreeing technical solutions with the SNRCU;*
- *renewing production assets, especially, the inventory of the nuclear control equipment to carry out routine maintenance and control conditions of the environment.*

Specialised enterprise storage facilities are of an imperfect type designed as long ago as in the "50s, which led to off-site contamination of groundwater with tritium at the Kyiv and Kharkiv specialised enterprises. At the Kyiv and Kharkiv specialised enterprise emergency plans were developed to carry out activities aimed at preventing accidents. At the Kharkiv specialised enterprise, a great number of the planned activities aimed at combating radiation accident were carried out which made it possible to confine the accident aftermath and make forecasts.

Fig. 4.2.1. Dynamics of the removal of solid radioactive waste to "Radon" specialised enterprises



In 2006 the Kyiv City Council provided for certain allocations from the Kyiv Environmental Protection Fund to carry out first-priority activities aimed at minimising the impact of radiation accident. Design materials developed to minimise the radiation accident impact are agreed with the SNRCU in August 2006.

The dynamics of the removal of solid radioactive waste, biologically protected and unprotected IRS to "Radon" specialised enterprises during 2000-2006 are shown as Figures 4.2.1.-4.2.3.

It should be also noted that during 2006:

1. *Control levels of individual equivalent doses of radiation exposure of the personnel category. A were not exceeded.*
2. *No overstepping of control levels of allowed*

Fig. 4.2.2. Dynamics of the removal of biologically protected IRS to "Radon" specialised enterprises

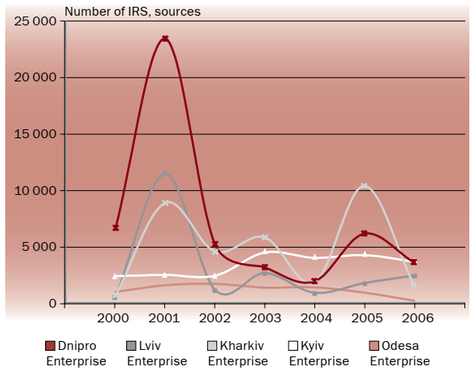
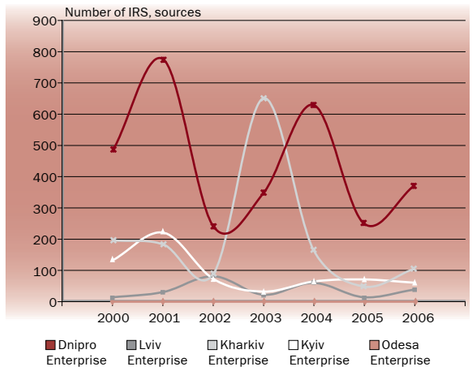


Fig. 4.2.3. Dynamics of the removal of biologically unprotected IRS to "Radon" specialised enterprises



Volume and characteristics of radioactive waste removed t o "Radon" Specialised Enterprises in 2006

(based on quarterly information provided by specialised enterprises to the SNRCU)

"Radon" enterprises	Solid		Liquid		Biological		IRS					Total activity, Bq
							biologically protected			unprotected		
	Bulk, kg	Activity, Bq	Volume m^3	Activity, Bq	Bulk, kg	Activity, Bq	Number of protected IRS, s	Protected bulk, kg	Activity, Bq	Number of unprotected IRS, s	Activity, Bq	
Dnipropetrovsk	4055	$8{,}819E^{+9}$	0	0	0	0	3608	559	$1{,}823E^{+11}$	369	$6{,}193E^{+12}$	$6{,}384E^{+12}$
Kyiv	14499	$2{,}145E^{+9}$	0	0	120	$1.7E^{+7}$	3731	16548	$5{,}849E^{+13}$	0	0	$5{,}852E^{+13}$
Lviv	497	$1{,}98E^{+10}$	0	0	0	0	2432	8419	$4{,}117E^{+13}$	38	$7{,}33E^{+11}$	$4{,}21E^{+13}$
Odesa	1612	$8{,}8E^{+9}$	0	0	0	0	204	899	$4{,}313E^{+11}$	59	$5{,}628E^{+12}$	$6{,}068E^{+12}$
Kharkiv	275888	$3{,}59E^{+12}$	0	0	0	0	1581	11677	$8{,}37E^{+11}$	103	$3{,}44E^{+11}$	$4{,}771E^{+12}$
TOTAL	306551	$3{,}63E^{+12}$	0	0	120	$1{,}7E^{+7}$	11556	28102	$1{,}01E^{+14}$	569	$1{,}29E^{+13}$	$1{,}188E^{+14}$

concentration of radionuclides in air of operating areas was registered at any specialised enterprise.

3. *Control levels of survey parameters for category B were not exceeded.*

Radiation protection of category C (population) living in control areas of specialised enterprises is ensured by adhering to standards and rules regulating radiation safety in the process of managing radioactive waste at hazardous works' facilities and timely carrying out surveys in the control area. The list of radiation survey parameters and location of survey stations ensure the timely detection of deviations from radiation safety provisions applicable in Ukraine and make it possible to rapidly assess the risk for all categories of the population.

4.3. MANAGEMENT OF RADIOACTIVE WASTE GENERATED BY NUCLEAR RESEARCH REACTORS

Solid radioactive waste generated by nuclear research reactors of VVR-M (National Academy of Sciences of Ukraine's Nuclear Research Institute, Kyiv) and DR-100 (Sevastopol Institute of Nuclear Energy and Industry) designs is collected on site, sorted along with certification by solid waste types, transported, registered and temporarily stored at nuclear research reactor sites and subsequently removed to specialised enterprise.

Using a special drainage system, liquid radioactive waste is collected in temporary storage reservoirs (metal tanks) located underground at nuclear research reactor sites.

At the National Academy of Sciences of Ukraine's Nuclear Research Institute site, the liquid radioactive waste processing unit is commissioned. It operates by the method of deep evaporation with subsequent cementing the remains.

The Sevastopol Institute of Nuclear Energy and Industry has no radioactive waste processing units.

The main characteristics of radioactive waste stored at nuclear research reactor sites in Ukraine are presented in the table:

Radioactive waste generated by nuclear research reactors

Enterprise	Quantities of solid radioactive waste	Volumes of liquid radioactive waste, m^3	Radioactive waste activity, Bq
Sevastopol Institute of Nuclear Energy and Industry (Sevastopol) Reactor IR-100	23,5 m^3	11,3	$5{,}61E^{+08}$
National Academy of Sciences of Ukraine's Nuclear Research Institute (Kyiv) Reactor VVR-M	7053 kg (in hot domes)	313,42	$2{,}61E^{+11}$

Spent Fuel Management

5.1. SPENT FUEL MANAGEMENT AT OPERATING NPPS

One of the most important components of the nuclear power plant cycle is spent fuel generated in the process of generating power in nuclear reactors.

After its use in the reactor, nuclear fuel is unloaded to reactor's cooling ponds where it is stored for a period necessary to reduce residual energy release (4-5 years). Residual release of energy is a process induced by radioactive decay of fission products.

After cooling in cooling ponds, spent fuel is loaded in special containers ensuring its safety as transported and delivered to the spent fuel storage facility.

There are several approaches to subsequent spent fuel management in the world:

1. ***Delayed decision means*** *long-term storage of spent fuel which provides a possibility to make a decision on subsequent spent fuel management taking into account future technologies and economic factors. Delayed decision is used by many countries, such as Argentina, Denmark, Spain, Canada, Lithuania, Germany, Norway, South Korea, Poland, Slovakia, Hungary, Czech Republic, Croatia;*
2. ***Processing means*** *spent fuel processing to obtain from it components and substances whose use is economically sound. However, it should be noted that a country processing spent fuel returns high-level waste to a country owning the same which, in its turn, requires the appropriate infrastructure to manage this waste.*
3. ***Disposal means*** *cooling spent fuel and its burial in deep geological formations (USA, Finland, Sweden).*

Spent fuel generated by reactors of Rivne, Khmelnytsky and South Ukraine NPPs is shipped to Russia – spent fuel from reactors of VVER-1000 design to be stored, and spent fuel from reactors of VVER-440 design (Rivne Units 1 and 2) to be reprocessed.

Taking into account that the Zaporizhzhya NPP operates 6 reactors of VVER-1000 design, in compliance with the Cabinet of Ministers of Ukraine's Resolution No. 881 of 24 December 1994, the decision was made to construct the spent fuel storage facility at the Zaporizhzhya site.

In 2001 the Zaporizhzhya NPP commissioned a dry-cask storage for spent fuel to be operated for 50 years. The dry-cask storage design was implemented using a tried technology of American company Duke Engineering & Services and meets provisions, rules and standards in the area of nuclear and radiation safety. The spent fuel storage site is designed to accommodate 380 containers to hold over 9,000 spent fuel assemblies. As of 1 January 2007, the storage had 48 containers with spent fuel.

An advantage of this project is that spent fuel containers are supplied by Ukrainian manufacturers.

Taking into account such factors as:

- *a rise in world prices for spent fuel transport, processing and storage;*
- *a need to create an infrastructure to manage high-level radioactive waste generated in the process of spent fuel processing which will be returned from Russia, as well as the fact that 95% of spent fuel are natural uranium and accumulated transuranic isotopes, the best raw product which can be used in nuclear technologies in the future;*
- *most nuclear states took a course of storing spent fuel until its regeneration becomes economically sound,*

Ukraine applies the "delayed decision' approach to preserve valuable energy resources to possibly use the same in the future.

The Action Plan 2006-2010 aimed at implementing the Energy Strategy of Ukraine until 2030 approved by the Cabinet of Ministers of Ukraine's regulation No. 427 of 27 July 2006 envisaged constructing in 2006-2010 the dry interim storage facility for spent fuel. Twenty-six December 2005 Energoatom and American company Holtec International signed a contract to construct in Ukraine the centralised dry interim storage facility at Rivne, Khmelnytsky and South Ukraine NPPs, using the tried dry-cask storage technology.

In early 2007, Energoatom will complete the paper on feasibility study of the dry interim storage facility construction to be sent to Ukrinvestekspertiza. It is prepared to go through public hearings. Furthermore, the operator plans the study of the paper by international experts. All decisions on the dry interim storage facility shall be made in compliance with the

Law of Ukraine "On the Procedure for Decision-Making when Locating, Designing, Constructing Units and Radioactive Waste Management Facilities of National Importance'.

5.2. SPENT FUEL MANAGEMENT AT CHORNOBYL NPP

During 2006 unloading of spent fuel from Unit 1 reactor to spent-fuel ISF-1was completed, and as of 1 January 2007 spent fuel of the Chornobyl NPP is stored in Unit 3 reactor, cooling ponds of Units 1, 2 and 3, and the wet interim storage facility (hereinafter called ISF-1).

ISF-1 was commissioned 12 December 1986. ISF-1 consists of 5 cooling ponds having a design capacity of 4,380 spent fuel assemblies each (actually around 4,300). A canyon before the cooling pond can additionally accommodate up to 380 spent fuel assemblies. One pond is a backup one.

As projected, spent fuel will be stored in leakproof containers to prevent the spread of radionuclides and ensure physical integrity of fuel assemblies. As

of 1 January 2007, ISF-1 contained 16,656 spent fuel assemblies.

ISF-1 is of 1977 design meeting documents which regulated safety in those times. In order to bring ISF-1 in line with the requirements of current regulations and rules in the area of nuclear and radiation safety, the operator developed the Programme for the Establishment of ISF-1 and Justification of the Period and Conditions of Its Subsequent Operation (hereinafter called the Programme) to be completed in June 2007. The Programme envisages inspections of ISF-1 structures, systems and equipment, determining their residual life, analysing inconsistencies in ISF-1 systems and elements with the requirements of current regulations and rules in the area of nuclear and radiation safety, developing and carrying out activities aimed at compensating these inconsistencies.

Based on the results of carrying out the said activities, the Chornobyl NPP shall provide the SNRCU with the justified Decision on the Period and Conditions of Subsequent Safe Operating ISF-1.

It should be noted that the design capacity does not allow ISF-1 to accommodate all spent fuel from units. In order to solve this problem, at the Chornobyl NPP site a Dry Interim Storage Fasility (ISF-2) is constructed.

ISF-2 is designed for a long-term storage of the Chornobyl NPP's spent fuel and is a precondition for decommissioning of Units 1, 2 and 3, and ISF-1.

Design capacity of ISF-2 is 25,000 spent fuel assemblies. Design spent fuel storage period is 100 years.

The contractor for the project is consortium FRAMATOME/AREVA. Construction was started in June 2000 and, as contracted, was to be completed in 2003. However, in May 2003, as a consequence of revealing weaknesses in the project, construction of ISF-2 was suspended.

As constructing the first concrete spent-fuel storage modules, as a consequence of imperfection of construction techniques, they showed cracks.

However, the most acute problem in the course of carrying out the project was imperfectness of the project in terms of managing non-leakproof fuel elements. The contractor failed to solve the problem of fuel drying (removal of water from non-leakproof fuel elements). The spent fuel storage concept using the so-called "porous insert' developed by designers in 2004 was rejected as not meeting the basic principles of safeguarding nuclear and radiation safety.

Poor quality of design and construction works was also confirmed by the results of auditing the ISF-2 project by Swedish company SKB International Consultants in 2006.

The Assembly of Donors of the Nuclear Safety Account met 27 June 2006 in London to find possible ways to solve the problem. At the meeting it considered proposals of Holtec International (USA) as to solving the problem of fuel drying. Holtec International used a model to present the possibility of solving the problem by creating a system to remove water from non-leakproof fuel elements, as well as put forth preliminary proposals as to completing the ISF-2 project. In general, these proposals were accepted, and in late 2006 termination of the previous and preparing the new contract were started following conceptual proposals by Holtec.

Transformation of the Shelter Object into an Ecologically Safe System. Decommissioning of Chornobyl Nuclear Power Plant

In 2006 20 years passed since the accident at Chornobyl Unit 4, which was the most sweeping and catastrophic disaster in the history of the nuclear sector. The explosion destroyed the reactor core and demolished protective barriers and safety systems.

