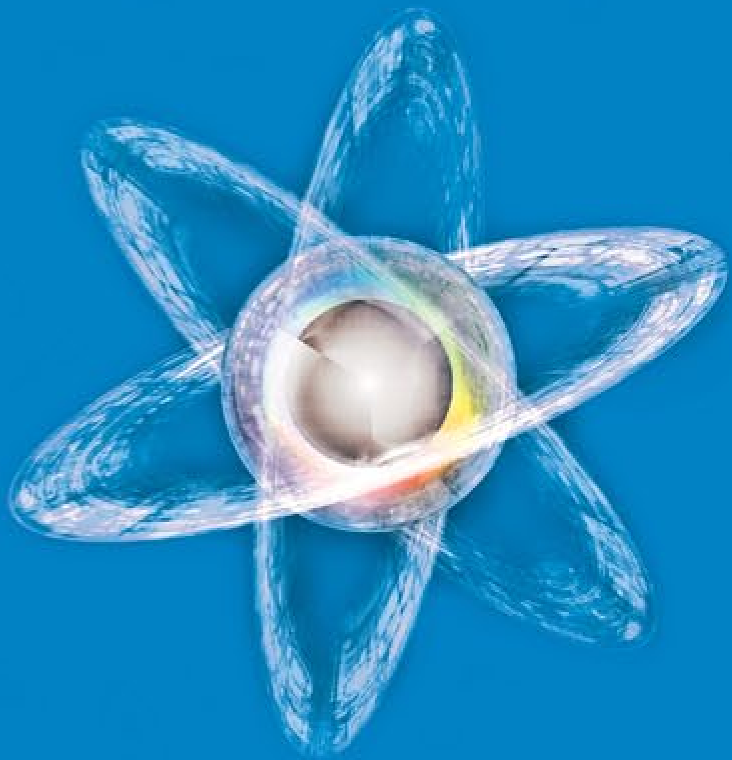

Nuclear and Radiation Safety in Ukraine Annual Report 2009

The State Nuclear Regulatory Committee of Ukraine

Dear readers!

The State Nuclear Regulatory Committee of Ukraine presents to your attention a Report on Nuclear and Radiation Safety in Ukraine in 2009. While working on every section of this Report we were trying to provide you with objective information about nuclear and radiation safety status in Ukraine.

The last year was marked with several anniversaries of so-called Soviet design reactors:

- **55** years since the start-up of first NPP in Obninsk;
- **45** since commissioning of first commercial unit of WWER type (unit № 1 of Novo-Voronezhsk NPP, 210 MWt);
- **25** since commissioning of first unit with WWER-1000/ V-320 (unit № 1 of Zaporizhzhya NPP).

For the nuclear energy of Ukraine the year 2009 was marked with the first significant achievements in the field of safety enhancement: after more than four hundred and thirty days of scheduled maintenance (from 11 October 2008 till 19 December 2009) at the unit № 1 of Rovno NPP all measures foreseen by the Concept of Safety Improvement of Operating NPPs were implemented. Also, the implementation of Safety Upgrading Program of Khmelnitsky unit № 2 and Rovno unit № 4 was completed.

At the meeting of SNRCU Board on 24th of December 2009 a decision on transportation of spent nuclear fuel from unit № 3 of Chernobyl NPP and its storage in the fifth module of the cooling pool of Spent Nuclear Fuel Storage Facility (ISF-1) was made. The release of unit № 3 of Chernobyl NPP from spent nuclear fuel allows to considerably increase the safety of activities at the Shelter at the stage of construction of new safe confinement.

Also, during the last year, an unprecedented series of missions on safety assessment of Ukrainian NPPs under the Joint Project Ukraine-EU-IAEA was completed, covering the following areas: design safety, operational safety, radioactive waste management and decommissioning and regulatory issues. In general, the results of safety assessment of Ukrainian NPPs showed the correspondence of the Ukrainian power units to the international standards and IAEA requirements on nuclear safety under the condition of full implementation of planned safety upgrading measures.

Furthermore, certain preconditions for subsequent steps in solving the problem of radioactive waste were created: special financing mechanism was launched and National environmental program on radioactive waste management in Ukraine was put into implementation.

The complete information on these and many other achievements in the area of nuclear and radiation safety is included in the Report. We did our best to make it interesting and we are looking forward to your feedback.

Chairperson
of the State Nuclear
Regulatory Committee of Uktaine

Olena Mykolaichuk

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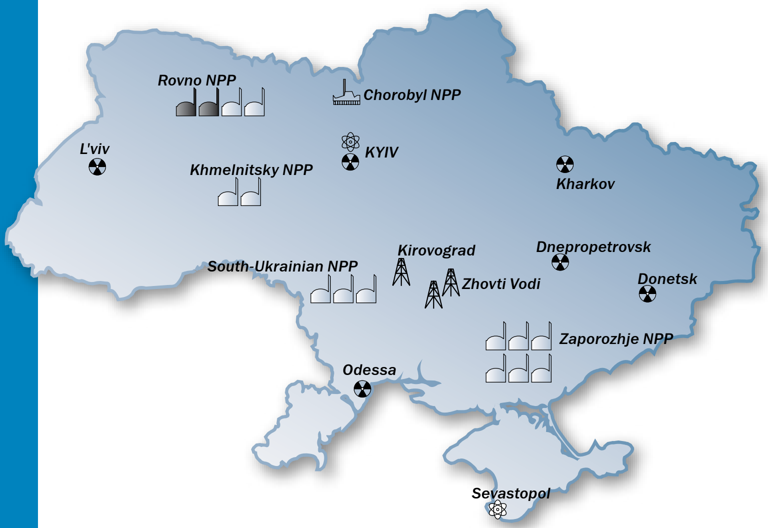
State Regulation In The Area Of Nuclear Energy

Pursuant to Articles 19-20 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and Articles 7-8 of the Convention on Nuclear Safety, Ukraine has undertaken to:

- *establish and maintain a regulatory and legislative framework to ensure the safety of nuclear energy, providing for: appropriate national safety requirements and regulations; a system of licensing with regard to nuclear energy use; prohibition of nuclear energy use without a license; a system of appropriate institutional and regulatory control and documentation and reporting; enforcement of applicable regulations and license terms; clear separation between the functions of bodies involved in different stages of spent fuel and radioactive waste management;*



- *establish and designate a regulatory body entrusted with the implementation of the legislative and regulatory framework and provided with adequate authority, competence, and financial and human resources to fulfill its assigned responsibilities;*
- *take all appropriate steps to ensure effective separation between the regulatory and other functions.*

The State Nuclear Regulatory Committee of Ukraine (SNRCU) is the main central executive body authorized to regulate the safety of nuclear energy and radiation safety in Ukraine, which was established in December 2000 by Presidential Decree.

The SNRCU's basic functions in regulating the safety of nuclear energy are to:

- *establish safety criteria, requirements and conditions for nuclear energy use **(rule-making);***
- *issue permits and licenses for activities in this area **(licensing);***
- *state supervision over compliance with legislation, standards, rules and regulations on nuclear and radiation safety **(supervision);***
- *apply sanctions envisaged by legislation in case of violations **(enforcement).***