6.1. STATUS OF SAFETY OF THE SHELTER OBJECT

In order to isolate the destroyed reactor, Chornobyl Unit 4 was very fast mothballed and surrounded with the protective structure. The Shelter Object is the Chornobyl Unit 4 destroyed by the unanticipated accident that lost its unit functions on which the first-line actions were taken and activities aimed at reducing the accident aftermath continue.

During 20 years domestic and foreign specialists and organisations have carried out activities to improve the safety of this project, however, the main objective – to transform the Shelter Object into an ecologically safe system – is still unachieved.

Activities at the Shelter Object are carried out based on license EO No. 000033 issued by the SNRCU in December 2001. The license sets both the scope of permitted activities and conditions of its carrying out, regulates activities aimed at transforming the Shelter Object into an ecologically safe system, especially, within the international Shelter Implementation Plan (SIP).

Nuclear safety of the Shelter Object is implemented by carrying out organisational and technical measures as elements of hazardous nuclear activities* and routine control over the condition of accumulations of fuel containing material (FCM), as well as maintaining them (in the event of exceeding critical levels) at a subcritical level and preventing self-sustaining chain fission reaction by using neutron-absorption mixes.

The status of the nuclear safety of the Shelter Object is continuously evaluated based on the results of routine taking FCM control parameters (γ-radiation exposure rate, neutron flux density). During 2006 control systems did not register any incidents resulting from changes in the said FCM parameters.

In 2006 a general tendency towards stabilisation of the radiation environment continued. At external facilities, the site and in operating spaces of the Shelter Object that are a permanent or periodic work place of the personnel, no overstepping of control levels of γ-radiation exposure rate and radioactive

contamination was registered. Emissions from the Shelter Object, as well as air concentrations of radioactive aerosols in Shelter Object spaces and neighbouring areas did not exceed control levels.

It should be noted that in 2006 the longstanding upward tendency in concentrations of radionuclides (other than 137Cs) and fissionable elements in pools of water inside the Shelter Object persisted. This is associated with the process of many years' destruction of lava-like FCM's and their leaching of radionuclides which leads to increased migration of radionuclides in- and outside the Shelter Object.

Improvement of the situation requires fastest carrying out SIP projects aimed at reducing the amount of liquid radioactive waste at the Shelter Object site, including constructing the new safe confinement.

As carrying out works at the Shelter Object site, the personnel of the Chornobyl NPP and contractors is surveyed and monitored, along with registering radiation doses.

** – In conformance with the Shelter Project Rules, hazardous nuclear activities include:*

- *removing fuel-containing materials (FCM), including logistics;*
- *delivering hydrogen-containing substances to FCM accumulations;*
- *construction and mining activities that may lead to the formation of hazardous nuclear compositions.*

In 2006 an average individual dose received by the Chornobyl NPP personnel working at the Shelter Object site did not exceed the last year's exposure and was 3.62 mSv.

Because of an increased scope of SIP activities, the median level of individual doses among the contractors' personnel increased by 36% vs. the last year and reached 4.72 mSv.

As carrying out stabilisation activities in 2006 to protect individual employees of contractors, control radiation doses levels were exceeded (without overstepping the dose limit) as a result of ignoring radiation safety rules by the contractors' personnel. The Chornobyl NPP investigated these violations and mapped out organisational and recompensing activities. The SNRCU controls carrying out of actions developed at the Chornobyl NPP.

Activities at the Shelter Object site lead to the generation of solid and liquid radioactive waste.

The main source of solid radioactive waste (soil, scrap metal, mixed construction waste) in 2006 were activities aimed at carrying out the SIP: implementing stabilisation measures, carrying out rehabilitation of security perimeter, preconstruction activities aimed at erecting the new safe confinement, etc.

In comparison with 2005, the total quantities of solid radioactive waste generated in the process of operating the Shelter Object and carrying out works within the framework of the SIP reduced by 134 tons (11%), and its total activity lowered by 1.37Ч1012 Bq (93,5%).

Some reduction in quantities of solid radioactive waste in 2006 is due to completing the basic activities aimed at stabilising the Shelter Object and delay in other works that may generate solid radioactive waste (for example, pioneer wall berm removal).

A significant reduction in the total activity of the removed Shelter's solid radioactive waste is due to the fact that, in the process of carrying out works during 2006, at the Shelter Object site no median- and high-level solid radioactive waste were detected.

Volumes of liquid radioactive waste removed from the Shelter Object in 2006 vs. 2005 increased by 84 m3 (2.4%), and its total activity lowered by 2.4r1010 Bq (17.3%).

One of the main projects under the SIP is constructing the new safe confinement (NSC) at the Shelter Object site.

During 2006 the Chornobyl NPP continued tender activities aimed at selecting the contractor to design, construct and commission the NSC Commissioning Stage-1 (CS-1). However, completion of the tender was delayed, and its results are expected to be announced in 2007.

In order to reduce regulatory risks in the process of designing the NSC and because of the lack of the preliminary NSC safety analysis report, as recommended by the EBRD International Consulting Group, the SNRCU initiated developing the NSC CS-1 Concept design safety document (CDSD).

The CDSD shall contain technical (functional) specifications, design safety criteria and the project concept proposed by the NSC CS-1 Contractor. The CDSD agreed by regulators must provide the basis for the NSC design.

In 2006 the structure and requirements to the content of the CDSD were approved and separate draft chapters of the paper were studied.

Within the framework of preconstruction works under the NSC project, the Chornobyl nuclear power plant set to removing the pioneer wall berm. Pioneer wall berm deconstruction and removal are the first step in NSC preconstruction activities in the southern area of the Shelter Object.

Prior to moving the NSC in the design position, the existing ventilation pipe 2 of the 2nd line of the Chornobyl NPP is to be deconstructed. Instead of ventilation pipe 2, before its deconstruction, the new ventilation pipe shall be installed and commissioned. In 2006 the SNRCU studied and agreed design criteria and requirements to the new ventilation pipe. As designing the new ventilation pipe and planning its construction, it is required to take into account the presence of spent fuel in Unit 3 rooms and reactor.

Stabilisation of the Shelter Object structures.

The main objective of stabilisation of the Shelter Object structure is to reduce the risk of its breakdown with possible heavy emission of radioactive dust into the atmosphere. At the end of 2006 the Chornobyl NPP almost completed carrying out 7 urgent stabilisation measures aimed at stabilising the Shelter structures that were the most unreliable and unsafe in view of possible breakdown. These stabilisation measures were picked out of the set of 15 activities specified by the conceptual design as those requiring urgent carrying out.

Activities are completed aimed at stabilising resting places of beams B1/B2 (strengthening the western element of the Shelter), deaerator stack frame, northern and southern panels, southern "hockey stick' panels, supports of the "Mammoth" beam.

Activity 2 – transferring loads from beams B1/B2 to the newly-constructed metal structures – remains uncompleted. As carrying out this activity, 50% of the load on beams B1/B2 was transferred instead of the designed 80%. In 2007 the Chornobyl NPP will control the behaviour of metal structures, their foundations, resting assemblies of beams B1/B2, ventilation shafts taking into account the impact of meteorological factors, shrinkage of foundations, etc. Based on the monitoring results, it will be decided on the optimal transfer of loads from beams B1/B2 to the newly-constructed metal structures.

Taking into account activities already carried out and due to the delay in implementing the NSC design, the SNRCU obliged the Chornobyl NPP to conduct the comprehensive analysis of the security of the Shelter Object in general and analyse the technical feasibility and criticality of carrying out the remaining of 15 stabilisation measures outside the urgent ones.

This analysis and the stabilisation scope assessment are expected to be conducted within the first half of 2007.

Liquid radioactive waste management at the Shelter Object site.

In order to solve the issue of liquid radioactive waste management at the Shelter Object site, the Conceptual technical decision on liquid radioactive waste management during the Shelter Object transformation into an ecologically safe system is developed to generally determine the entire liquid radioactive waste management chain at the Shelter Object site.

Mapping and carrying out activities aimed at implementing the said conceptual technical decision are controlled by the Cabinet of Ministers of Ukraine.

Creating a special site to temporary stockpiling of soils and technological materials.

As constructing the new safe confinement and other structures under the SIP, it is planned to remove some 100,000-150,000 cubic meters of soils and other technological materials. Management of these technological materials is a complex problem, primarily because heavy engineering capacities are required. At the same time, safety requirements are to be met.

For the purpose of temporary storing soils and technological materials, the Chornobyl NPP constructed a special site and established process material acceptance rules and safety measures to prevent the spread of radioactive substances in air and underground water, unauthorised access, etc. In 2006 the SNRCU issued the authorisation to commission and operate the site. Filling the site with technological materials resulting from the removal of the pioneer wall berm has been started.

Creating the modernized dust suppression system.

In 2006 the SNRCU approved the design of and permitted operating the modernized dust suppression system at the Shelter Object site.

The main functions of this system are confining radioactive substances that are under the Shelter Object roofing in the form of dust, and lowering the emission of radioactive aerosols into the environment by spraying the dust suppression mixture and covering surfaces of under-roof spaces with a stable protective polymeric film.

6.2. MANAGEMENT OF RADIOACTIVE WASTE OF CHORNOBYL ORIGIN

The Chornobyl Exclusion Zone is an part of Ukrainian territory most heavily contaminated with radionuclides as a consequence of the Chornobyl disaster. In the Chornobyl Exclusion Zone a lot of radioactive waste is accumulated. Characteristics of this radioactive waste widely differs in radionuclide composition and specific activity.

Radioactive waste totals (the Shelter Object excluded) some 2.8 million cubic meters including over 2.0 million cubic meters of radioactive waste having the total activity of about 7x1015 Bq that are located at radioactive waste disposal sites and temporary radioactive waste localisation sites.

The main economic subjects in the area of radioactive waste management in the Exclusion Zone are State specialised enterprises "Kompleks" and "Technocenter".

Based on the SNRCU's license, "Kompleks" collects and transports radioactive waste in the Exclusion Zone; operates the existing "Buryakivka" radioactive waste disposal site; monitors "Pidlisny" and "3rd Chornobyl Line" radioactive waste disposal sites and temporary radioactive waste localisation sites. The license specifies activities aimed at bringing disposal and temporary radioactive waste localisation sites existing in the Exclusion Zone in line with the requirements of applicable radiation safety standards and rules.

The "Buryakivka" radioactive waste disposal site was constructed in 1986, practically immediately in the wake of the Chornobyl accident and has been operated since 1987. As of 1 January 2007, "Buryakivka" facilities contained radioactive waste totalling 580,000 cubic meters that had the total activity of 2.47x1015 Bq (estimate).

Recently the "Buryakivka" disposal site receives about 25,000 cubic meters of radioactive waste per year, its design capacity is increasingly exhausted – the reserve of 30 design trenches each having a capacity of 22,000 cubic meters (design capacity of 15,000 cubic meters is increased as agreed with the regulator) is 40,000-45,000 cubic meters. Therefore, the Ministry for Emergencies, as a control authority in the area of radioactive waste management, resolved to rehabilitate

the "Buryakivka" disposal site by constructing 6 additional intertrench systems to hold 120,000 cubic meters of radioactive waste. In February 2006 the SNRCU studied the Technical Decision modifying the reconstruction project. After the study the Technical Decision was returned to be finalised in view of its lacking the re-evaluation of "Buryakivka" disposal safety.

At the "Pidlisny" disposal site (operated from December 1986 until 1988), modules A-1 and B-1 having a capacity totalling 22,880 cubic meters are partly filled with long-lived high-level radioactive waste

(3,960 cubic meters, having activity of 1.0 E $^{+15}$ Bq) and low- and mid-level radioactive waste (7,040 cubic meters, having activity of 2.5 E $^{+12}$ Bq).

The "3rd Chornobyl Line" disposal site (functioned until the end of 1986) has radioactive waste totalling around 26,200 cubic meters, that has an activity of 3.91E $^{+14}$ Bq.

The "Pidlisny" and "3rd Chornobyl Line" disposal sites do not operate, and "Kompleks" carries out routine safety activities at the same. In the course of the radiation and environmental monitoring of the disposal sites, no cases of exceeding control levels of radionuclide contamination of the air and soils were registered.

"Kompleks" carries out activities aimed at removing radioactive waste from temporary radioactive waste localisation sites, for example, by surveying the removal of radioactive waste from trench T-5 of Naftobaza's site 5.1 located at the Prypyat riverside. Based on the experience gained, a project for removal of radioactive waste from other trenches of this temporary localisation site is developed.

A control level for yearly individual effective dose of external exposure of "Kompleks" personnel of cat. A is set at 5 mSv/year, and the control level for inhaling Cs^{137} by personnel of cat. A is 11 kBq/year.

In 2006 281 "Kompleks" workers were monitored. Several cases of exceeding control levels of air concentrations of Cs^{137} and Sr^{90} in operating rooms of the radiation-contaminated material pre-decontamination site were registered. They were investigated to find out factors that led to overstepping control levels, and activities aimed at their elimination were carried out.

Average annual exposure of the company's personnel in 2006 was 1.49 mSv (Dose limit is 100 mSv in 5 years (20 mSv per year)).

Based on the SNRCU's license, "Technocenter" constructs the "Vektor" production complex. The complex is constructed:

1st line *(as designed):*

- *to dispose short-lived radioactive waste that resulted from the Chornobyl disaster.*

2nd line *(under the Integrated Radioactive Waste Management Programme):*

- *to treatment and permanently store long-lived radioactive waste that resulted from the Chornobyl disaster;*
- *to dispose short-lived radioactive waste that resulted from operating the Shelter Object and that to be generated in the process of transformation of this Object into an ecologically safe system;*
- *to dispose short-lived radioactive waste that resulted from operating nuclear power plants and that to be generated in the process of decommissioning all nuclear power plants;*
- *to dispose or long-term store radioactive waste generated by industrial companies, medical, research and other institutions;*
- *to store high-level radioactive waste that will be generated during reprocessing spent fuel of Ukrainian nuclear power plants in the Russian Federation.*

In order to efficiently use allocations from the State Budget, minimise capital inputs and facilitate commissioning the "Vektor", in the 1st line design the Start-Up Complex was highlighted, that includes two radioactive storages (TRO-1, TRO-2) and infrastructural elements.