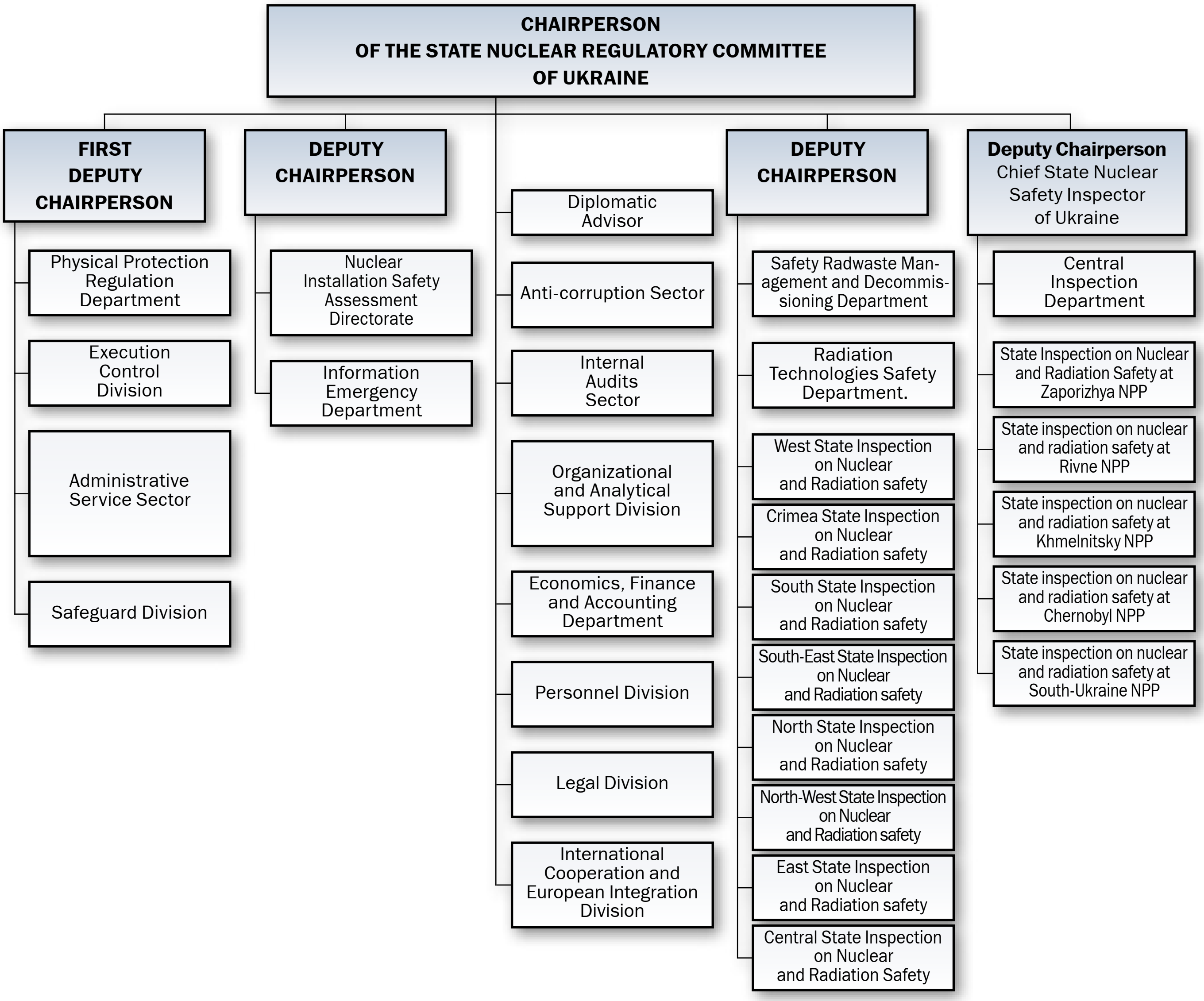
The SNRCU regulates the safety of:

- 15 nuclear power units operating in Ukraine:
  - *– 6 units of the Zaporizhzhya NPP,*
  - *– 4 units of the Rivne NPP,*
  - *– 3 units of the South Ukraine NPP,*
  - *– 2 units of the Khmelnitsky NPP;*
- 3 units of the Chornobyl NPP at the stage of decommissioning;
- 2 operating spent fuel storage facilities at the Zaporizhzhya and Chornobyl NPPs and one storage facility under construction at the Chornobyl NPP;
- 2 research reactors;
- radioactive waste storage facilities and radioactive waste management enterprises:
  - *– 6 UkrDO Radon specialized plants,*
  - *– SSE Complex,*
  - *– SSE Tekhnocenter;*
- uranium milling enterprises;
- radioactive material transport on the territory of Ukraine;
- use and production of radiation sources and radiation technologies.

As of late 2009, the total number of SNRCU positions (including regional inspectorates) was 292 (46 vacancies: 38 at the headquarters and 8 in state regional inspectorates for nuclear and radiation safety).

It should be noted that the SNRCU has to solve the issue of staff leaving scientific departments since their remuneration does not correspond to the assigned tasks and responsibility.

Above 70% of staff members have higher technical education. Most of them were employed by the SNRCU after gaining experience in industry and design and scientific institutions.



COLLECTIVE DECISION-MAKING IN THE FIELD OF NUCLEAR ENERGY

To provide recommendations on important aspects and top-priority areas of state nuclear safety regulation, the SNRCU Board was established on a permanent basis. The Board's activities are organized through meetings. The Board includes the SNRCU Chairperson, Deputy Chairpersons (by virtue of their positions), other SNRCU managerial staff, heads of enterprises, establishments and organizations under SNRCU jurisdiction and, upon agreement, people's deputies and leading scientists, representatives of the National Academy of Sciences of Ukraine. Top management and experts from other central and local executive bodies, local governments and people's deputies, representatives of enterprises, establishments and organization and community leaders and mass media participate in Board meetings.

During 2009, 11 SNRCU Board meetings were conducted to discuss aspects important for nuclear and radiation safety, such as the radwaste management system in the Exclusion Area; safety of radwaste management facilities, UkrDO Radon state interregional specialized plants; safety of spent fuel storage at Chornobyl ISF-1; availability of the regulatory and legal framework for measures under the Energy Strategy of Ukraine up to 2030; NPP safety analysis and verification, etc.

At the beginning of 2009, the Boards of the SNRCU and the Ministry for Fuel and Energy of Ukraine convened a joint meeting to discuss safety improvement of operating nuclear power units and potential design lifetime extension of NPP units.

On 27 August 2009, the Boards of the SNRCU and State Committee of Health and Safety at Work of Ukraine convened a joint meeting to discuss basic areas of interaction and coordination between the two authorities.

The proceedings of the SNRCU Board meeting can be found on the site www.snrc.gov.ua under the heading 'Activity'.

Advisory functions in making decisions in the field of nuclear energy are also performed by the Scientific and Technical Council, Reactor Safety Council and Public Council under the SNRCU.

During 2009, the Scientific and Technical Council convened meetings with participation of leading establishments of the National Academy of Sciences of Ukraine in the field of nuclear physics and materials science – Kyiv Nuclear Research Institute,

Meeting of SNRCU Board

Kharkiv Physical and Technical Institute, E. Paton Electric Welding Institute, G. Pisarenko Institute for Problems of Strength and T. Shevchenko Kyiv National University – to discuss important aspects of safe operation of reactor pressure vessels at Ukrainian NPPs in the context of their design lifetime extension, namely:

- *reassignment of loading cycles for thermomechanical equipment as a way to extend safe operation of NPP reactor pressure vessels;*
- *role of certification of nondestructive inspection systems in the safe operation of NPP reactor pressure vessels;*
- *modification of surveillance specimens as a way to improve prognosis of radiation embrittlement of NPP reactor pressure vessels.*

Special attention should be paid to the Reactor Safety Council, which was established in 2008 as an advisory body to provide independent and competent recommendations on the state policy with regard to the safety of nuclear energy and research reactors in accordance with practices of leading nuclear states. Upon SNRCU request, the two meetings held on 21 April and 21 October in Kyiv focused on the:

- *development and improvement of nuclear legislative and regulatory frameworks in Ukraine in relation to licensing of new nuclear power units;*
- *lessons learnt and experience in safety regulation in ChNPP decommissioning;*
- *problems encountered in licensing of alternative fuel.*

The resulting recommendations are set forth in minutes of Council meetings, which can be found on the SNRCU site www.snrc.gov.ua under the heading 'Reactor Safety Council'.

The SNRCU uses the Council's recommendations in the decision-making process and justification of proposals on amendment of legislation. In particular, this practice was used in preparing and discussing amendments to the Law of Ukraine On Authorizing Activity in Nuclear Energy Use.

The Council includes acknowledge experts whose names are associated with the history of nuclear energy in the world.

Mykola Shteinberg was appointed Head of the Advisory Council and Viktor Sidorenko (Russian Federation) and Rolf Janke (Germany) were appointed Deputy Heads.

European Union states have gained experience in using such councils for constructive interaction with competent experts in the field to make decisions to deal with current safety challenges and meet social and technical development.

The SNRCU Public Council has been acting since 2005. Its composition was renewed in 2009. The Public Council consists of 20 members including representatives of mass media, scientists, community of the regions where nuclear installations are located. Sergiy Kurykin, Head of the Green Party of Ukraine, was appointed Head of the Public Council for the second time and Anna Golubovska-Onisimova, Honorary President of the All-Ukrainian Ecological Public Organization MAMA-86, and Boris Prister, an academician of the National Academy of Sciences of Ukraine, were appointed Deputy Heads once again. In 2009, to maintain an active dialogue with the public, the SNRCU Public Council discussed the draft regulations Requirements for the Procedure of Safety Justification for Upgrading Safety-related Systems (Components) of Nuclear Installations, Requirements for Periodic Safety Verification of Nuclear Power Units and Requirements for Safety Assessment of Nuclear Power Plants.