Infrastructural elements of the Start-Up Complex will also be critical for operation of a special near surface solid radioactive waste disposal (LOT-3) of the Chornobyl NPP's industrial solid radioactive waste management complex constructed at the Start-Up Complex site using the European Commission's funds under the Chornobyl NPP decommissioning programme.

Construction of the Start-Up Complex is carried out under the project positively estimated by experts who conducted a comprehensive study including nuclear and radiation safety study, environmental study and other studies under applicable laws.

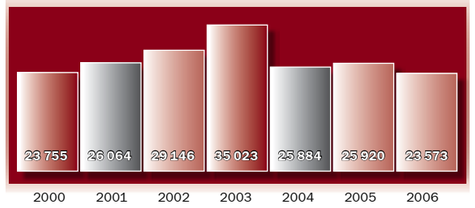
Construction of the Start-Up Complex was launched in March 1998.

The source of finance is the "Vektor" Start-Up Complex Construction line of the State Budget of Ukraine.

Actual financing carried out over the previous years and the rate of utilizing investments were not adequate to complete the construction in 2004 as envisaged by the Integrated Radioactive Waste Management Programme. Presently, no realistic deadline for completing the construction of the Start-Up Complex is set.

According to "Technocenter", in 2006 the following facilities were ready to be inspected by the working commission: control post, transformer substations and on-site power supply and lighting networks, operating fleet depot, approaches and on-site roads, firefighters' and drinking water pumping station, waste water biotreatment station, tank tower, 150 cubic m water reservoir, rainwater treatment structures, accumulating tanks, bioponds, on-site water supply and sewage networks, "Maryanivka" collector for treated household and storm sewer discharges, off-site water supply networks (before the intake), water intake, household discharge station. Construction activities are completed at the sanitary inspection post and firefighters' depot.

Fig. 6.2.1. Dynamics of removing solid radioactive waste to "Kompleks" (Bulk, tons)



6.3. DECOMMISSIONING OF THE CHORNOBYL NPP

Chornobyl Units 1, 2, 3 are under termination of operation (cessation) stage. Unit 1 was shut down in November 1996, Unit 2 in October 1991, and Unit 3 in December 2000.

Termination of operation (cessation) is the final operational phase of an installation, implemented after the decision of its decommissioning, and during which, this installation brought to a state corresponding to absence of nuclear fuel on its site or presence of nuclear fuel within the site only in spent fuel stores designed for long-term safe storage.

As of early 2007, some spent fuel still was in Unit 3 reactor and reactor's cooling ponds of Units 1, 2, 3.

The design life of Unit 1 expires in September 2007, that of Unit 2 in December 2008. This means that until then all spent fuel should be removed from units.

Because of delays in carrying out the ISF-2 project, total defuelling of units is impossible.

In this situation, the Chornobyl nuclear power plant decided to primarily remove spent fuel from unit reactors to cooling ponds. During 2006 all spent fuel assemblies were loaded from Unit 1 reactor to the reactor's cooling pond, with some assemblies loaded to ISF-1.

In 2007 it is planned to load all spent fuel assemblies from Unit 3 reactor to ISF-1 and some assemblies to reactor's cooling ponds of Units 1, 2, 3.

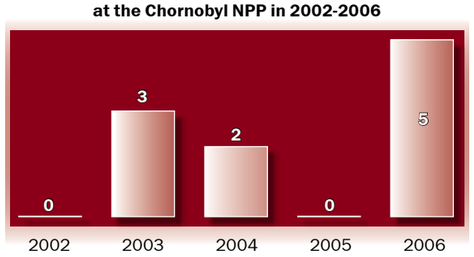
In 2006 the Chornobyl NPP adopted the Action Programme for Setting Operation Deadline for Chornobyl Units in the Process of Shutdown and Decommissioning.

The Programme envisaged activities aimed at determining the technical condition and the remaining life of systems and equipment, conducting critical safety analyses to set the deadline and conditions for further activities aimed at shutting down and decommissioning Chornobyl units.

As programmed, by 15 August 2007 the Chornobyl NPP shall provide the SNRCU with the package of documents justifying extending the operation of Unit 1.

In 2006 at the Chornobyl NPP there were 5 reported events, 4 of which were classified level '0' and 1 event – level '1' on the INES scale.

The number of events at the Chornobyl NPP in 2002-2006



Events at the Chornobyl NPP were caused by the increased number of technological operations, deterioration of the equipment and poor qualification of the personnel. Furthermore, events were slackly investigated (3 of 5 event reports were sent back to NPP for reinvestigation).

By the categories, events at the Chornobyl NPP were split as follows (figures in parenthesis represent the total number of events of the given category).

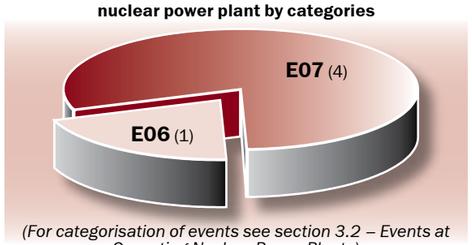
In order to improve the situation, by its prescription the SNRCU prohibited moving spent fuel before conducting the special check of knowledge of operating personnel and technical managers, and official investigation.

In compliance with Chornobyl NPP decommissioning license EO 000040 of 22 March 2002, the Chornobyl NPP operator carries out a set of activities and operations aimed at decommissioning power units, including works mapped out as a components of the termination of operation (cessation) of units.

Deadlines set by special conditions for termination of operation (cessation) stage activities are not met by far. Delayed termination of operation (cessation) stage is primarily caused by the delay in constructing the spent fuel storage (ISF-2). Therefore, the most important task has been to maintain safety of units, taking into account that spent fuel still remains in the units.

Under the said license, activities are also carried out aimed at creating the Chornobyl radioactive waste management infrastructure at the Chornobyl NPP's site and in the Exclusion Zone. It should be noted that deadlines for performing the relevant license conditions are not met because of systematic delays in carrying out international projects. In line with the license conditions, the Chornobyl NPP shall take out separate authorisations to carry out works or operations related to commissioning and operating radioactive waste management facilities. During 2006, in compliance with project schedules, the SNRCU was

Distribution of events at the Chornobyl nuclear power plant by categories



(For categorisation of events see section 3.2 – Events at Operating Nuclear Power Plants)

expected to issue separate written permissions to commissioning a liquid radioactive waste processing plant and operate the interim storage for high-level long-lived radioactive waste. However, as a result of not meeting project deadlines, the Chornobyl NPP failed to apply for these permissions.

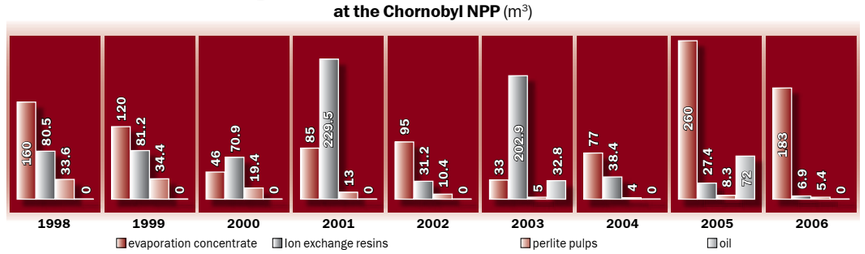
6.4. RADIOACTIVE WASTE MANAGEMENT AT THE CHORNOBYL NPP

Radioactive waste management activities at the Chornobyl NPP are carried out based on and within licenses issued by the SNRCU:

- *License EO 000040 of 22 March 2002 to carry out Chornobyl NPP decommissioning activities;*
- *License EO 000033 of 30 December 2001 to operate the Chornobyl NPP's Shelter Object;*
- *License OV 000334 of 23 August 2006 to carry out radioactive material transport activities.*

Radioactive waste at the Chornobyl NPP is stored in special storages. On the perimeter of the storages, a network of observation wells is created to control the condition of ground water.

Fig. 6.4.1. Generation of liquid radioactive waste at the Chornobyl NPP (m^3)



Liquid radioactive waste accumulated as a result of previous operation is stored in two storages at the Chornobyl site connected with each other using special pipelines to pump liquid radioactive waste, and at the temporary warehouse for spent radioactive oil:

- *liquid radioactive waste storage to hold 26,000 cubic meters of waste. It consists of 5 receiving tanks having capacity of 5,000 cubic meters and 2 receiving tanks having capacity of 500 cubic meters, made of corrosion-resistant steel;*
- *storage for liquid and solid radioactive waste where only liquid radioactive waste is stored, to hold 12,000 cubic meters of waste, consists of 12 receiving tanks of corrosion-resistant steel having capacity of 1,000 cubic meters;*
- *temporary warehouse for spent radioactive oil to hold up to 144 cubic meters of oil consists of two reservoirs (tanks) having a capacity of 72 cubic meters.*

Radioactive waste stored in reservoirs is low- and mid-level waste such as:

- *evaporation concentrate;*
- *ion exchange resins;*
- *perlite pulps.*

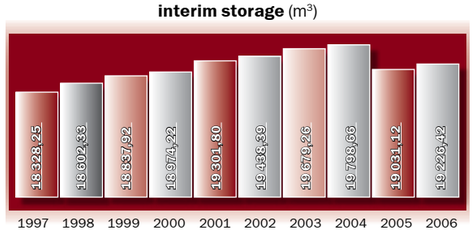
During 2006 the Chornobyl NPP generated and stored 183 cubic meters of evaporation concentrate, 6.9 cubic meters of spent ion-exchange resins, 5.4 м3 cubic meters of perlite pulps (Figure 6.4.1.). Accumulated liquid radioactive waste totals 19,226.42 cubic meters including 12,873 cubic meters of evaporation concentrate, 4,002.55 cubic meters of ion exchange resins, 2,246.07 cubic meters of perlite pulps, 104.8 cubic meters of spent radiation-contaminated oil (Figure 6.4.2.).

Solid radioactive waste accumulated in the process of operating the Chornobyl NPP and eliminating aftermath of the 1986 accident is stored using the solid radioactive waste storage at the Chornobyl NPP's site designed to temporarily store solid radioactive waste of activity categories one, two and three. Presently, the storage does not receive any radioactive waste due to constructing the industrial solid radioactive waste management complex. Solid radioactive waste accumulated in the storage totals: 1,096 cubic meters of waste of category one, 926.5 cubic meters of category two, 506.93 cubic meters of category three.

Low- and mid-level solid radioactive waste resulting from shutting down units and transformation the Shelter Object into an ecologically safe system are transported to the "Buryakivka" radioactive waste disposal site of the State Specialised Enterprise "Kompleks" located in the Exclusion Zone. During 2006 3,560.9 cubic meters (3,903.87 tons) of low- and mid-level waste were removed to the disposal site.

High-level waste is collected using special containers (KTZV-0.2) designed to transport and store solid radioactive waste of group 3 and is stored in the special interim storage for solid high-level waste at the Chornobyl NPP's site. In 2006 no high-level waste was generated, and thus no high-level waste was removed to the storage. In general, the interim storage for solid

Fig. 6.4.2. Dynamics of accumulation of liquid radioactive waste in Chornobyl NPP's interim storage (m^3)



high-level waste holds 0.62 cubic meters of high-level long-lived radioactive waste having an activity totalling around 0.5 TBq (Figure 6.4.3.).

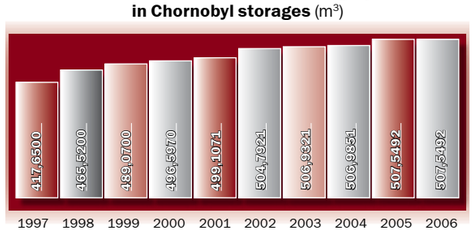
Currently, the Chornobyl NPP does not operate any facilities to process liquid and solid radioactive waste.

6.5. CREATING THE RADIOACTIVE WASTE MANAGEMENT INFRASTRUCTURE AT THE CHORNOBYL NPP

International projects aimed at creating the infrastructure to manage Chornobyl radioactive waste include:

- *constructing the liquid radioactive waste treatment plant;*
- *constructing the industrial solid radioactive waste management complex to include:*

Fig. 6.4.3. Dynamics of accumulation of solid radioactive waste category 3 in Chornobyl storages (m^3)



- *Lot 1 – solid radioactive waste removal plant,*
- *Lot 2 – solid radioactive waste processing plant. Lot 2 also includes the interim storage for low- and mid-level long-lived and high-level radioactive waste constructed at the storage for the Chornobyl NPP's liquid and solid radioactive waste (hereinafter called the Temporary Storage),*
- *Lot 3 – special surface solid radioactive waste storage constructed at the "Vektor" site ("Technocenter" is an operator).*

In the process of implementing the said projects, a number of common problems arose:

- *falling far behind the planned dates,*
- *increased project cost,*
- *poor co-ordination of projects,*
- *management shortcomings,*
- *complex relations between the Chornobyl NPP and international contractors.*

Liquid radioactive waste treatment plant

The liquid radioactive waste treatment plant is designed to process liquid radioactive waste accumulated in the process of operation, including its removal from storages at the Chornobyl NPP's site, as well as processing liquid radioactive waste to be generated in the process of decommissioning the Chornobyl NPP.

It was planned to commission the plant in mid 2006.

However, because of unsolved technical problems, shortcomings in project management and complex relations between the Chornobyl NPP and the contractor, works were not completed.

23 November 2006 Supplement 8 to the liquid radioactive waste treatment plant construction contract was signed under which 15 October 2006 the Chornobyl NPP has terminated the contract with the Contractor (the consortium led by the Belgian company Belgatom).

In order to complete the project, the Chornobyl NPP planned to conclude the contract with the domestic General Contractor Energoprominvest. The relevant proposals along with the developed Plan for Completion of the Liquid Radioactive Waste Treatment Plant were sent by the Chornobyl NPP to the EBRD.

However, the Assembly of Donors of the Nuclear Safety Account that met 14 December 2006 did not adopt the proposals. The Assembly postponed making the decision on the plant until its next meeting.

As a result, the completion of the project is delayed again. The Chornobyl NPP is finalising the Plan for Completion of the Liquid Radioactive Waste Treatment Plant.

Industrial solid radioactive waste management complex.

Lot 1 is designed to remove solid radioactive waste from the existing solid radioactive waste storage at the Chornobyl NPP and deliver it to Lot 2 sorting facility.