Decisions of the Public Council can be found on the SNRCU site www.snrc.gov.ua under the heading 'Public Council'.

During 2009, the Public Council members took an active part in public activities conducted by the SNRCU. In particular, representatives of the Public Council participated in the workshop initiated by the Nuclear Safety Regulatory Authorities of Ukraine (SNRCU) and Finland (STUK) for Finnish jornalists in May 2009. The workshop participants visited the Chornobyl NPP and Nuclear Research Institute, National Academy of Sciences of Ukraine. They met leading Ukrainian experts in the field of nuclear and radiation safety. The SNRCU's major task s and areas and mechanisms of interaction with the public and mass media were presented to Finnish jornalists.

In addition, on 5 March 2009, on the initiative of the Public Council, SNRCU experts met with representatives of Ukrainian ecological public organizations to discuss design lifetime extension of Ukrainian NPP units.

Other SNRCU advisory bodies, such as the **Working Commission on Regulatory Control and Licensing Commissions for personnel and organizations**, acted in 2009 to coordinate activities and make collective and open decisions in respective areas.

In 2009, the SNRCU Licensing Commission for personnel reviewed 174 applications for licensing of NPP personnel for reactor control and for routine extension of operating licenses/extension of operating licenses with regard to a new position.

Based on the review:

- *23 licenses were issued to personnel: 10 licenses to ZNPP personnel, 4 to RNPP personnel, 3 to KhNPP personnel and 6 to SUNPP personnel;*
- *151 operating licenses were extended (regular extension – 120 licenses; extension for a new position – 31 licenses).*

During 2009, 17 licenses were cancelled within the licensing process in compliance with safety requirements for licensed personnel who took up positions that did not require a license or were dismissed.

In 2009, 8 licenses were suspended since personnel did not comply with their terms (incompliance with operating procedure – 6 cases; failure to pass regular examination – 2 cases). After appropriate measures were taken, 7 licenses were renewed.

The SNRCU Licensing Commission for organizations considers proposals on making a decision to issue, re-

Participants of the workshop arranged by the SNRCU and STUK for Finnish jornalists ject, reissue, extend or terminate, cancel and renew a license for use of nuclear energy (excepting licenses for personnel for direct reactor control).

Supervision (inspection) of the SNRCU is purposed to protect personnel, the pubic and the environment against adverse effects of radiation and radioactive contamination resulting from practices at nuclear installations and is primarily intended to:

- *monitor compliance with law, codes and standards on nuclear and radiation safety, requirements and conditions of licenses and permits, physical protection of nuclear installations, nuclear materials, radioactive waste, other radiation sources;*
- *keep state accounting of nuclear materials, radioactive waste, other radiation sources for their proper storage and prevention of illicit use, etc.;*
- *monitor measures aimed at prevention of accidents at nuclear installations, radioactive waste management facilities and uranium enterprises, during production and use of radiation sources, and also inspection of preparedness of enterprises, institutions and organizations to mitigation of accident consequences.*

State supervision is conducted through scheduled and unscheduled inspections to verify safety of routine and other operations.

RESULTS OF LICENSING ACTIVITY IN 2009

ACTIVITY	Number of licenses					
	New	Reissued	Amended	Cancelled	Rejected	Suspended
Design of a nuclear installation or radioactive waste disposal facility	2	2	–	–	–	–
Uranium ore milling	1	1	–	–	–	–
Radioactive material transport	6	7	3	–	–	1
Radioactive waste processing, storage and disposal	4	3	1	–	–	–
Production of radiation sources	2	2	1	–	–	–
Use of radiation sources	612	103	105	10	2	–
Personnel training for operation of a nuclear installation	–	1	1	–	–	–
Design of physical protection systems for nuclear installations, nuclear material, radioactive waste, other radiation sources	1	1	1	–	–	–
Design of engineered means for security of nuclear installations, nuclear material, radioactive waste, other radiation sources	1	2	1	–	–	–
Installation, setup, maintenance, repair of engineered means for security of nuclear material, radioactive waste, other radiation sources	–	3	1	–	–	–
Construction of a nuclear installation or radioactive waste disposal facility	–	–	1	–	–	–
Operation of a nuclear installation or radioactive waste disposal facility	1	–	2	–	–	–
Decommissioning of a nuclear installation	–	–	2	–	–	–
Licensing of personnel for direct reactor control	23	153	–	4	–	–
Total:	**653**	**278**	**119**	**14**	**2**	**1**

Scheduled inspections are performed according to supervisory plans developed for the entire calendar year. These inspections are aimed at determining and assessing compliance of the licensees' nuclear energy activities with safety requirements. Depending on the purpose and scope, scheduled inspections can be comprehensive, special, and response.

Unscheduled inspections are performed when scheduled inspections reveal safety deficiencies in the licensee's activity that require further more detailed or more frequent inspections. Unscheduled inspections can be response and special.

There are inspections of the applicant performed prior to issuing a license or permits for nuclear energy activities or operations. They are intended to verify information submitted by the applicant to the SNRCU to obtain a license or permit for compliance with the actual status and check that there are conditions for the applied activity or operations.

For supervisory activity, inspection commissions are established and are composed of state inspectors, a special category of skilled SNRCU experts. If necessary, independent technical experts can be involved in inspection commissions.

In 2009, SNRCU inspectors conducted 614 scheduled inspections, 498 unscheduled inspections and 469 inspections of enterprises, establishments and organizations that deal with nuclear energy.

The inspectors revealed 5076 violations, issued 1015 prescriptions, 106 inspection reports and 469 inspection acts.

Pursuant to Article 95 of the Code on Administrative Offence of Ukraine (KUpAP), administrative proceedings were instituted against 62 persons for administrative offence, who were fined for 23 139 UAH; pursuant to Article 188/18 of KUpAP, 83 persons were fined for 19 635 UAH.

***The central inspectorate brought one case to the Public Prosecutor for nuclear energy use without an SNRCU license.**

For information:

KUpAP Article 95 establishes administrative liability for incompliance with standards and rules on nuclear and radiation safety by officials of enterprises, establishments and organizations regardless of their ownership;

KUpAP Article 188/18 establishes administrative liability for incompliance with lawful requirements (prescriptions) issued by officials of state nuclear safety regulatory bodies and envisages elimination of incompliance with legislation on nuclear and radiation safety, liability for failure to provide necessary information or provision of false information and for posing other obstacles in performing their duties.

To improve the SNRCU effectiveness, the quality control system (QCS) was further implemented under DSTU ISO 9001-2001. In 2008, the SNRCU obtained an international quality certificate to confirm compliance of the QCS with ISO 9001-2001 regarding regulatory services in the field of nuclear energy and radiation safety.

The SNRCU represented its achievements in QCS implementation at the International Exhibition TOPQualitEX under the International Forum Innovations and Highest-Quality Technologies from 30 September to 2 October 2009 in Kyiv.

SCIENTIFIC AND TECHNICAL SUPPORT OF STATE REGULATION IN NUCLEAR ENERGY USE

Scientific and technical support to the SNRCU is provided by three state enterprises working in the field. This allows the SNRCU to efficiently perform its functions.

The State Scientific and Technical Center for Nuclear and Radiation Safety (SSTC NRS) was established in February 1992 by Cabinet Resolution No. 52 of 3 February 1992 for comprehensive scientific and technical support to state regulation of nuclear and radiation safety to protect the public and the environment against man-induced radiation impacts.

To improve SSTC NRS effectiveness and promote further extension of technical capabilities, the SSTC

NRS was given the status of double subordination by Resolution No. 618/192 of 25 November 2008; the SNRCU is subordinated both to the SNRCU and the National Academy of Sciences of Ukraine (NASU). In 2009, strategic plans for further development of SSTC NRS capabilities were discussed and approved at a meeting of the NASU Nuclear Physics and Energy Department headed by Academician Neklyudov.

SSTC NRS has gained a great scientific potential to provide technical support to SNRCU rule-making, licensing and inspection activities.

In 2009, the SSTC NRS performed the following basic activities:

- *development of 24 draft standards, rules and regulations on nuclear and radiation safety;*
- *scientific and technical support to regulation of nuclear energy use and radiation technologies (31);*
- *expert support and assessment of current nuclear safety state of nuclear installations and radiation technologies, risk assessment of their use (529).*

During 2009, SSTC NRS experts participated in 7 inspections within regulatory inspections.