Lot 2 is designed to sort solid radioactive waste of all categories and treatment (by fragmenting, incinerating, pressing, cementing) low- and mid-level short-lived solid radioactive waste removed using Lot 1, as well as waste resulting from decommissioning of the Chornobyl NPP. It is also expected to use Lot 2 to package long-lived and high-level radioactive waste resulting from sorting in 200 litre casks and store the same using the Temporary Storage.

Lots 1 and 2 are constructed by 75 %, mounting of equipment is started.

The Temporary Storage is designed for interim (for 30 years) storage of long-lived and high-level radioactive waste to be generated in the process of sorting using Lot 2 unit, as well as to store high-level radioactive waste resulting from activities in anticipation of constructing the Shelter's New Safe Confinement. This storage is created by reconstruction and re-equipping area 138 of the Chornobyl liquid and solid radioactive waste storage that has not been operated heretofore.

As recently planned by Chornobyl, the storage will be commissioned in late October 2007.

In 2006 experts studied nuclear and radiation safety aspects of the interim storage safety analysis report, interim storage design quality programme and interim storage design. The design was agreed. However, taking into account the lack of final results of inspecting constructions, the SNRCU set requirements to operating the facility in order to render it safe until conducting additional inspections and demonstrating stability of the structure under design loads.

Lot 3 storage having a capacity of 50,250 cubic meters is designed to bury concrete containers from Lot 2 and 200 l casks from the processing plant.

At "Vektor" site activities are carried out to concrete Lot 3 modules, mount the equipment, complete the construction of the control post.

The main aspect of successful implementing Lot 3 project, as well as processing plant and Lots 1, 2 projects is safety assessment of Lot 3 storage , including in a long perspective after closure the storage and completing the institutional control (for 300 years and more). Radioactive waste acceptance criteria Lot 3 facility to be set based on the results of this assessment shall be agreed with characteristics of conditioned radioactive waste to be generated by the Liquid radioactive tratment plant and Lot 2.

The deadlines for the construction of facilities of the industrial solid radioactive waste management complex are not met.

After almost one year of negotiations with the European Commission on Amendment 4 to the Industrial solid radioactive waste manegment complex construction contract, final agreement was not reached. At the same time, the European Commission set a strict deadline for financing the complex project – the end of 2007.

To adhere to special conditions of license EO 000040, the Chornobyl NPP developed the Decommissioning Programme for Units 1, 2, 3 and at the end of 2006 sent it to the SNRCU. The Programme shall ensure activities planning at the strategic level, assessment of use of finance and human resources, including the critical feasibility studies to develop decommissioning projects.

Using Ionizing Radiation Sources

Ionizing radiation sources (IRS) are widely used in Ukraine by 3,804 companies, organisations and institutions (2,837 of which are medical and 967 non-medical). In 2006 a wider use of IRS is observed, especially in medicine. IRS are used both as devices containing radioactive substances and devices generating ionizing radiation. Due to the ability of ionizing radiation to permeate the fabric, IRS are necessary components of different devices and equipment. IRS equipment is used to monitor processes and control metal products for defects, and thus contributes to safety in metal, coal and chemical industry, etc. IRS are widely used in oil and gas exploration, construction survey. Without IRS it is impossible to imagine modern medicine, both diagnostics (radionuclide, fluoro-, X-ray, tomo-) and treatment, especially, cancer treatment. However, useful properties of ionizing radiation making it possible to kill tumour cells, sterilise medical instruments and materials, if IRS are not regulated by the state, may produce a contrary effect – radiation accidents. The regulation in Ukraine is carried out within the radiation safety state regulation system.

** – IRS use and production activities include works specified by the Safety Requirements and Conditions (license conditions) as Using Ionizing Radiation Sources approved by Decree of the State Nuclear Regulation Committee of Ukraine No. 125 of 2 December 2002, registered with the Ministry of Justice of Ukraine 17 December 2002, Reg. No. 978/7266, and the Conditions and Rules as Producing Ionizing Radiation Sources approved by Decree of the Ministry of Ecology and Natural Resources of Ukraine No. 111 of 20 March 2001, registered with the Ministry of Justice of Ukraine 11 April 2001, Reg. No. 334/5525.*

The state regulation of IRS safety is based on the principle of licensing. Licensing in the area of IRS activities applies to IRS production and use*. State regulation is not required when using IRS whose activity is lower than the set Unregulated IRS Specific and Total Activity Levels (approved by resolution of the Cabinet of Ministers of Ukraine No. 1718 of 16 November 2000). No license is required to use IRS that meet non-regulation criteria and are specified in the List of Ionizing Radiation Sources Not to Be Licensed approved by resolution of the Cabinet of Ministers of Ukraine No. 912 of 1 July 2002. In 2006 the SNRCU initiated supplementing the said list in view of arrival of new IRS types and classes. The license is issued by the SNRCU subject to the licensee's proven ability to adhere to safety standards and rules and license conditions.

In 2006 the state made an extremely important decision – it renewed functioning of the SNRCU's state radiation safety inspectorates (see Section 2). This made it possible to quantitatively and qualitatively improve the state supervision over IRS management safety in the country. Despite the fact that in 2006 inspectorates were understaffed (25% of the staff) and were in the process of setting up, their work significantly improved the level of IRS management safety, especially, IRS security. Seventy-one inspections were conducted.

In 2006 IRS use was covered by 168 licenses. Most companies using IRS for non-medical purposes took out licenses. Companies that did not obtain the license were instructed to stop their IRS activities until taking out licenses. An upward tendency in the number of IRS producers is observed. In 2005 the SNRCU issued 4 licenses to produce IRS, and in 2006 6 licenses. In 2006 the SNRCU also agreed 11 technical conditions for IRS production.

The SNRCU's institutional strengthening in 2006 encouraged new important steps towards strengthening IRS safety and security:

- *licensing of medical institutions and establishments using IRS;*
- *developing and implementing the system of activities aimed at improving safety and security of spent high-level IRS;*
- *practical completion of the State IRS Register;*
- *strengthened combating illegal circulation of IRS.*

LICENSING MEDICAL INSTITUTIONS

Medical institutions and establishments using ionizing radiation sources in diagnostics and treatment were licensed using a differentiated approach depending on a potential IRS danger. In 2006 4 licenses were issued to cancer centres to use IRS. Special attention is paid to IRS use quality systems with respect to protection of patients against radiation.

ACTIVITIES AIMED AT STRENGTHENING SAFETY AND SECURITY OF SPENT HIGH-LEVEL IRS

One of safety deficits currently existing in the state is companies' having large quantities of spent high-level IRS* inherited from Soviet time. In order to ensure safety of management of high-level IRS whose life expired and in accordance with decree of the Cabinet of Ministers of Ukraine No. 18-r of 18 January 2006, the SNRCU developed the State Spent High-Level IRS Storage Safety Programme approved by resolution of the Cabinet of Ministers of Ukraine No. 1092 of 3 August 2006. The Programme time frame is 2007-2009. The Programme envisages making the register for spent high-level ionizing radiation sources (IRS), developing the technology for their removal from units, creating the spent high-level IRS management infrastructure, removal and interim storage of spent high-level IRS using the constructed special storage system. Contractors for the Programme are the SNRCU and the Ministry for Emergencies. In 2006 the SNRCU has practically completed the register for spent high-level IRS. The register contains some 1,500 entries. In order to finalise the register and obtain reliable information on the location of spent high-level IRS, the administrative search for individual IRS-containing units is continued. In the search, information on units shipped to Ukraine in the USSR times (until 1990) was also used. Register activities made it possible to supplement the State Register with information on a large number (roughly over 600) of spent high-level sources.

Due to limited financing of the State Programme from the State Budget of Ukraine, the SNRCU sent a request to the IAEA as to providing assistance in implementing the Programme at individual sites and received preliminary consent to render assistance in carrying out the following activities:

** – 'High-level' means that the direct contact with the specified source without the appropriate protective barriers for several minutes to several hours may cause death.*

- *inspecting technical and radiation condition of units and physical condition of spent sources they are equipped with;*
- *developing technologies to remove these sources, determining characteristics and containerisation of the same;*
- *removing, containerising and transporting sources to interim storage sites of specialised radioactive waste management companies.*

The IAEA's decision as to possibility of additional financing of the State Programme activities within the framework of a separate IAEA's project is received.

CREATING THE STATE IRS REGISTER

In order to ensure the state registration and control of IRS, IRS are entered in the State Register in accordance with the Rules of State Registration of Ionizing Radiation Sources approved by the Cabinet of Ministers of Ukraine in its resolution No. 1718 of 16 November 2000.

In 2006 the State IRS Register and its regional centres were completed. During 2004-2006 the results of the state IRS inventory activities at companies and institutions of Ukraine were entered in the Register.

STRENGTHENED COMBATING ILLEGAL IRS CIRCULATION

The SNRCU actively participates in investigating cases of detecting radiation-contaminated metal scrap. It systematises information on companies owning radiation-contaminated metal scrap as regards radionuclide composition of contamination, possible ways of its travel. The said information is sent to the Ministry of Industrial Policy of Ukraine (body in charge of licensing metal scrap management) which responds to the same.

According to information registered with the SNRCU, during 2006 22 radiation incidents involving IRS occurred, 15 of which were radiation-contaminated metal scrap, and 7 illegally circulating IRS. As compared with 2005, the number of incidents reduced almost by one third. This reduction was due to reduced number of cases when radiation-contaminated metal scrap was detected.

The analysis of causes of detecting radiation-contaminated metal scrap shows a large component of metal products contaminated with natural radionuclides. Normally, contaminated metal scrap arrives as pumping and compressor pipes and depreciated equipment which, in the process of production activities of oil and gas producers, are contaminated with natural radionuclides, especially, radium (Ra226) and thorium (Th232). Therefore, the SNRCU started co-operating with Naftogaz of Ukraine to remedy the situation.

As a result of interface between the SNRCU and the Ministry of Industrial Policy as a central executive authority regulating non-ferrous and ferrous metal procurement, and processing activities, in 2006 2 subjects of economic activities – owners of contaminated scrap metal – were deprived of licenses to carry out the said activities, 7 licensees were instructed to eliminate violations of license conditions.

As regards detecting IRS in illegal circulation, 3 IRS were detected during the customs inspection, 2 by investigators of the Ministry of Internal Affairs and Security Service of Ukraine, and 2 as a result of inspecting territories.

In all cases it was sealed sources, that is sources containing the radioactive substance and having a shape that, under the normal conditions of using the source, prevents the radioactive substance from passing to the environment (for example, the radioactive substance can be placed in a double or triple capsule). In all cases it was the so-called "abandoned sources'. Abandoned ionizing radiation sources are sources that do not receive the proper "attention', that is, sources left uncontrolled despite their concealing a danger to be controlled. Abandoned IRS are frequently found in illegal circulation and represent a permanent potential radiation damage.

For example, in December of the current year in Okhtyrka rayon, as inspecting a building, an IRS container was detected on the outer surface of which there was the sign of radiation danger. The appearance of this container is presented as Figure 7.1.

As a result of co-ordinated interaction of local executive bodies, the container was examined, removed and stored at the site of a specialised company. The interaction and response to cases of detecting illegally circulating IRS are regulated by the Cabinet of Ministers' resolution*.

It should be noted that in all the above cases there were no radiological consequences for the population and no environmental contamination.

Fig. 7.1. Appearance of the IRS container.

Fig. 7.2. Appearance of IRS in illegal circulation

** – Res. No. 813 of 2 June 2003 on approving the Rules for Interaction of Executive Authorities and Corporations Carrying Out Activities in the Area of Nuclear Energy in the Event of Detecting Illegally Circulating Radionuclide Ionizing Radiation Sources*

Uranium Milling Safety

In the territory of Ukraine, uranium ores are mining and milling by Eastern Ore Mining and Milling Works (Zhovti Vody, Dnipropetrovsk oblast) (hereinafter called the SkhidGZK) in order to obtain the uranium ore concentrate as a starting material to produce fuel for nuclear power plants. The second industrial processor of uranium ores and uranium-containing material in order to obtain the uranium ore concentrate – Dnieper Chemical Works (Dniprodzerzhynsk, Dnipropetrovsk oblast) – was shut down in 1991.

SKHIDGZK

SkhidGZK is the sole uranium producer and processor operating in Ukraine. Uranium ore is mined at Smolinka and Ingul mines and milling at the hydrometallurgical plant. SkhidGZK launched its activities in the "50s of the last century. At that time the radiation safety as producing and especially processing uranium ores was not paid the appropriate attention, as a consequence of which in Zhovti Vody a poor radiological and environmental situation came to exist, which adversely impacts the environment and health of population. For a long time, local inhabitants have been forced to live in the area of permanent man-caused radiation contamination.

The most dangerous SkhidGZK's uranium ore milling facilities are: hydrometallurgical plant, slurry pipeline, Brownstone Pit (hereinafter called the KBZ) and the Shcherbakivske tailings. During 2006 milling waste was stored in the the Shcherbakivska tailing. Since 1996 the KBZ tailing have been mothballed. After reclaiming, former underground leaching areas Bratske and Devladovo were delivered to the initial user to be freely used in agriculture.

The main factors of radiation exposure of the personnel, population and environment are as follows: emissions of airborne alpha-emitting long-lived uranic radionuclides (ore dust) at the hydrometallurgical plant's workshops and sites; emission of aerosols from dry surfaces and infiltration of tailing solutions into ground water in the KBZ and Shcherbakivske tailings.

In order to protect inhabitants of the place against radiation exposure and related adverse factors, improve natural environment, prevent man-caused emergencies, preserve health of people and provide social protection, the State Radiation Protection Programme 2003-2012 for Inhabitants of Zhovti Vody (hereinafter called the Programme) was developed and approved by the Cabinet of Ministers of Ukraine in its resolution No. 565 of 5 May 2003. The Programme is implemented mainly using subventions from the state budget to Zhovti Vody's local budget. It should be noted that in 2006 the Programme was financed in full. The Programme activities were carried out in two areas – social and radiation protection. In 2006, as allocating funds to carry out activities, larger sums were allocated to implement activities in the social area. Funds were allocated to partly recover cost of nourishment of preschool and schoolchildren, improve health of children and provide aid in improving health and treating inhabitants of the place living or working in environmentally hazardous areas. Allocations to carry out radiation protection activities were used in Zhovti Vody to plant greenery, construct protective structures at schools and kindergartens to lower radon concentration at first levels of buildings and in basements.

In order to prevent more heavy radiation contamination of the place and surrounding areas, specialists of SkhidGZK continuously conduct radio-ecological monitoring. Based on the monitoring results, environmental protection activities are carried out.

In 2006, similarly to previous years, the State Nuclear Regulation Committee of Ukraine carried out control over obeying radiation safety standards and rules as milling uranium ores at SkhidGZK. In accordance with radiation safety standards and rules, the company monitors external and internal exposure of the personnel. In 2006 the total radiation exposure at the company's mines is 6.5-7.5 mSv, and 4.5 mSv at the hydrometallurgical plant. At the same time, for individual professions the total annual dose reaches 12-17 mSv, while yearly limit is 20 mSv. Taking into account that about 80% of annual radiation dose is internal radiation, creating the up-to-date personnel monitoring system by implementing at the company the individual internal radiation monitoring using personal dosimeters and using uranium based on results of biophysical analyses receives a special importance. During 2006 the company failed to implement the said system.

DNIEPER CHEMICAL WORKS

Milling of uranium ores and other uranium-containing material in order to obtain the uranium ore concentrate at Dnieper Chemical Works (hereinafter called the Works), Dniprodzerzhynsk, was launched in 1948. The company started producing uranium salts from slags obtained as a result of melting

uranium iron ores in blast furnace 6 of Dzerzhynsky Metallurgical Works. The uranium ore concentrate was used in the defence, and subsequently also to produce fuel for nuclear power plants. Construction of the works and its activities in that period were a top-secret file. Production waste was stored in neighbouring ravines and gullies without respecting elementary environmental protection requirements, which led to a heavy radioactive contamination of the works' site and adjacent area, as well as accumulation of large quantities of solid and slurry-type production waste containing a lot of natural radioactive substances.

On the premises of the works and outside it tailings (Western, Central Yar, Southeastern, Dniprovske,

Sukhachivske and Lanthanum Fraction) were constructed, along with the facility to store deconstructed structures of blast furnace 6 and the former uranium ore warehouse (Base S) that, in the period of the works' operation, accumulated around 42 million tons of uranium ore milling waste having an activity totalling 3.1×10^{15} Bq. It should be noted that a high activity (15% of the total) is concentrated in relatively small quantities of waste resulting from deconstructing blast furnace 6. The total area of tailings is about 2.43 million square meters. The exposure dose rate on the soil surface of these facilities is within 30-35,000 μR/hr (100 μR/hr is normal). The most heavily contaminated areas of the former Works are the area around building 103 and Central Yar and Southeastern tailings.

After decommissioning of the Works' in 1991, contrary to sanitary rules applicable at that time, tailings and uranium milling facilities were not liquidated, mothballed or converted. This has been the cause of all subsequent events. In the process of restructuring the Works, over 10 differently specialised companies were set up, whose activities were not associated with uranium ore milling. Engineering structures, such as the shop where they obtained uranium oxide from nitric solutions (building 103) and tailings were abandoned.

In order to solve this extremely complex issue that is very important for the well-being of inhabitants of Dniprodzerzhynsk and surrounding places, the Cabinet of Ministers of Ukraine by its resolution No. 1846 of 26 November 2003 approved the State Programme 2005-2014 aimed at rendering Dnieper Chemical Works' dangerous facilities environmentally safe and protecting the population against adverse impact of ionizing radiation. Control over implementing the Programme rests with the Ministry of Fuel and Energy.

The programmed activities are carried out by the Baryer enterprise established by the Ministry of Fuel and Energy of Ukraine as a company to manage waste generated by former uranium producers of Dnieper Chemical Works. Within the framework of the Programme, in 2006 the enterprise carried out the following activities:

- *completing the removal of remaining ore from the former uranium ore warehouse (Base S) to be reprocessed at the SkhidGZK's hydrometallurgical plant in Zhovti Vody. Activities were carried out by the SkhidGZK's personnel under supervision of Baryer radiation surveyors;*
- *deconstructing overpassing pipelines near building 103, as a result of which exposure dose rates markedly reduced. However, the deconstruction of pipelines did not solve the problem of lowering radiation exposure of the personnel of neighbouring enterprises, since there are other sources of radioactive contamination in adjacent areas;*
- *developing and projects for deconstructing building 103 and reclaiming Base S that are submitted to state experts for comprehensive study;*

In December 2006 the Base S reclamation and deconstruction of contaminated equipment in building 120 were launched. Contrary to laws of Ukraine in the area of nuclear energy, the activities were carried out without the license permitting uranium ore milling.

In order to render dangerous facilities safe and evaluate their impact on the personnel, environment and the population, Baryer conducts radiation motoring. In 2006 radiation monitoring on Baryer facilities was carried out on the contractual basis under an abridged programme due to poor financing. The monitoring results show that:

- *exceeding limit concentration in underground water in wells was mainly observed in terms of both alpha-active radionuclides and heavy metal macroions and sulphates which is the evidence of the impact of contaminated water in the body of tailings on the adjacent areas. The estimated velocity of migration of the front of underground water in the direction of Dnieper waters is up to 10 meters per year, that is, it is rather high. Survey of observation wells in the territory of the Works showed their unsatisfactory condition and criticality of carrying out urgent activities to restore their operation;*
- *the most heavily contaminated areas of the former Works are the area around building 103, Central Yar and Southeastern tailings. At the same time, sources of air contamination in areas where tailings are located are exhalation (emission) of radon and radon daughter products (lead 210 and polonium 210);*
- *as compared with the results of monitoring over the previous years, the concentration of alpha-active nuclides in water of the Konoplyanka river somewhat increased, but did not exceed the levels set by Radiation Safety Standards of Ukraine 97 (1 Bq/l).*

As shown by individual survey conducted at the enterprise, the control level of external exposure of the personnel is not exceeded.

The planned inspection of Baryer conducted in September 2006 detected a series of violations of laws, provisions, rules and standards in the area of nuclear energy. First of all this concerned the poor radiation and technical status of individual facilities and slack radiation monitoring.

As instructed based on the inspection results, Baryer shall carry out organisational and technical activities to remedy the violations.

Uranium processors of Ukraine are under the SNRCU's continuous supervision. It should be noted that effectiveness of state supervision in 2006 improved after setting up territorial bodies – state inspectorates for nuclear and radiation safety one of which, the Central one, is located in Dnipropetrovsk, in the region where uranium ores are mining and milling. One of the main tasks of this state inspectorate is to conduct state supervision over adhering to laws of Ukraine in the area of nuclear energy.

Emergency Preparedness and Response

The Law of Ukraine "On Protection of Population and Territories against Man-Induced and Natural Emergencies' of 18 June 2000 has set the organisational framework of the Single State System on Prevention of and Response to Man-Induced and Natural emergencies (the System), that was established and is under operation in Ukraine.

Within the System, in accordance with the resolution of Cabinet of Ministers of Ukraine No. 1198 of 3 August 1998, the SNRCU is responsible for establishment and operation of the functional subsystem "Safety of Nuclear Power Facilities'.

9.1. SNRCU EMERGENCY AND INFORMATION CENTRE

The functional subsystem "Safety of Nuclear Power Facilities' operates at two levels – the national level and the facility level. At the facility level, operation of the subsystems is ensured by the State Residence Inspectorates on Nuclear Safety. At the national level the key element of the subsystem is the SNRCU Emergency and Information Centre (EIC), which, when activated, is staffed by the most experienced specialists of the SNRCU divisions and subordinate organisations.

In normal (routine) mode of EIC operation, a 24-hour duty service is maintained, operational information is received from Ukrainian NPPs, information on NPP events is analysed, registered and entered into the computerised database. Summaries on the status of Ukrainian NPPs and information on NPP events are published at the SNRCU's website www.snrc.gov.ua.

The main EIC systems are the reliable power supply system, the telephone conversation recording system, the automated EIC personnel notification system and the remote monitoring system for Zaporizhzhya (Units 1-6) and Rivne (Units 1-3) NPPs designed to transmit NPP technological and radiological parameters to the EIC in on-line mode.

In order to regulate activities under the functional subsystem, updated versions of two important documents were developed during the year of 2006:

First, in accordance with provisions of Radiation Accident Response Plan NP-306.5.01/3.083-2004, the Response Plan of the functional subsystem "Safety of Nuclear Power Facilities' was developed, approved by the SNRCU Board and put in force by the SNRCU order No. 4 of 10 January 2006. The plan is the main SNRCU internal document that regulates functioning of the SNRCU emergency preparedness and response system. All other procedures are to be developed according to the plan. The plan supersedes the previous outdated SNRCU document issued in 1994.

In accordance with this plan, the SNRCU missions in emergency response are as follows:

- *international exchange of information within the framework of the Convention on Early Notification of a Nuclear Accident and the relevant bilateral agreements with other countries;*
- *emergency notification and follow-up periodical informing of the Cabinet of Ministers of Ukraine and the Ministry for Emergencies under the Governmental Analytical & Information System on Emergencies;*
- *prompt notification via media about radiological accidents on the territory of Ukraine and beyond its borders in case of potential transboundary release of radioactive substances.*

Second, the procedure on interaction between SNRCU and the Ministry for Emergencies in the area of information exchange was updated and approved by the joint decree of the SNRCU and the Ministry No. 31/103 of 27 February 2006. The updated procedure was developed taking into account changes in the regulatory documents and experience gained. Since protection of the population and territories in the case of emergency is within the competence of the Ministry for Emergencies, and SNRCU is the primary recipient of information in the event of radiation accident abroad (with threat of transboundary release), their interface is an important factor to ensure such protection.

As of 1 January 2007, Ukraine concluded 13 bilateral agreements with other countries on early notification and follow-up exchange of information in the event of nuclear or radiological accident. Such agreements are set with Sweden, Turkey, Belarus, Slovakia, Hungary, Finland, Norway, Poland, Germany, Austria, Bulgaria, Latvia and Romania.

Pursuant to the agreements, communication tests with competent points of contact of these countries have been performed periodically during 2006. Additional test with Hungarian point of contact was performed in the course of one of emergency exercises that had been conducted by the Hungarian Atomic Energy Authority.

9.2 EMERGENCY CENTRES OF ENERGOATOM

The Energoatom's emergency preparedness and response system is a component of the functional subsystem "Nuclear Power Industry and Fuel&Energy Complex' that is within the competence of the Ministry of Fuel and Energy of Ukraine.

This functional subsystem includes the main and backup emergency centres of the operating organization Energoatom, as well as a separate structure of this organisation – the Technical Centre for Emergencies located in Bilohorodka village of Kyiv region.

In the event of emergency at an NPP, specialists of the Technical Centre for Emergencies are deployed at the NPP in emergency and put under the command of the NPP incident commander. Using, if required, robots and other unique equipment, the centre specialists perform radiological and engineering surveys, collect radioactive waste, conduct decontamination and, etc.

The main emergency centre of Energoatom is located in the organization`s headquarters in Kyiv, the backup emergency centre is established and operates at the former Chornobyl NPP of-site emergency centre in Dniprovske village of Chernihiv region. During 2006, in the backup emergency centre the room for the Energoatom`s Commission on Emergencies was refurbished, one of rooms was converted into the workplace of the engineering support group and equipped with advanced computer equipment.

In order to provide a reliable communication link in the event of emergency,
Energoatom installed a satellite communications system, that covers the main and backup emergency centres, emergency centre
of the Technical Centre for Emergencies, Rivne, Zaporizhzhya, Khmelnytsky
and South Ukraine NPPs.
An automated notification system was put into operation to warn members of the Energoatom's Commission on Emergencies.

SNRCU Emergency and Information Centre

Except the abovementioned backup and main emergency centres of Energoatom, regulatory documents envisage setting up an internal (on-site) and an external (off-site) emergency centres at each NPP.

An NPP internal emergency centre is designed to manage works on accident localization and consequences mitigation at an NPP site and in the sanitary and protection zone.
An NPP external emergency centre is to be used in case if work in an internal emergency centre becomes impossible due to accident conditions.

Activities to bring NPPs emergency centres in full compliance with the provisions of the regulatory document "Requirements to NPP Internal and External Emergency Centres' (2004) are carried out according to the schedule approved by the SNRCU and shall be completed in 2007.

9.3 EMERGENCY DRILLS AND EXERCISES

The Radiation Safety Standards of Ukraine (NRBU-97) requires conduct of emergency exercises for operator personnel participating in emergency response actions.

Each NPP develops an annual exercise programme and a schedule of its implementation for every quarter. The schedule envisages participation of every person belonging to operating personnel in emergency exercises at least once per quarter. One time per year an integrated emergency exercise at one of NPPs is conducted with involvement of Energoatom headquarters and representatives of external organisations, including the Ministry for Emergencies, Ministry of Fuel and Energy, SNRCU.

In November 2006 such exercise was conducted at the Zaporizhzhya NPP. In the course of the exercise, the SNRCU EIC was activated; specialists of the State Residence Inspectorates on Nuclear Safety took part in the exercise directly at the NPP site. In the course of the exercise the EIC interaction with emergency centres of Energoatom and Zaporizhzhya NPP was worked out, communication with the Cabinet of Ministers of Ukraine and Ministry for Emergencies was simulated, internal emergency operating procedures, equipment and communication means were tested.

Under the Convention on Early Notification of a Nuclear Accident and bilateral agreements, sending several messages to the IAEA and other countries was simulated. Communications with competent organisations of Latvia, Poland and Hungary was performed in reality.

Exercise in EIC was observed by representatives of the U.S. Nuclear Regulatory Commission, Swedish Radiation Protection Authority and National Atomic Energy Agency of Poland.
As envisaged by the existing procedures, as a result of analysis of the revealed shortcomings, comments and proposals of exercise participants and observers, the SNRCU has developed a number of corrective measures aimed at improving both the in-house emergency preparedness and response system and such a system of the operating organization.