Scientific and analytical studies and assessments conduced in 2009 were focused on nuclear and radiation safety aspects as follows:

- *thermohydraulic processes;*
- *probabilistic safety analysis;*
- *neutron-physical calculations;*
- *spent fuel and radwaste management;*
- *strength and structural reliability;*
- *reliability of control and monitoring systems;*
- *radiation protection.*

The research results are presented annually at national and international conferences, forums and workshops. In 2009, for further development of cooperation, discussion of joint efforts and exchange of experience in ensuring proper nuclear and radiation safety, 94 SSTC NRS experts took part in 57 measures arranged by the IAEA and scientific organizations and technical support organizations of the regulatory bodies of the USA, Germany, France, Belgium, Japan, Slovakia, Czech Republic, Italy, Hungary, Bulgaria, Russian and Ukraine.

In 2009, SSTC NRS concluded agreements on cooperation with the following organizations to extend a range of scientific and analytical activities in the area of nuclear and radiation safety:

- *G. S. Pisarenko Institute for Problems of Strength, NASU;*
- *Nuclear Research Institute, NASU;*
- *Scientific and Engineering Center for Radiohydroecological Field Studies, NASU;*
- *National Scientific Center Kharkiv Physical and Technical Institute, NASU;*
- *O. M. Marzeev Institute for Hygiene and Medical Ecology, Academy of Medical Sciences of Ukraine;*
- *National Sevastopol Institute for Nuclear Energy and Industry.*

To expand international relations, the SSTC NRS applied to join the European TSO Network (ETSON) in 2009. The SSTC NRS application was considered at the EUROSAFE Forum (Brussels, Belgium) at the ETSON Association meeting. Since Ukraine is not a member of the European Community, it was decided that the SSTC NRS would join the ETSON as an associated member.

Since 1998, the SSTC NRS has been issuing the Nuclear and Radiation Safety Journal registered by the Higher Certification Commission (HCC) as a special periodical on technical sciences. In 2009, the Nuclear and Radiation Safety Journal was updated to comply with HCC new requirements and then was entered into a new list of special scientific periodicals by HCC Ordinance No. 1-05/4 of 14 October 2009.

Since 2004, the Nuclear Power Plant Safety Series has been issued by the SSTC NRS, which represents books with the common subject and purpose. SSTC NRS employees are co-authors of eight scientific and educational books in the series. Two monographs were prepared for printing in 2009: 'Decontamination' and 'Control and Protection Systems of Nuclear Reactors'.

State Center for Quality Regulation of Supplies and Services (SE Derzhtsentryakosti) was established in the system of state nuclear safety regulation in 1992.

The SE Derzhtsentryakosti provides services on assessing and confirming the compliance of equipment and components used in safety-related systems in the field of nuclear energy. Independent confirmation of compliance with national standards, rules and regulations on nuclear and radiation safety permits the regulatory body to make objective and well-grounded decisions on the use of equipment, devices and components at NPPs and other facilities with radiation technologies.

The SE Derzhtsentryakosti has been accredited in the National UkrSEPRO System as a product certification body (SERTATOM Certification Body) since 1997 and as a quality system certification body since 2001. Certificates of conformance issued by the SERTATOM in the National UkrSEPRO System under obligatory and facultative certification are objective and independent confirmation of quality of products acknowledged in the field of nuclear energy.

The center has 5 specialized regional divisions located in the main industrial regions of Ukraine:

- *Ivano-Frankivs'k regional division assesses compliance in manufacturing piping valves for nuclear energy facilities;*
- *L'viv regional division assesses compliance in manufacturing electrotechnical equipment at enterprises;*
- *Sumy regional division assesses compliance in manufacturing pumps for nuclear energy facilities;*
- *Nickopol' regional division assesses compliance in manufacturing pipe and metal products at enterprises;*
- *Kharkiv self-supporting division Certification Center of Automated Control Systems provides confirmation of compliance to enterprises that manufacture and supply NPP automated control systems.*

Experts of the SE Derzhtsentryakosti and its regional divisions also assess compliance of Ukrainian enterprises that manufacture equipment, products, component parts, materials and semi-finished articles delivered to NPPs of the Russian Federation, China, India and Iran in accordance with authorities granted by the FSUE VO Safety, independent division of the Russian regulatory body Rostekhnadzor.

Successive harmonization of relations between the regulatory bodies of Russia and Ukraine with regard to compliance confirmation has eliminated practically all technical obstacles in mutual supplies of NPP safety-related products. In 2008-2009, the Russian operating organization Rosenergoatom jointly with Rostekhnadzor implemented new compliance assessment procedures and granted authorities to acknowledged organizations for independent confirmation of product compliance with national standards, rules and regulations on nuclear and radiation safety. This greatly simplified supplies from Ukrainian manufacturers to Russian Federation NPPs.

To confirm compliance of Ukrainian equipment in the Russian Federation OIT Certification System, the SE Derzhtsentryakosti was accredited as a certification expert center SERTATOM and a testing laboratory of automated control systems.

In 2002, the Head of the Derzhstandart issued an order to appoint the SE Derzhtsentryakosti as the basic organization of the Technical Standardization Committee TK 79 Nuclear Energy. In 2009, the SE Derzhtsentryakosti was entrusted with functions of a metrological service of the SNRCU.

Center for Information Technologies for Nuclear Energy Use (SE Infoatom) was established in 1994. Its main tasks are information and analytical support to the SNRCU, involvement in public information on nuclear and radiation safety in Ukraine and design, development, implementation and support of information computer networks and automated databases on nuclear and radiation safety needed for the SNRCU's efficient performance.

The SE Infoatom has gained a wide experience in working with Ukrainian, foreign and international organizations dealing with nuclear energy, including the SNRCU, Ministry for Environmental Protection of Ukraine, SE Isotop, IAEA, regulatory bodies of the USA, Germany, Finland, Sweden, etc.

Legislation And Rule-Making In Nuclear Energy Use

The current Ukrainian legislation on nuclear energy is comprehensive and regulates most activities and relations in this area.

There are the following main regulatory and legal acts:

- **Law of Ukraine On Nuclear Energy Use and Radiation Safety.** This Law establishes the priority of human and environmental safety, rights and duties of the public in the area of nuclear energy; regulates the use of nuclear facilities and radiation sources; sets forth legal frameworks for international obligations of Ukraine in nuclear energy use, etc.

- **Law of Ukraine On Radioactive Waste Management** to protect people and the environment against adverse effects of radioactive waste at present and in future. This Law covers all radioactive waste activities;

- **Law of Ukraine On Uranium Ore Mining and Milling;**

- **Law of Ukraine On Human Protection against Ionizing Radiation;**

- **Law of Ukraine On General Principles of Subsequent Operation and Decommissioning of Chornobyl NPP and Transformation of Its Destroyed Unit 4 into an Ecologically Safe System;**

- **Law of Ukraine On Authorizing Activity in Nuclear Energy Use;**

- **law of Ukraine On Physical Protection of Nuclear Facilities, Nuclear Materials, Radioactive Waste, Other Radiation Sources;**

- **Law of Ukraine On Civil Liability for Nuclear Hazard and Its Financial Support;**

- **Law of Ukraine On Arranging Nuclear Safety Issues. This Law** establishes legal and administrative principles for funding the cessation and decommissioning of nuclear facilities;

- **Law of Ukraine On Procedure for Making Decisions on Siting, Designing, Constructing of National Nuclear Facilities and Radioactive Waste Management Facilities,** etc.

The Ukrainian legislation on nuclear energy also includes a number of international acts jointed by Ukraine.

However, current legislative acts on nuclear energy still have shortcomings and contradictions: some regulatory and legal acts on nuclear energy conflict with other legislative areas and do not consider new regulatory requirements, in particular, IAEA recommendations. For this reason, the national legislation on nuclear energy is continuously improved and developed.

The improvement of the national nuclear legislation, standards, rules and regulations on nuclear energy was continued in 2009.

In particular, on 17 November the Verkhovna Rada of Ukraine passed the Law of Ukraine On Amending Certain Laws of Ukraine with regard to Ratification of the Amendment to the Convention on the Physical Protection of Nuclear Material. This Law amends the Laws of Ukraine On Nuclear Energy Use and Radiation Safety and On Physical Protection of Nuclear Facilities, Nuclear Materials, Radioactive Waste and Other Radiation Sources.

This Law will contribute to further improvement of the legislation and enhance the international regime of nuclear weapons non-proliferation.