In 2006, to assess adequacy of an NPP personnel response actions and an NPP emergency response system as a whole, the State Inspectorates on Nuclear Safety at NPPs participated in 481 emergency exercises conducted by NPPs. 39 emergency exercises were plan-level ones.

In October 2006 the Head of the State Inspectorate on Nuclear Safety at Zaporizhzhya NPP participated as an observer in emergency exercise on testing preparedness in the area of physical protection that was conducted by Energoatom.

In 2006 SNRCU participated in IAEA test ConvEx 2c based on scenario of a simulated accident at the Embalse NPP in Argentina. Similar exercises are conducted by the IAEA every year to test communication link between the IAEA incident and emergency centre and national competent organisations in accordance with the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

Accounting for and Control of Nuclear Materials

In accordance with the Provision, the SNRCU co-ordinates activities aimed at carrying out the Agreement between Ukraine and the IAEA for the Application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), Additional Protocol. By its Resolution № 834 of 15

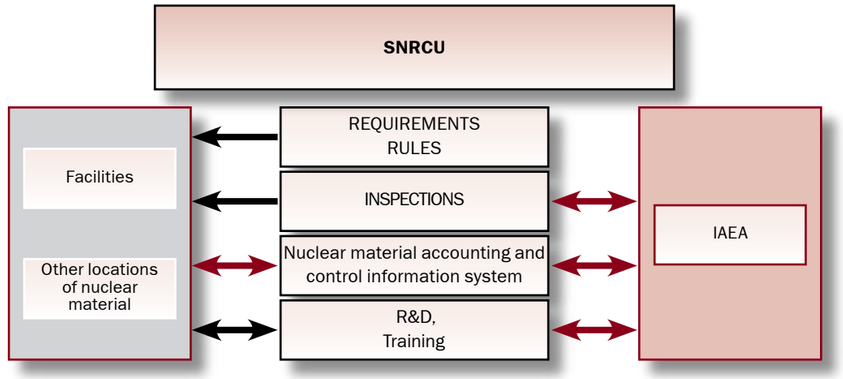
June 2006, the Cabinet of Ministers of Ukraine established the procedure for carrying out the Additional Protocol to the Safeguards Agreement in connection with the NPT.

The SNRCU continuously maintains all working contacts with the IAEA as regards carrying out the Safeguards Agreement. Especially, they provide information and reports on the location and quantities of nuclear material, other information on organising IAEA's inspections in Ukraine (Figure 10.1.).

During the year Ukraine approved 224 IAEA employees appointed as safeguards inspectors in Ukraine. In the last year the IAEA conducted in Ukraine:

- *72 inspections at NPPs: 19 inspections at the Zaporizhzhya NPP, 11 at South Ukraine NPP, 10 at Rivne NPP, 11 at Khmelnytsky NPP, 8 at Chornobyl NPP, 8 at Kharkiv Physics and Technology Institute, 4 at Kyiv Institute of Nuclear Research, 1 at Sevastopol Institute of Nuclear Energy and Industry;*
- *6 inspections at other locations, for example Institute of Oncology and IZOTOP in Kyiv, Radon in Odessa, Damen Shipyards Ocean in Mykolayiv;*

Fig. 10.1. Functioning of the state system accounting for and control of nuclear material



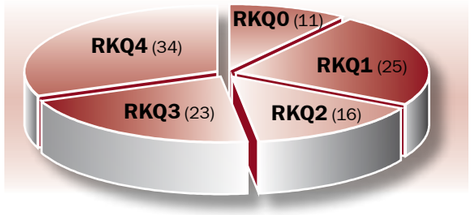
Based on information on safeguards received from companies, the IAEA received the following information:

- *16 preliminary information on export/import of nuclear material;*
- *156 nuclear material inventory change reports (ICR);*
- *52 nuclear material inventory reports (PIL+MBR);*
- *schedules of nuclear material movement, maintenance works, physical inventory taking in each material balance area at nuclear power plants.*
- *6 complementary accesses according to the Additional Protocol: 3 at research facilities and 3 at nuclear power plants.*

Application of the Safeguards Agreement in Ukraine is based on using data of the state system accounting for and control of nuclear materials (SSAC). In accordance with the Law of Ukraine "On Uses of Nuclear Power and Radiation Safety', Regulatory Authority organising and maintaining the SSAC, besides, the SNRCU supervises adhering by licensees requirements on accounting of nuclear material and carrying out non-proliferation undertakings of Ukraine.

The SSAC in Ukraine started in 1994 at 9 facilities most of which were NPPs. Apart from nuclear power

Fig. 10.2. Territorial distribution of companies and institutions by material balance areas



RKQ0 *— City of Kyiv and Kyiv oblast*
RKQ1 *— Vinnytsya, Volyn, Ivano-Frankivsk, Zhytomyr, Carpathian, Rivne, Lviv, Chernivtsi, Khmelnytsky, Ternopil*
RKQ2 *—Sumy, Kharkiv, Poltava, Cherkasy, Chernihiv*
RKQ3 *—Luhansk, Donetsk, Dnipropetrovsk*
RKQ4 *—Zaporizhzhya, Kherson, Mykolayiv, Kirovohrad, Odesa, Crimea*

quantity of nuclear material in Ukraine, some nuclear material is used by other companies and institutions. These companies and institutions are territorially distributed by material balance areas: 11 companies in RKQ0; 25 in RKQ1; 16 in RKQ2; 23 in RKQ3; 34 in RKQ4 (Figure 10.2.).

The Regulatory Authority has developed and continuously improves the regulation in order to ensure the functioning of the SSAC to meet international non-proliferation commitments. New regulations on nuclear material accounting and nuclear material measurements were approved in the last year.

The adequacy of the level of the SSAC is evidenced by the fact that over 12 years no loss of nuclear material entered in the state nuclear material database has been detected.

24 January 2006 the Additional Protocol to the Safeguards Agreement came into force in Ukraine. Ukraine became the 72nd state in the world to implement a new, more efficient and effective mechanism of safeguards. This document obliges countries to provide the Agency's inspectors with freer access to their territory, as well as more detailed information on their nuclear activities, export/import of dual-use material.

In order to prepare an initial declaration according to Additional Protocol Cabinet of Ministers of Ukraine has been approved the regulation "The Guidelines on Carrying Out the Additional Protocol to the Safeguards Agreement between Ukraine and the IAEA in connection with the NPT`. 2 practical workshops were conducted with the IAEA's assistance in Vienna and Kyiv with purpose to facilitate preparation of the initial declaration. As required by the Additional Protocol, in July 2006 the IAEA received the initial declaration of Ukraine. The quality and completeness of information presented in it were assessed by the Agency as adequate.

According to the IAEA request Ukraine has provided 6 complementary accesses for inspectors (at 2 and 24 hours' notice) in order to verify information given in the declaration. Based on the results of the analysis, IAEA experts made additional requests responses to which shall be given in the next yearly declaration.

Therefore, a state system is created and properly maintained, that ensures fully meeting by Ukraine its non-proliferation commitments under the Safeguards Agreement and Additional Protocol.

TRANSPORT OF RADIOACTIVE MATERIALS

Radioactive materials are transported in connection with their use in the power sector, industry, medicine, radioactive waste management and nuclear fuel transit across Ukraine. Materials are transported as follows:

- *fresh nuclear fuel from Russia to nuclear power plants of Ukraine and spent fuel to the back direction;*
- *uranium ore from mines to the hydrometallurgical plant and the uranium ore concentrate abroad;*
- *mid- and high-level radioactive sources used in instrumentation, exploration, gamma-ray detection, sterilisation, etc.;*
- *radiopharmaceuticals and high-level radioactive sources used in medicine for diagnostic and therapeutic purposes;*
- *low- and mid-level radioactive waste by State Specialised Enterprises "RADON";*
- *radioactive waste within the 30 km Exclusion Zone;*
- *transit of fresh nuclear fuel across Ukraine from Russia to Slovakia, Hungary, Bulgaria and spent fuel from Bulgaria to Russia.*

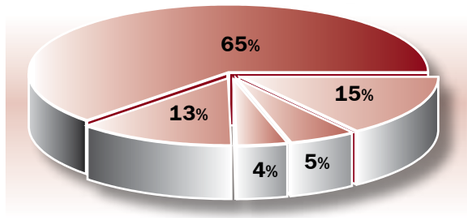
In accordance with legislation, transport activities are licensed. By the end of 2006 37 companies and organisations took out licenses to carry out radioactive material transport activities. The biggest activities in radioactive material transport are Energoatom, Eastern Ore Mining and Milling Works, Izotop Association, state interregional specialised enterprises of "RADON", "Ukrgeofizyka", "Kompleks", International Airport "Boryspil". In 2006 the SNRCU issued 4 licenses to corporations carrying out activities related to the transport of radioactive materials, re-registered 4 licenses and changed 1 license.

In 2006 the SNRCU issued 93 permits to carry international transport of radioactive materials, especially:

14 permits to transport fresh fuel for nuclear power plants of Ukraine;

- *5 permits to transport spent fuel from nuclear power plants of Ukraine to Russia;*
- *4 permits to transport uranium ore concentrate from Ukraine;*
- *9 permits to transit fresh fuel from Russia to Slovakia, Hungary and Bulgaria;*
- *2 permits to transport spent fuel from Bulgaria to Russia;*
- *1 permit to transport uranium ore concentrate from the Czech Republic to Russia;*

Structure of transport of radioactive materials across Ukraine in 2006



transporting fresh fuel for nuclear power plants of Ukraine (14)
transporting spent fuel from nuclear power plants of Ukraine (5)
transporting uranium ore concentrate from Ukraine (4)
transit of fresh and spent fuel and uranium ore concentrate (12)
transport of other radioactive materials (58)

- *58 permits to transport other radioactive materials.*

Transit of nuclear material to nuclear power plants of the Czech Republic, Slovakia and Hungary across the territory of Ukraine based on current intergovernmental agreements concluded from 1992 until 1998.

As regards the transit of nuclear material between the Republic of Bulgaria and the Russian Federation across the territory of Ukraine, the Treaty between the Cabinet of Ministers of Ukraine, the Government of the Republic of Bulgaria and the Government of the Russian Federation on Transport of Nuclear Material between the Republic of Bulgaria and the Russian Federation across the Territory of Ukraine was signed

and, as required by law, ratified by the Verkhovna Rada of Ukraine only in 2006. Meanwhile, nuclear material was transported between the Republic of Bulgaria and the Russian Federation across the territory of Ukraine based on single permits issued by the SNRCU as an exception and after meeting all safety requirements.

Therefore, the signature of this Agreement fitted the issue of transporting nuclear material across the territory of Ukraine back into the appropriate legal framework and discontinued carrying out these activities based
on single permits without the guarantee of allocation of responsibilities and any obligations between participants of transport.

Similarly to previous years, important components of the system of regulatory activities in 2006 were:

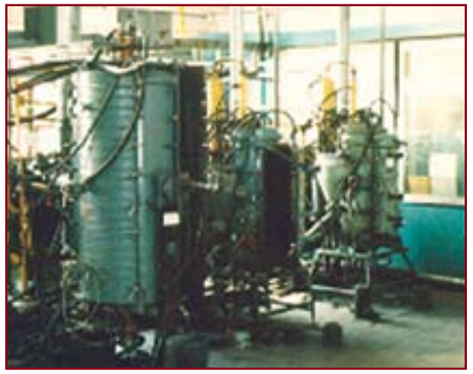
- *approving package designs and special condition of transport of radioactive materials – 15 certificates were issued;*
- *developing transport safety standards and rules – Nuclear and Radiation Safety Rules in Radioactive Material Transport 2006 were put into force, that meet the last edition (2005) of the IAEA's rules and the Requirements to Radioactive Material Transport Quality Assurance Programmes;*
- *inspection of licensees.*

Adhering by participants of transport to the legislation and safety rules in radioactive material transport is a guarantee of safety of the population, personnel and environment. In 2006 no any incidents and accidents as transporting radioactive materials were registered in Ukraine.

R&D Activities in the Area of Nuclear Energy

In compliance with the Decree of the President of Ukraine and the order of the Prime Minister of Ukraine, the National Academy of Sciences of Ukraine developed the State Programme of Fundamental and Applied Research on Problems of Using Nuclear Material, Nuclear and Radiation Technologies in the Area of the Development of Economic Sectors 2004-2010 (approved by resolution of the Cabinet of Ministers of Ukraine No. 1165 of 8 September 2004).

The main objective of the Programme is to do fundamental and applied research in the area of using nuclear material and radiation technologies in the nuclear power sector and other economic sectors, their development in order to carry out the National Energy Strategy of Ukraine.



Carbon-carbonic composites unit

Samples of products made of carbon-carbonic materials

The Programme especially envisages research into reactor processes, expert study of the level of their safety and reliability, R&D activities aimed at improving reactors and their bench tests, studying the problems of the nuclear fuel cycle, especially, radioactive waste management, providing continuous scientific and technical support to nuclear power plants. By its regulation, the Presidium of the National Academy of Sciences of Ukraine defined the Kharkiv Institute of Applied Physics National Research Centre as the basic institution providing scientific and organisational support to the Programme.

The Institute is one of the oldest and largest centres of physical science in Ukraine. From 1972 until the end of 1991 the Institute functioned as the organisation leading the co-ordination of activities in the area of radiation materials science and radiation technologies. Since 1992 the Institute has actively participated in the process of developing the research system of Ukraine, as well as shaping policy of the relevant institutes of Ukraine in the nuclear industry and nuclear power sector. Taking into account the national importance of fundamental and applied research for the development of nuclear science and engineering, in 1993 by the Decree of the President of Ukraine the Institute received the status of the first National Research Centre in Ukraine.