For information:

The Convention on the Physical Protection of Nuclear Material was signed on 3 March 1980 and came into force on 5 August 1993 for Ukraine. This Convention is an important instrument for international nuclear safety and is included into 13 universal antiterrorist Conventions and Protocols. The Security Council of the United Nations Organization appealed to all states of the world to join these Conventions and Protocols.

Along with other 25 member countries, Ukraine initiated and prepared amendments to the Convention on the Physical Protection of Nuclear Material. The Amendment to the Convention on the Physical Protection of Nuclear Material (hereinafter referred to as the Amendment) was signed by Ukraine together with other 88 member countries on 8 July 2005 at the Diplomatic Conference in Vienna (Austria).

On 21 May 2009, the Verkhovna Rada of Ukraine passed the Law On Amending Certain Legislative Acts on State Supervision in Nuclear Energy Use. This Law amended the Code of Ukraine on Administrative Offences and the Law of Ukraine On Nuclear Energy Use and Radiation Safety. This Law eliminated contradictions between the legislative acts stated above.

On 23 June 2009, the Law of Ukraine On Amending Article 2 of the Law of Ukraine 'On Basic Principles of the State Supervision (Control) in the Economic Activity' in Terms of Safe Nuclear Energy Use was passed. In accordance with this Law, the state supervision over compliance with nuclear and radiation safety requirements is based on the relative legislation which governs relations in nuclear energy use and radiation safety pursuant to the main principle of the state policy in this area, in particular, the priority of human and environmental protection against radiation. The Law is intended to support the state supervisory system in nuclear energy use in accordance with international standards and to prevent weakening of the state supervision as a part of the state regulation on nuclear and radiation safety.

During 2009, the Cabinet of Ministers of Ukraine approved a number of regulatory and legal acts on nuclear and radiation safety:

- *on 25 March 2009, Cabinet Resolution No. 257 amended the Provisions on the State System of Accounting for and Control of Nuclear Materials approved by Cabinet Resolution No. 1525 of 18 December 1996;*

- *on 24 April 2009, Cabinet Resolution No. 391 amended the Procedure for Establishing Standards to Determine and Collect Charges for Environmental Contamination approved by Cabinet Resolution No. 303 of 1 March 1999. The above measures are intended to develop and introduce a mechanism for allocation of costs to the State Fund of Radioactive Waste Management by its payers, i.e., entities that generate radioactive waste and store it temporary at the Ukrainian territory, within its continental shelf and exclusive (sea) economic area.*

- *Cabinet Resolution No. 571 of 10 June 2009 amended item 4 of the Provisions on the State Nuclear Regulatory Committee of Ukraine approved by Cabinet Resolution No. 1830 of 27 December 2006 resulting from amendments made by the Law of Ukraine On Amending Certain Legislative Acts of Ukraine with regard to Renaming the Executive Bodies No. 885 VI of 15 January 2009 to the Code of Trade Navigation of Ukraine.*

The development of standards and rules on nuclear and radiation safety was continued in 2009.

SNRCU Order No. 34 of 16 February 2009 approved the Requirements for Packages for Long-term Storage and Disposal of High-level Radioactive Waste resulting from Spent Nuclear Fuel Processing (registered in the Ministry of Justice of Ukraine No. 197/16213 of 3 March 2009).

To determine procedures to meet the requirements established in the Agreement between Ukraine and IAEA on Application of Safeguards with regard to the Treaty on the Non-proliferation of Nuclear Weapons and in the Additional Protocol to the Agreement between Ukraine and IAEA for the Application of Safeguards with regard to the Treaty on Non-proliferation of Nuclear Weapons, the SNRCU, by its Order No. 102 of 2 July 2009, developed and approved the Procedure for Applying Safeguards for Non-proliferation of Nuclear Weapons (registered in the Ministry of Justice of Ukraine No. 683/16699 of 23 July 2009).

Basic regulations, international conventions, standards and rules that govern relations in nuclear energy use may be found on the SNRCU website www.snrc.gov.ua, headline 'Regulatory Acts'.

Ukraine's Contribution To International Nuclear Safety Regime

INTERNATIONAL NUCLEAR SAFETY CONVENTIONS

Obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention).

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (signed for Ukraine on 29 September 1997 in Vienna) was ratified by the Law of Ukraine on 20 April 2000. Ukraine takes an active part in the processes and measures under the Convention. Pursuant to Article 32 of the Joint Convention, Ukraine prepares and submits national reports on compliance with obligations under the Joint Convention. National reports are presented at meetings between the Parties to the Joint Convention at the IAEA Headquarters in Vienna. The comments and recommendations resulting from the review of the national reports are incorporated in the state policy of radwaste and spent fuel management, in safety improvement measures and development of legislation.

The First and Second National Reports of Ukraine were presented to the Parties to the Joint Convention in 2001 and 2005, respectively. In 2009, the Third National Report was prepared and submitted in full compliance with the requirements under the Joint Convention and Guidelines Regarding the Form and Structure of National Reports and with account for the Final Report of the Second Review Meeting. This Report, as the previous reports, is based on Ukrainian current regulations and official reports of state executive bodies responsible for the development and implementation of state nuclear energy policy and operating organizations.

The main objective of the Report is to provide objective information to the Parties to the Joint Convention and the general public of Ukraine on the state of spent fuel management and on the safety of radioactive waste management, on measures and actions taken in Ukraine to protect personnel, the public and the environment against harmful effects of radiation and on changes made after the Second Review Meeting and issues to be solved.

The Third National Report of Ukraine on compliance with obligations under the Joint Convention was presented on 12 May 2009 by the SNRCU Chairperson, Olena Mykolaichuk. The presentation focused on the infrastructure of radwaste and spent fuel management, legislative aspects, policy and plans for future and, no less important, improvements reached in this area.

The presentation and report obtained favorable assessment, and substantial progress was made since the Second Meeting of the Parties. This relates to the approval of the national target ecological program for radwaste management, creation of the state fund for radwaste management, national program for Chornobyl NPP decommissioning and Shelter transformation into an ecologically safe system, implementation of new regulations on safety of radwaste management, including transport and disposal, creation of the infrastructure for radwaste and spent fuel management, development of policy for improving safety indicators for safe management of radiation sources, completion of Shelter stabilization measures, strengthening of the infrastructure for nuclear and radiation safety regulation, improvement of regulation and public involvement into decision-making process and transparency of state policy in radwaste and spent fuel management.

The following was noted as good practice:

- *preparation of the long-term strategy for radwaste management;*
- *signature of a joint action plan by the Ministry for Emergencies and Ministry for Fuel and Energy of Ukraine regarding the state policy of managing NAEK Energoatom radioactive waste when transferred into state ownership;*
- *implementation of a system for state registration of radiation sources to monitor their state from initial use to transfer to specialized enterprises for storage and disposal;*
- *development and implementation of a quality control system at the SNRCU and issuance of a respective certificate (ISO 9001);*
- *successful international IRRS mission in June 2008, including development and governmental approval of an action plan to implement recommendations of the mission;*
- *development and successful implementation of measures to optimize the collective dose of Shelter personnel involved in hazardous activities.*

Based on review of the National Report of Ukraine, recommendations were prepared for implementation of the following measures over the next three-year period:

- *conduct periodic safety verification of UkrDO Radon specialized plants to prepare well-grounded decisions for each disposal facility located on their*

sites, namely: retrieve radwaste for further disposal or closure of disposal facilities;
- *modernize Chornobyl ISF-1;*
- *complete Chornobyl ISF-2;*
- *take measures under the Shelter Implementation Plan;*
- *commission the Industrial Complex for Solid Radwaste Management and Liquid Radwaste Treatment Plant at the Chornobyl NPP site;*
- *construct radwaste management facilities on the Vektor site of the SSE Tekhnocenter including a temporary storage facility for high-level waste resulting from spent fuel processing in the Russian Federation;*
- *ensure security of high-level radiation sources;*
- *manage waste from uranium ore mining and milling;*
- *prepare and construct a centralized spent fuel storage facility;*
- *complete systems for conditioning of operational radwaste at NPPs;*
- *implement the Chornobyl NPP decommissioning program;*
- *implement the IRRS mission plan.*

There are still the following challenges for Ukraine:
- *implementation of the construction design of the Shelter New Safe Confinement to transform the Shelter into an ecologically safe system and*
- *completion of the construction design of the spent fuel storage facility (ISF-2) at the Chornobyl NPP site for timely removal of spent nuclear fuel from the units.*

Obligations under the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities.