In 2006 104 researches were completed within the framework of 17 activities mapped out by the Programme. These researches were contributed to by 40 research institutions, establishments of higher education and organisations of Ukraine. Outcomes of the Programme will provide solution to important problems of using nuclear material, nuclear and radiation technologies in the nuclear power sector of Ukraine. Especially, the Institute:

- *scientifically vindicated and developed state-of-the-art methods for technical diagnostics, assessing the life of the NPP main equipment and pipelines in order to extend their life;*
- *measured the coercive force on vessels of Zaporizhzhya Units 1 and 6, South Ukraine Units 1 and 3, as well as on the bench vessel of the Crimean reactor;*

- *creates the pilot plant to make highly reliable and long-lived fuel and absorbing elements;*
- *developed and improved methods of obtaining pure metals (Zr, Hf, Nb, Ta, etc.) based on which new structural materials are created, inter alia, those having a submicrocrystalline and nanocrystalline structures to be used in the existing and future power reactors;*
- *improved the process to obtain the ZrlNb alloy at stages of sublimation, reduction, electron-beam melting in order to improve operating characteristics; studied strength and plasticity characteristics of Ukrainian ZrlNb samples at temperatures within 77-650 K; solved the complex problem of creating fuel element pipes for VVER reactors of Ukraine;*
- *obtained nuclear hafnium to be used as a neutron absorber in absorbing elements;*
- *designed and created new carbon-carbonic composites having a high radiation and thermal stability to be used in the nuclear power sector;*
- *designed wearproof coatings for turbine blades operating in moist steam environment under high pressure at > 300°C;*
- *developed an environmentally friendly method to study express degradation of physicomechanical properties of structural materials treated with dual beams of heavy ions (Cr, Ar, Kr) and technologically critical gases such as He and H2.*
- *constructed technological systems of the pilot plant to work with samples of materials rayed using electron accelerators;*
- *created high-performance plasmochemical reactors to treat and decontaminate water from storm water pumping stations and natural water;*
- *physically started up the stellarator-torsatron Uragan-2M; created and heated plasma by high-frequency methods; obtained plasma having density at 10i12 cubic cm in a magnetic field of 4.8 kG with HF generator operating at 100 kW;*
- *designed and created benches using high-powered electron accelerators to conduct researches in the area of radiation materials science and modifying properties of materials;*
- *develops the conceptual design of the neutron source using an accelerator-controlled subcritical assembly;*
- *constructs the terawatt laser to generate X-ray, gamma- and neutron fluxes.*

Another major centre of fundamental and applied research in the area of nuclear energy is the National Academy of Sciences of Ukraine's Kyiv Nuclear Research Institute.

Under the said Programme, a group of Institute's scientists developed the Concept and Feasibility Study for New Multi-Purpose Pilot Reactor.

Ukraine has only one functioning high-powered research reactor to conduct research in the nuclear area. It is the VVR-M research reactor of the Kyiv Nuclear Research Institute. The license under which the said research reactor is operated expires in 2008. According to the most optimistic forecasts, after upgrading different backup systems, operation of the reactor could be continued until 2015. After reaching this deadline, the reactor will be shut down. However, Ukraine can not do without the research reactor, especially, taking into account its plans to increase NPP capacities in accordance with the Energy Strategy of Ukraine until 2030, as well as implement radioactive waste management programmes, use radioactive isotopes in the industry, medicine, agriculture, etc.

The document prepared by the specialists of the Kyiv Nuclear Research Institute conceptually sets basic requirements to designing, constructing and operating the new research reactor in Ukraine, while ensuring adequate protection of people and the natural environment and reducing risks of radiation accidents and man-caused disasters.

The Concept gives options of reactor types and technical characteristics, possible locations of the research reactor, maps out the main applications for the reactor and the necessary technological infrastructure.

Furthermore, in 2006 the tender for new projects under the Programme was conducted. Two hundred ten bids were made by 50 organisations of the National Academy of Sciences of Ukraine, Ministry of Fuel and Energy, Ministry of Education and Science, Ministry of Industrial Policy, etc. Bids were considered by the State Programme Expert Committee that in 2007 awarded bids for 106 urgent projects. By its Resolution No. 178 of 21 March 2007, the Presidium of the National Academy of Sciences of Ukraine approved the Programme ToR's and their 2007 finance.

International Co-operation

Ukraine's international co-operation in the area of nuclear and radiation safety is aimed at attaining global standards set for safe operation of power units throughout their life cycle, from selecting sites and design to decommissioning, spent fuel and radioactive waste management, based on multi- and bilateral international treaties.

Multilateral international co-operation is primarily aimed at carrying out commitments of Ukraine as a Party to Conventions, in order to ensure appropriate nuclear and radiation safety and solve urgent problems in this area.

Within the framework of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the Second National Report of Ukraine was prepared and sent to the IAEA. It was discussed 16 May 2006 at the Second Meeting of Parties to the Convention held from 13 until 24 May 2006 at the IAEA's headquarters in Vienna.

The presentation of the Second National Report of Ukraine on carrying out commitments arising from the Joint Convention, inter alia, included replies and comments to 117 written questions put with respect to the Report in the process of preliminary consideration by 17 Parties, as well as oral questions put by the task force members and representatives of member countries.

The conclusion based on the results of consideration of the National Report of Ukraine contains provisions on basic changes that took place in the area of spent fuel and radioactive waste management after carrying out recommendations of the First Meeting of the Parties (November 2003), positive examples of the best practice, present challenges and issues to be a focus over three years to come. The participation of Ukraine's delegation in the Second Meeting allowed it to familiarise itself with international experience and existing practice of other countries in the area of spent fuel and radioactive waste management. The information gained is used in the processes of developing national documents, especially, the national radioactive waste management strategy and creating financial mechanisms in the area of radioactive waste management. As decided by the Parties, the Third Meeting of the Parties to the Joint Convention will be held from 11 until 22 May 2009.

An important event of 2006 was the commemorative 50th session of the IAEA General Conference held 19-21 September 2006 at the IAEA's headquarters in Vienna (Austria) with the participation of the delegation of Ukraine led by Minister for Fuel and Energy of Ukraine Yuriy Boyko. The head of the Ukrainian delegation acquainted members of the Conference with the main areas of the development of the nuclear power sector in our state. Especially, he emphasised the importance of commissioning two new units at the Khmelnytsky and Rivne NPPs and informed the Conference about the planned increase of installed capacities in line with the Energy Strategy of Ukraine until 2030. A special accent was on co-operation of Ukraine with the IAEA in the area of improving security and safety of reactors, strengthening the system of safeguards, consolidating efforts aimed at mitigating the global threat of proliferation of nuclear and radioactive materials, improving the system of physical protection of nuclear material and plants. In the course of the plenary meeting, consultations with delegations of the Agency's member-countries and meetings with its managers, Ukraine's progress was marked in the

areas of nuclear and radiation safety, creating the legislative framework, capacity building of the national regulator, control over radioactive sources, innovative reactors and fuel cycles (INPRO).

The IAEA General Conference 2006 formalised the procedure of exchange of information on implementing by the member-countries the Code of Conduct in promoting safety and security of radioactive sources and the related Guidelines on export and import of radioactive sources.

In 2006 co-operation with the IAEA was carried out based on the IAEA Technical Co-Operation Programme 2005-2006. The Programme marks out the following sectoral areas of co-operation:

- *nuclear power sector;*
- *nuclear safety;*
- *decommissioning of the Chornobyl NPP;*
- *radioactive waste management;*
- *radiological monitoring of environment;*
- *support to the regulator;*
- *application of nuclear technologies in brachiotherapy;*
- *improving reactor safety.*

During 2006 specialists of ministries, agencies, companies and other institutions of Ukraine participated in IAEA's activities (technical meetings, task forces, workshops, conferences, training, etc.) carried out within the framework of 26 regional and 12 national IAEA projects. Beneficiaries under these projects were the Ministry of Fuel and Energy, Ministry for Emergencies and Protection of Population against Chornobyl Aftermath, Ministry of Health, State Nuclear Regulation Committee, Energoatom, Chornobyl NPP, etc.

Co-operation with the IAEA within the framework of missions of the Operational Safety Review Team (OSART) continued. In 2006 the planned OSART mission at the South Ukraine NPP was organised. Nine areas of principal activities of the South Ukraine NPP were inspected: management, organisation, administration; training and attestation; operation; maintenance and repairs; radiation protection; chemistry; emergency preparedness; operating experience feedback; technical support. This was the first many-sided inspection conducted in Ukraine. Based on the outcomes of missions, international experts produced recommendations and proposals as to ways and methods of improving the existing programmes aimed at upgrading effectiveness of NPP operation.

Furthermore, jointly with Energoatom the IAEA conducted a workshop in order to solve technical and methodological issues with respect to carrying out OSART missions at the Khmelnytsky NPP in 2007, improving operating safety by objectively assessing safe operation, exchange of information on new practices. As the outcome of the workshop the closing meeting was called to establish the procedure and methods of the mission, the NPP's contribution to activities of the mission in 2007.

In 2006 active co-operation between Ukraine and the EU continued in the area of nuclear energy in line with the EU-Ukraine Action Plan that is an important instrument in establishing close co-operation with the EU.

In February at the European Commission's headquarters (Brussels), with the assistance of EC Commissioner Andris Piebalgs, the conference "Electric Power Sector of Ukraine: The Present and the Future' was held. The signature of the EU-Ukraine Memorandum of Understanding on co-operation in the power sector 1 December 2005 and Ukraine's receiving the status of an observer under the Energy Community Agreement called for carrying out the said activity in the context of the development of a new strategic area of EU-Ukraine co-operation in the power sector – electricity.

The EU-Ukraine Memorandum of Understanding on co-operation in the power sector envisages joint assessment of the status of safety of Ukrainian nuclear power plants in order to strengthen the role of Ukraine as a trading partner on the EU electricity market. This assessment shall confirm that safety of nuclear power plants of Ukraine meets international nuclear safety standards and requirements based on safety improvement activities both implemented and planned.

In line with the Memorandum provisions, the Nuclear Safety Road Map implementation plan was developed. This plan covers four main areas: Design Safety, Operating Safety, Radioactive Waste and Decommissioning, Regulatory Issues. In the area of Design Safety, the National Plant Safety Assessment Report for Ukraine was developed, which in October 2006 was presented to the EU side.

In October and December 2006, managers of the Ministry of Fuel and Energy and the SNRCU met with the EC commissioner for energy. The commissioner expressed his satisfaction with the pace of implementing by Ukraine provisions of the EU-Ukraine Memorandum of Understanding on co-operation in the power sector. An advance was marked in interface between Ukraine and the EU in the nuclear power sector, especially, reactor safety.

The primary EC contractor for TACIS projects in the area of nuclear safety regulation is the consortium of EU technical support organisations (EU TSOs) – RISKAUDIT IRSN/GRS International. Therefore, regulatory activities are supported by western and Ukrainian experts through joint technical assessment of all project activities which makes it possible to effectively combine international and domestic experience in the area of nuclear and radiation safety.

In 2006 the bilateral co-operation continued in the area of nuclear and radiation safety, in line with international intergovernmental and interagency treaties.

In compliance with Ukraine-USA treaties in force, in April 2006 the SNRCU and the U.S. Nuclear Regulatory Commission (NRC) signed the Agreement on Exchange of Technical Information and Co-Operation in Nuclear Safety and the annual Memorandum. It should be noted that the signature of the said Agreement fundamentally changed approaches to co-operation between regulators. The practice of receiving assistance by the Ukrainian side from the USA changed into reciprocal partnership and co-operation.

During the IAEA's General Conference held in September 2006, SNRCU Head Olena Mykolaychuk met with newly-appointed U.S. NRC Chair Dale Klein. They discussed the status of carrying out Chornobyl decommissioning projects, including the construction of Storage System 2. They also discussed the Energy Strategy of Ukraine until 2030, strengthening the role of the SNRCU and its support by the Government of Ukraine, safety culture, training and professional development in the nuclear sector, as well as aspects of bilateral co-operation within the framework of the annual Memorandum.

The U.S. Ministry of Energy and the SNRCU signed the Executive Agreement on co-operation aimed at improving security of ionizing radiation sources used in Ukraine. Within the framework of this agreement, the technical assistance project was registered aimed at improving security of ionizing radiation sources used in Ukraine. The project activities are primarily aimed at strengthening systems of physical protection of units using high-level sources.

Within the framework of co-operation with the U.S. State Department's Nonproliferation and Disarmament Fund, activities under the project "Facilitating Creation of the State Register for Ionizing Radiation Sources' are carried out. The Register has been created in 2004-2006 within the framework of the Action Programme for Creation of the State Register for Ionizing Radiation Sources. In 2007 the commercial operation of all registered ionizing radiation sources will be started. In June 2006 representatives of the Nonproliferation and Disarmament Fund negotiated with managers of the SNRCU over enhancing bilateral co-operation in the area of safety and security of ionizing radiation sources.

The above areas of co-operation were also reaffirmed within the framework of the visit of the Prime Minister of Ukraine to the USA in December 2006. The American side reaffirmed its interest in developing energy projects, especially, in the area of improving safety in the nuclear power sector.

In April 2006 the new Programme of Co-Operation between the SNRCU and the Federal Ministry of Environment, Protection of Nature and Reactor Safety of Germany was signed.

Within the framework of the above Programme, in 2006 3 workshops were conducted to highlight:

- *regulating safety and physical protection as transporting radioactive substances taking into account transit (Odesa, Ukraine);*
- *licensing and supervision in the process of decommissioning nuclear power plants (Kozlodui, Bulgaria);*
- *exchange of experience gained in actualising and updating national nuclear regulation taking into account the state of the art and international harmonisation (Saint Petersburg, Russia).*

Co-operation with nuclear regulators of other foreign countries was based on the relevant bilateral treaties.

During 2006 Ukrainians met with representatives of the Swedish Radiation Protection Authority (SSI) and the Swedish Nuclear Inspectorate (SKI) to discuss project proposals as to further co-operation in the area of radiation safety and physical protection. In the same year project implementation activities with the SSI were launched aimed at improving laws in the area of radiation protection, emergency response, radioactive waste management. Together with the SKI the project was started aimed at improving laws in the area of physical protection of nuclear power plants.

In December SNRCU Head Olena Mykolaychuk invited by the Swedish Nuclear Inspectorate led the Ukrainian delegation including the people's deputy of Ukraine Volodymyr Bronnikov, as well as specialists of the SNRCU, Ministry of Fuel and Energy and Ministry of Justice, and took part in the formal workshop on "Experience of Swedish Experts Gained in Organising the System of Physical Protection of Nuclear Power Plants, Nuclear Material and Radioactive Sources'. During the meeting with SKI Director Ms. Judith Melin they discussed the results of ten year's Ukraine-Sweden co-operation in the area of nonproliferation and its perspectives. They also talked about further activating and expanding co-operation between nuclear and radiation safety regulators of the both states. In particular, the SKI Director said that the Swedish Government made the decision to provide the Ukrainian side with finance to implement new safety maintenance activities – activities in the area of reactor safety. The SKI has already gained experience in the co-operation in the said area with the Russian Federation and Lithuania.