The physical protection of nuclear installations, nuclear material, radioactive waste and other radiation sources, which is one of the nuclear energy areas, is intended to protect interests of national safety, prevent and terminate diversions, theft or any other illicit removal of radioactive material, radioactive waste or other radiation sources and to strengthen the nuclear weapon non-proliferation regime.

Law envisages that physical protection, as an inseparable part of nuclear and radiation safety, is a necessary condition for dealing with nuclear installations, nuclear material, radioactive waste and other radiation sources.

The SNRCU and other central executive bodies ensure fulfillment of Ukraine's international obligations under the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities. Ukraine ratified Amendment to the Convention on the Physical Protection in 2008 to implement the fundamental principles of physical protection and open new approaches in this area. The Verkhovna Rada adopted a law in 2009 to introduce a number of new provisions to the Laws of Ukraine On Nuclear Energy Use and Radiation Safety and On Physical Protection of Nuclear Facilities, Nuclear Materials, Radioactive Waste, Other Radiation Sources that underlie the legislation on physical protection.

Implementation of the 'design threat' at legislative level gives grounds for assessing the realistic capability of physical protection systems to withstand threats of diversion, theft or other malicious acts against nuclear installations, nuclear materials, radioactive waste and other radiation sources, including that during their transportation. Moreover, state assessment of the threat will have an economic effect and establish justified limits of funding needed to develop and maintain physical protection systems.

A clause on the state physical protection system introduced into the Law is the basis for developing a national structure aimed at achieving physical protection objectives at the state level and implementing state physical protection policy.

Moreover, the Law defines the important notion of the 'security of nuclear installations, nuclear materials, radioactive waste and other radiation sources', which is equal to the international notion of 'nuclear security' and is wider and wider used by the IAEA in international practice.

In order to implement the Amendment to the Convention on the Physical Protection of Nuclear Material, systemize the legislation and identify deficiencies in the regulatory and legal framework for physical protection, a hierarchic pyramid of regulations on physical protection has been developed. The hierarchic pyramid will enable not only systematic development or revision of physical protection standards and rules but also identify documents that have become irrelevant or duplicate other regulations and also combine similar documents.

The SNRCU's priorities in the area of physical protection are still to implement the Amendment to the Convention on the Physical Protection of Nuclear Material into the Ukrainian legislation on physical protection and develop a state physical protection system. Adaptation of the regulatory and legal framework on physical protection to the European Union acquis communautaire is also an important task. In the next years, physical protection and prevention of illicit use of radioactive materials in the preparation for the 2012 UEFA European Football Championship will also be priority measures.

MEMORANDUM OF UNDERSTANDING IN THE FIELD OF ENERGY BETWEEN THE EUROPEAN COMMISSION AND UKRAINE

On 1 December 2005, Ukraine and the European Commission signed the Memorandum of Understanding in the Field of Energy (henceforth referred to as the Memorandum).

The cooperation is intended to implement the EC-Ukraine Action Plan agreed in February 2005 by the EC-Ukraine Cooperation Council under the Agreement on Partnership and Cooperation.

The main objective of the Memorandum is to extend cooperation between Ukraine and EC in the field of energy with the purpose of integrating energy markets.

Regarding the ‘nuclear safety’ area under the Memorandum, a joint Ukraine-EC-IAEA project is underway to carry out a joint safety assessment of Ukrainian NPPs to determine their compliance with current IAEA standards. The terms of reference for the joint project were agreed at the end of April 2007. The safety of Ukrainian NPPs is assessed in four areas: ‘design safety’, ‘operational safety’, ‘radioactive waste and decommissioning’, ‘regulatory aspects’.

In the ‘design safety’ area, pilot IAEA missions were conducted at Khmelnitsky-2 (13-24 October 2008), Rivne-1 (12-23 January 2009) and South Ukraine-1 (2-11 February 2009) to verify the design safety of these units for compliance with IAEA standards (NS-R-1 «NPP Safety: Design»). This IAEA standard contains 192 requirements for the NPP design, including technical requirements for individual systems and components.

The IAEA mission showed that the design safety of Ukrainian power units in general complied with IAEA safety standards. There is some incompliance regarding equipment qualification, seismic safety and severe accident analysis.

Taking into account results of the pilot missions, in 2009 the IAEA conducted missions at South Ukraine-2 and Rivne-2 (25 May-5 June), Zaporizhzhya-1-6 and South Ukraine-3 (21-30 July), Rivne-3-4 and Khmelnitsky-1 (5-16 October).

Figure 1 summarizes results of the design safety missions.

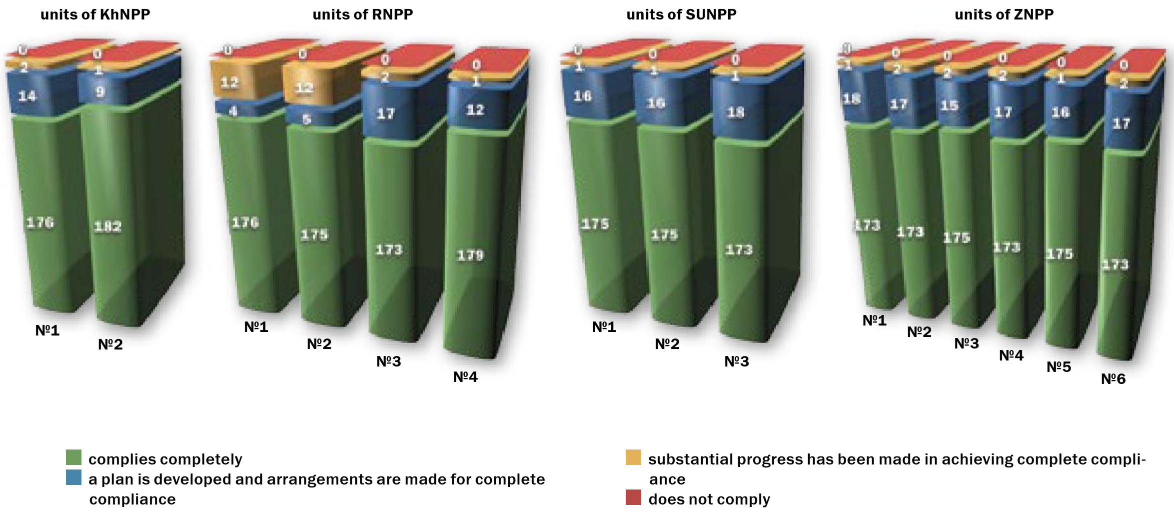
Compliance with IAEA standards is classified as follows:

- *complies completely (C);*
- *complies partially (P);*
- *a plan is developed and arrangements are made for complete compliance (P1);*
- *substantial progress has been made in achieving complete compliance (P2);*
- *does not comply (N).*

Table2 shows areas of incompliance and associated power units (marked with *).

The regulatory authority established requirements for further elimination of the revealed incompliance.

Figure 1



In the 'operational safety' area, the IAEA conducted missions to verify compliance of the operational safety of the units with IAEA standards (NS-R-2 'NPP Safety: Operation') at Zaporizhzhya NPP (3-7 November 2008), Rivne NPP (24-28 November 2008), South Ukraine NPP (6-9 April 2009) and Khmelnitsky NPP (1-4 June 2009). There were also OSART mission at Rivne-3-4 (25 November – 11 December 2008) and OSART post-mission at South Ukraine-3 (30 March – 3 April 2009) and at Khmelnitsky-1-2 (25-29 May 2009). In addition, on 2-6 November 2009, limited OSART mission was conducted at South Ukraine-1-2.

Table 2

MAJOR AREAS OF INCOMPLIANCE	KhNPP		RNPP				SUNPP			ZNPP					
	1	2	1	2	3	4	1	2	3	1	2	3	4	5	6
Equipment qualification	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Severe accident account	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Seismic stability calculation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Deterministic and probabilistic analysis	●				●	●			●	●	●	●	●	●	●
Radwaste storage	●	●													
Protection against internal impacts and common-cause failures							●	●							
Probabilistic safety analysis							●	●							
Demonstration of implementation of safety improvement measures			●	●											

In the 'radioactive waste and decommissioning' area, the IAEA conducted missions at the South Ukraine on 2-7 February 2009, at the Khmelnitsky NPP on 25-29 May 2009, at the Rivne NPP on 22-26 June 2009 and at the Zaporizhzhya NPP on 17-12 August.

The SNRCU is the leading executive body entitled with the 'regulatory aspects' area. The IAEA mission for the complex assessment of regulatory aspects (IRRS mission) was conducted on 8-20 June 2008 at the SNRCU.