In March 2006 Ukraine was visited by President and Executive Director of the Canadian Nuclear Safety Commission Linda J. Quinn to discuss the development of bilateral Ukrainian-Canadian co-operation in the area of nuclear and radiation safety regulation.

Improving laws in the area of safe nuclear energy, physical protection of nuclear material, extending operation of operating nuclear power plants became in September the subject of negotiations with the delegation of the nuclear regulator of the Slovak Republic. They also discussed concluding the Ukrainian-Slovak-Russian treaty on transporting spent fuel from the Slovak Republic to the Russian Federation across the territory of Ukraine.

In October representatives of regulators of Ukraine and Poland met in Kharkiv on the premises of the Kharkiv Institute of Applied Physics National Research Centre. The Polish delegation was led by Head of the National Atomic Energy Agency Jerzy Niewodniczański. The Ukrainian side was represented by the people's deputy of Ukraine Ala Aleksandrovska, Director General of the Institute, member of the National Academy of Sciences of Ukraine Ivan Neklyudov, SNRCU Deputy Head Serhiy Bozhko. They met to exchange experience in the area of adapting Polish laws to the EU requirements, licensing activities, organising inspection activities, radioactive waste management, carrying hazardous cargo and implementing international rules regulating carriage, radiation exposure of uranium and coal miners, interface between regulators and the public and mass media, other issues of Ukrainian-Polish co-operation.

The sides agreed to continue co-operation and exchange of experience in the area of improving nuclear legislation of Ukraine in order to adapt it to EU laws, licensing activities in the area of management of ionizing radiation sources (IRS), radioactive waste management, interface with the public as carrying out governmental decisions on the criticality of further development of the nuclear power sector, improving law regulating natural radionuclides in the industry, carrying out experimental radiation measuring activities at coal and iron ore mines using Polish equipment and technologies (testing Polish dosimeters) and other aspects of mutual concern.

Active co-operation with the regulator of the Republic of Finland (STUK) continues. The key event was the visit to Ukraine of the regulator's head Ukka Laaksonen. The focus of discussion was constructing new reactors, including competences of the regulator and operator, qualified carrying out procedures throughout the project. Ukka Laaksonen said that EU experts developed a document mapping out requirements of EU operators to the construction and operation of nuclear power plants. During the visit he met with the Vice Prime Minister of Ukraine, the people's deputies of Ukraine, managers of sectoral ministers and agencies, managers and personnel of the Chornobyl NPP, representatives of the public.

Aspects of international co-operation in the area of nuclear and radiation safety were also reflected by international activities (conferences, workshops, roundtables, etc.) the most weighty of which were the following.

The international conference "Control and physical safety of nuclear material in Ukraine: Past achievements and Global Partnership agenda' (Kyiv, 24-26 January 2006) aimed at attracting finance of the Big Eight countries to fulfil requirements of our state in the area of nonproliferation and disarmament. Initiators of this conference were the Swedish Nuclear Inspectorate, the German Radiation and Nuclear Safety Agency and Nuclear Power Plant and Reactor Safety Society. There were around 120 participants representing 16 countries and 7 international organisations and institutions. During four plenary meetings they presented 39 reports on urgent aspects of nuclear physical safety and nonproliferation. The participants received project proposals from Ukrainian authorities and companies, research institutions and educational establishments, non-governmental organisations covering the main areas and models of possible co-operation in this area.

The international scientific conference "Twentieth anniversary of the Chornobyl disaster. Look into the future!' (Kyiv, 24-26 April 2006). Participants at this three days' forum were top-level representatives of U.N.O., UNESCO, European Commission, International Atomic Energy Agency, and World Health Organisation. The conference became one more step toward realising the joint effort aimed at mitigating adverse consequences of the accident, improving nuclear and radiation safety, promoting further development of international co-operation in the area of combating Chornobyl aftermath.

The international conference "Safety culture at nuclear power plants of Ukraine' (Kyiv, 27-28 September 2006). Participants at the Conference were experts in safety culture from the Verkhovna Rada of Ukraine, Cabinet of Ministers, Ministry of Fuel and Energy, State Nuclear Regulation Committee, RAO AES Moscow Centre, Ukrainian and foreign nuclear power plants – over 200 specialists working in the area of nuclear energy.

Annex 1

LIST OF REGULATIONS IN FORCE SINCE 2006

1. *Resolution of the Cabinet of Ministers of Ukraine No. 796 of 7 June 2006 "The State Nuclear Regulation Committee'.*
2. *Resolution of the Cabinet of Ministers of Ukraine No. 834 of 15 June 2006 "On Approving the Rules for Fulfilling Requirements of the Additional Protocol to the IAEA-Ukraine Agreement under Which Ukraine Undertakes to Accept Safeguards Arising from the Nonproliferation Treaty'.*
3. *Resolution of the Cabinet of Ministers of Ukraine No. 996 of 19 July 2006 "On Amending Resolutions of the Cabinet of Ministers of Ukraine No. 953 of 23 June 2003 and No. 1307 of 20 August 2003'.*
4. *Resolution of the Cabinet of Ministers of Ukraine No. 1092 of 3 August 2006 "On Approving the State Programme Aimed At Safe Storage of Spent High-Level Ionizing Radiation Sources'.*
5. *Resolution of the Cabinet of Ministers of Ukraine No. 1829 of 27 December 2006 "On Amending Resolutions of the Cabinet of Ministers of Ukraine No. 1471 of 25 December 1997 and No. 625 of 26 April 2003'.*
6. *Resolution of the Cabinet of Ministers of Ukraine No. 1830 of 27 December 2006 "On Approving the Provision on the State Nuclear Regulation Committee of Ukraine'.*
7. *On Approving the Concept of the Programme Aimed At Safe Storage of Spent High-Level Ionizing Radiation Sources No. 18-r of 18 January 2006.*
8. *The Provision on Qualification Attestation of Officials of the State Nuclear Regulation Committee of Ukraine Directly Engaged in the State Regulation of Nuclear and Radiation Safety approved by Decree of the SNRCU No. 9 of 23 January 2006 and registered with the Ministry of Justice of Ukraine 1 February 2006 under document number 89/11963.*
9. *The List of Officials of the State Nuclear Regulation Committee of Ukraine Directly Engaged in the State Regulation of Nuclear and Radiation Safety to Go Through Qualification Attestation approved by Decree of the SNRCU No. 21 of 9 February 2006 and registered with the Ministry of Justice of Ukraine 21 February 2006 under document number 156/12030.*
10. *The List of Positions in the Central Apparatus of the State Nuclear Regulation Committee of Ukraine Whose Holders Receive an Extra Pay for Working under Special Conditions approved by Decree of the SNRCU No. 22 of 9 February 2006 and registered with the Ministry of Justice of Ukraine 21 February 2006 under document number 155/12029.*
11. *Requirements to the Periodicity and Content of Reports Presented by Licensees in the Area of Nuclear Energy approved by Decree of the SNRCU No. 162 of 16 October 2006 and registered with the Ministry of Justice of Ukraine 6 December 2006 under document number 1268/13142.*
12. *The Procedure of Individual Reception of Citizens and Contacting over Hot Lines with the Head, First Deputy Head and Deputy Heads of the State Nuclear Regulation Committee of Ukraine approved by Decree of the SNRCU No. 194 of 18 December 2006 and registered with the Ministry of Justice of Ukraine 11 January 2007 under document number 8/13275.*
13. *Nuclear and Radiation Safety Rules 2006 for Carriage of Radioactive Materials (NP 306.6.124-2006) approved by Decree of the SNRCU No. 132 of 30 August 2006 and registered with the Ministry of Justice of Ukraine 18 September 2006 under document number 1056/12930.*
14. *Regulation "Procedure for the State RAW Inventory" registered by the Ministry of Justice of Ukraine(NP 306.5.04/2.059-2002) approved by Decree of the SNRCU No. 75 of 30 May 2006 and registered with the Ministry of Justice of Ukraine 13 June 2006 under document number 703/12577.*
15. *The Provision on the Nuclear Material Measurements System (NP 306.7.120-2006) approved by Decree of the State Nuclear Regulation Committee of Ukraine No. 24 of 13 February 2006 and registered with the Ministry of Justice of Ukraine 1 March 2006 under document number 213/12087.*
16. *Nuclear Material Registration and Control Rules (NP 306.7.122-2006) approved by Decree of the State Nuclear Regulation Committee of Ukraine No. 97 of 26 June 2006 and registered with the Ministry of Justice of Ukraine 17 July 2006 under document number 849/12723.*
17. *Physical Protection Rules for Nuclear Plants and Nuclear Material (NP 306.8.126-2006) approved by Decree of the SNRCU No. 116 of 4 August 2006 and registered with the Ministry of Justice 21 September 2006 under document number 1067/12941.*
18. *Response Plan for the Functional Subsystem "Safety of Nuclear Power Facilities' of the State Emergency System for Prevention of and Response to Man-Caused and Natural Accidents approved by Decree of the SNRCU No. 4 of 10 January 2006.*

Annex 2

ADDRESSES OF STATE INSPECTORATES FOR NUCLEAR AND RADIATION SAFETY

State Inspectorate	Head of State Inspectorate	Administrative subdivisions	Phone number	Address, e-mail
Northern State Inspectorate Kyiv	Lyudmyla S. Kuraksa	Vinnytsya, Zhytomyr, Kyiv, Cherkasy, Chernihiv, City of Kyiv	Tel. 8 067 695-53-50 Tel./fax 8 044 292-01-95	3, Verkhovna Rada Avenue, 02100 Kyiv, Ukraine kuraksa@inspect.snrc.gov.ua
North-Western State Inspectorate Rivne	Volodymyr V. Khabarov	Volyn, Rivne, Ternopil, Khmelnytsky	Tel. 8 067 695-53-61 Tel./fax 8 0362 23-61-85	41 S. Bandery Street, 33028 Rivne, Ukraine
Western State Inspectorate Ivano-Frankivsk	Oksana V. Dzhuranyuk	Carpathian, Ivano-Frankivsk, Lviv, Chernivtsi	Tel. 067 695-53-47 Tel./fax 8 0342 71-34-26	77 S. Bandery Street, office 103, 76014 Ivano-Frankivsk, Ukraine
Southern State Inspectorate Odesa	Serhiy V. Kobylinsky	Mykolayiv, Odesa, Kherson	Tel. 8 067 695-53-25	30 Bunina Street, 69045 Odesa, Ukraine kobylinskiy@breezein.net
South-Eastern State Inspectorate Donetsk	Borys P. Zemsky	Donetsk, Zaporizhzhya, Luhansk	Tel. 8 067 695-54-27 Tel./fax 8 062 385-84-46 Tel. 8 062 385-84-47	2 Razenkova Street, 83003 Donetsk, Ukraine bpz@mail.ru
Central State Inspectorate Dnipropetrovsk	Serhiy V. Myts	Dnipropetrovsk, Kirovohrad	Tel. 8 067 695-53-74 Fax 8 0562 96-08-77	P.O. box 946, 49010 Dnipropetrovsk, Ukraine , eco06@email.dp.ua
Eastern State Inspectorate Kharkiv	Viktor T. Pravdyuk	Poltava, Sumy, Kharkiv	Tel. 8 067 695-53-58	P.O. box 4619, 61022 Kharkiv, Ukraine , areshek@ua.fm
Crimean State Inspectorate Simferopol	Alla I. Pashentseva	Crimea, Sevastopol	Tel. 8 067 695-53-30	P.O. box 1446, 95000 Semferopol, Ukraine crimInspyadbesp@ukr.net

Annex 3

ADDRESSES OF STATE REGISTRATION CENTRES AND REGIONAL REGISTRATION CENTRES OF THE STATE REGISTER FOR IONIZING RADIATION SOURCES

№	Registration centre	Coverage (oblasts)	Address	Contact person
	The Main Registration Centre of the State Register for Ionizing Radiation Sources	Ukraine	152 Gorkoho Street, 03680 Kyiv, Ukraine tel. (044) 528 31 04	Borys S. Horemykin
1	Registration centre in Rivne	Rivne, Ternopil, Khmelnytsky, Volyn	1 Soborna Street, office 310, 33000 Rivne, Ukraine tel. (036) 263 61 81	Larysa O. Khabarova
2	Registration centre in Odesa	Odesa, Mykolayiv, Kherson	P.O. box 126, 65111 Odesa, Ukraine tel. 8 050 495 91 92	Feliks O. Rozhkov
3	Registration centre in Kyiv	Zhytomyr, Cherkasy, Kyiv, Vinnytsya, City of Kyiv	152 Gorkoho Street, 03680 Kyiv, Ukraine tel. (044) 528 31 04	Borys S. Horemykin
4	Registration centre in Dnipropetrovsk	Dnipropetrovsk, Kirovohrad	16 Plekhanova Street, flat 76, 49000 Dnipropetrovsk, Ukraine tel. (056) 372 80 13	Dmytro H. Hazhev
5	Registration centre in Donetsk	Donetsk, Zaporizhzhya, Luhansk	5 Khodakovskoho Street, office 901-a, 83023 Donetsk, Ukraine tel. 8 062 312 77 79	Serhiy V. Podolsky
6	Registration centre in Kharkiv	Kharkiv, Poltava, Sumy	7/8 Povstannya Street, office 802, 8th floor, 61005 Kharkiv, Ukraine, tel. (057) 732-89 49	Serhiy K. Bastanzhyyan
7	Registration centre in Simferopol	Crimea Sevastopol	1 Kirova Street, office 607, 95015 Simferopol, Ukraine, tel. 065-254-38-22	Kateryna L. Zaonehina
8	Registration centre in Ivano-Frankivsk	Lviv, Carpathian, Ivano-Frankivsk and Chernivtsi	77 Bandery Street, office 304, 76014 Ivano-Frankivsk, Ukraine	Oksana I. Olenych