During the IRRS mission, IAEA experts carried out a comprehensive assessment of the nuclear safety regulatory system of Ukraine for compliance with modern IAEA standards. The results of the IRRS mission are presented in IAEA Report No. IAEA-NS-IRRS-2208/02 on Integrated Regulatory Review Service (IRRS) in Ukraine. IAEA experts provided 20 recommendations and 34 proposals to improve regulation and pointed out 14 good practices. The general conclusion of the mission has been that the SNRCU efficiently regulates nuclear and radiation safety within its responsibility; comprehensive legal infrastructure has been established that incorporates international requirements and includes all appropriate effective international conventions (IAEA Report No. IAEA-NS-IRRS-2208/02).

The 'Plan of Measures for Implementation of the Recommendations and Proposals of the IAEA Integrated Regulatory Review Service (IRRS) Mission' (the Plan) was developed by the SNRCU with involvement of central executive bodies. To incorporate the IRRS mission results, the Plan of Measures was approved by Cabinet Resolution No. 1307-r of 8 October 2008.

The Plan encompasses 17 comprehensive measures that summarize the recommendations and proposals of the IRRS mission. The measures are to be implemented over 2008-2011. The following central executive bodies are involved in the measures: SNRCU, Ministry of Emergencies, Ministry of Health, Ministry for Fuel and Energy, Ministry for Environmental Protection, Ministry of Justice, Ministry of Finance and Ministry of Economy.

From 22 to 30 November 2010, the IAEA IRRS post-mission is to be conducted in Ukraine.

The objective of the IRRS post mission is to verify the implementation, effectiveness and adequacy of measures taken to incorporate the recommendations and proposals of the full-scale IRRS mission and check effect of the measures on regulation.

Safety Of Nuclear Energy In Ukraine

Nuclear energy of Ukraine began its history in 1977 with commissioning the first power unit of the Chornobyl NPP. According to plans of nuclear energy development in the former USSR, nine nuclear power units were to be constructed on the territory of Ukraine. From 1977 to 1989, it was planned to commission 16 power units with the total power of 14 800 MW at five nuclear power plants: Zaporizhzhya, Rivne, Khmelnitsky, Chornobyl and South Ukraine NPPs.

The increasing demands for electric power promoted the rapid construction of nuclear power units: when the accident occurred at Chornobyl unit 4 in April 1986, 10 power units were in operation in Ukraine, including 8 units for 1000 MW (4 WWER-1000 and 4 RBMK-1000). From 1986 to 1990, other six units of 1000 MW each were commissioned: three units at the Zaporizhzhya NPP and one at the South Ukraine, Rivne and Khmelnitsky NPPs.

However, after the Chornobyl accident, the Verkhovna Rada declared a moratorium in 1990 on the construction and operation of new nuclear power units.

As a result, the construction of new units at the Khmelnitsky, Zaporizhzhya and Rivne NPPs was suspended.

After the Verkhovna Rada eliminated the moratorium, the restoration and modernization of the incomplete units became necessary. Their construction and commissioning were primarily needed to replace power units whose lifetime expired or those that did not meet new safety requirements.

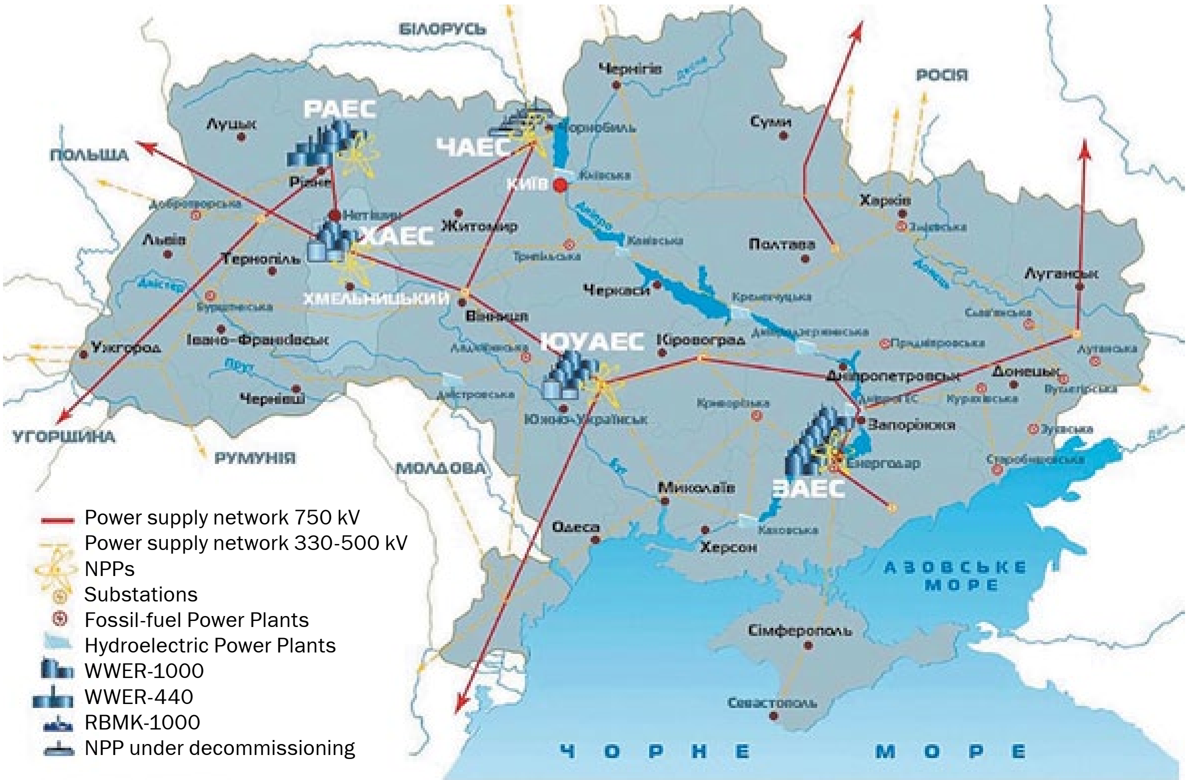
In December 1991, nuclear energy enterprises were combined into the Ukratomenergoprom Concern, which was reorganized into the State Nuclear Energy Committee of Ukraine – Goskomatom.

In October 1995, commercial start-up of the Zaporizhzhya NPP took place. The Zaporizhzhya NPP with installed capacity of 6 mln. kW became the largest in Europe.

On 17 October 1996, Cabinet Resolution No. 1268 established the State Enterprise National Nuclear Energy Generating Company Energoatom.

MAIN CHARACTERISTICS OF EXISTING UKRAINIAN NPPS

	Unit No.	Reactor type	Installed capacity (MW)	Beginning of construction	Date of commercial start-up
ZNPP	1	WWER 1000/320	1000	April 1980	10 December 1984
	2	WWER-1000/320	1000	April 1981	22 July 1985
	3	WWER-1000/320	1000	April 1982	10 December 1986
	4	WWER-1000/320	1000	January 1984	18 December 1987
	5	WWER-1000/320	1000	July 1985	14 August 1989
	6	WWER-1000/320	1000	June 1986	19 October 1995
RNPP	1	WWER-440/213	420	August 1976	22 December 1980
	2	WWER-440/213	415	October 1977	22 December 1981
	3	WWER-1000/320	1000	February 1981	21 December 1986
	4	WWER-1000/320	1000	1984	16 October 2004
SUNPP	1	WWER-1000/302	1000	March 1977	31 December 1982
	2	WWER-1000/338	1000	October 1979	6 January 1985
	3	WWER-1000/320	1000	February 1985	20 September 1989
KhNPP	1	WWER-1000/320	1000	November 1981	22 December 1987
	2	WWER-1000/320	1000	1983	8 August 2004



The NPP share of electricity production remains high in Ukraine: 43.8 % in 1996, 45.3% in 2000, 53.2% in 2004, 52.3% in 2005, 46.9% in 2006, 47.5% in 2007 and 46.8% in 2008.

After the Chornobyl NPP was closed, four nuclear power plants remained in operation in Ukraine with 15 units; 13 units are of WWER-1000 type and 2 units are WWER-440. The total installed capacity of the Ukrainian operating units is 13835 MW.

Ukraine ranks eighth in the world and fifth in Europe for the NPP installed capacity.

In 2009, the nuclear power plants of Ukraine produced 83155.3 mln. kW.

Pursuant to the Law of Ukraine On Authorizing Activity in Nuclear Energy Use, since 2002 the regulatory authority has issued licenses to the NAEK Energoatom to operate nuclear installations at the South Ukraine, Zaporizhzhya, Rivne and Khmelnitsky NPPs based on comprehensive safety assessment of nuclear installations and assessment of the operator's capability to take all measures to ensure safety.

The licenses establish terms and restrictions on operations, technological systems and site boundaries to which they apply. The licenses authorize the NAEK Energoatom to conduct all operations at nuclear installations on its own or with involvement of subcontractors. According to the Law of Ukraine On Nuclear Energy Use and Radiation Safety, the entire responsibility for the operational safety of nuclear installations rests with the operating organization, which fulfills financial obligations for nuclear damage at the rate and on terms established by Ukrainian legislation. The licenses also identify activities or operations that may be undertaken only under individual SNRCU permits.

Permits to start up power units after scheduled repair outage involving core reloading are issued to the NAEK Energoatom only provided that measures identified in the previous permit and terms of valid licenses, in particular, after implementation of safety improvement measures, have been implemented completely.

SAFETY ENHANCEMENT OF OPERATING NPPS

In order to bring target safety indicators into accordance with internationally recognized nuclear safety standards, rules and regulations, the NAEK Energoatom implements measures under:

- *Concept for Safety Improvement of Operating NPPs approved by Cabinet Resolution No. 515-r of 13 December 2005 (henceforth, the Concept);*
- *Khmelnitsky-2/Rivne-4 Safety Upgrading Program in compliance with the Law of Ukraine On the Ratification of the Guarantee Agreement between Ukraine and the European Atomic Energy Community (No. 2818-IV of 7 September 2005) (henceforth, the Upgrading Program).*

According to Joint Order No. 19/10 of the SNRCU and Ministry for Fuel and Energy of Ukraine of 25 January 2006 On Arranging Safety Improvement Activities for Operating NPP Units (with amendments made by Joint Order No. 87/27 of 12 February 2009), all measures under the Concept are to be completed by the end of 2010. All pilot projects in nine safety enhancement areas are to be completed by the end of 2009.

The measures under the Upgrading Program are to be implemented within three fuel campaigns in compliance with schedules agreed with the SNRCU.

The SNRCU monitors the implementation of safety enhancement measures through:

- *review and assessment of NAEK Energoatom reports on measures;*
- *inspections on NPP sites including direct monitoring of measures under the above programs;*
- *meetings conducted before every unit is taken out of scheduled repair and decisions to permit transfer to hot zero power;*
- *SNRCU Board meetings to review the status of state and branch safety enhancement programs carried out by the licensee at operating NPPs.*

The status of safety enhancement measures for 2009 was considered by the SNRCU Board at the beginning of 2010.

As noted above, all 250 pilot measures under the Concept and 243 adaptation measures were to be completed by the end of 2009.

As of 2009, the NAEK Energoatom submitted 229 reports on pilot measures under the Concept and 273 reports on adaptation measures to the SNRCU.

Therefore, 21 pilot measures were not completed in 2009 (16 measures at South Ukraine-1, 4 measures at Zaporizhzhya-5, 1 measure at Zaporizhzhya-3).

All pilot measures under the Concept were completed only at Rivne-1 (WWER-440/213 design).

Regarding the Upgrading Program, based on the decision made at the meeting of 10 October 2007 between representatives of the NAEK Energoatom, European Commission, EBRD, Euratom and SNRCU and based on RISKAUDIT conclusions, the SNRCU agreed on carrying over 17 measures for Khmelnitsky-2 and 6 measures for Rivne-4 to the fourth fuel campaign.

In late 2009, the SNRCU agreed 72 and 73 reports on post-commissioning measures and 80 and 81 reports on planned measures for the Khmelnitsky and Rivne NPPs, respectively.

In early 2010, the SNRCU involved RISKAUDIT experts into inspection of Rivne-4 to check completeness of all measures under the Upgrading Program.

Since the SNRCU conducted similar inspections with involvement of RISKAUDIT experts in 2006 and 2007, the last inspection was intended to check measures implemented in the third scheduled repair (30 measures) and those to be implemented in the fourth scheduled repair (8 measures).

The SNRCU inspection commission made the following conclusions:

- *30 measures of the Upgrading Program were completed (in accordance with the scope determined in cards for each measure);*
- *8 measures planned for the fourth scheduled repair were physically implemented. The Rivne NPP yet had to conduct tests and prepare and submit documents to the SNRCU to confirm their final implementation.*

In the above regard, the SNRCU Board stated that safety enhancement measures under the Rivne-4 Upgrading Program were physically implemented, i.e., the program has been completed at this power unit.

To implement completely the Upgrading Program at Khmelnitsky-2, the delivered equipment is to be assembled and tested in the next shutdown.

Since the Concept for Safety Improvement of Operating NPPs and Khmelnitsky-2/Rivne-4 Upgrading Program expire in 2010, the NAEK Energoatom developed the Integral Safety Improvement Program for Ukrainian NPPs to further enhance the safety of power units, bring them into compliance with safety standards and rules and fulfill obligations to international organizations (EBRD, Euratom) to implement measures under the upgrade package. This program incorporates measures under the Concept, Upgrading Program and experience feedback on NPP operational events.

The program also takes account of IAEA design safety missions within the Memorandum of Understanding in the Field of Energy between the European Union and Ukraine in the area of nuclear safety.

Assessment of the Integral Program carried out by the SNRCU with involvement of RISKAUDIT experts will be completed in 2010.

NPP DESIGN LIFETIME EXTENSION

Rivne-1, Rivne-2 and South Ukraine-1 are pilot units for lifetime extension. Their design lifetime expires in 2010, 2011 and 2012, respectively.

The lifetime extension efforts on these units are made in compliance with the Comprehensive Program for Lifetime Extension of Operating Nuclear Power Units approved by Cabinet Resolution No. 263-r of 29 April 2004 and detailed schedules.

In late 2008, Rivne-1 and Rivne-2 were shut down for long-term repair to carry out activities under the schedules. Scheduled outages 2008-2009 confirmed the possibility to complete the preparation for lifetime extension of the units.

The operating organization developed and submitted the periodic safety reassessment report for Rivne-1 to the SNRCU regarding all safety factors according to NP 306.2.099-2004 General Requirements for NPP Design Lifetime Extension Based on Periodic Safety Reassessment.

All safety enhancement measures under the Concept for Safety Improvement of Operating NPPs have been completed.

Recovery annealing of the reactor pressure vessel remains to be carried out and technical state of some equipment is to be assessed at Rivne-1 to the end of 2010.

Equipment qualification for harsh environmental conditions and seismic impacts and assessment of the technical state of the reactor pressure vessel, closure assembly, internals and structures to justify the possibility of their design lifetime extension are also to be completed at Rivne-2.

Assessment of the technical state and lifetime reassignment for crucial components, such as reactor pressure vessel, closure assembly, internals, etc., started in the scheduled outage at South Ukraine-1 in 2009.

Preparation of Zaporizhzhya-1 for operation beyond the design lifetime, which is the pilot WWER-1000/320 unit for lifetime extension, is in its initial stage.

RADIATION SAFETY AT OPERATING NPPS

NPP impact on personnel, the public and the environment is assessed based on analysis of doses for individuals, radioactive releases into the atmosphere and radioactive effluents into water bodies according to the following parameters:

- *doses of personnel obtained during a calendar year (individual and collective doses of personnel are the main quantitative and qualitative indicators of radiation safety and radiation protection);*
- *daily releases of inert radioactive gases – IRG (xenon, krypton, argon);*
- *daily releases of long-lived radionuclides (LLR);*
- *daily releases of radioactive iodine radionuclides (radioiodines);*
- *In addition to the above parameters, the following is monitored at all NPPs:*
- *monthly releases of manganese-54, cobalt-60, zirconium-95, iron-59 (activation and corrosion products of process equipment metal), cesium isotopes-134, 137 (nuclear fuel decay products);*
- *quarterly releases of strontium-89, 90;*
- *effluents of radionuclides in open water bodies (effluents are monitored by 15 radionuclides).*

One of the criteria for NPP safe operation is non-exceeding of reference levels for radioactive releases and effluents appropriately established and endorsed by the regulatory bodies. This criterion reflects the achieved level of radiation safety at NPPs.

During 2009, individual and collective dose limits for personnel were not exceeded at the Zaporizhzhya NPP.

Radioactive releases into the atmosphere are monitored with automated radiation monitoring systems installed at all sources of releases and with laboratory analysis of samples.

During 2009, permissible and reference levels were not exceeded at the Zaporizhzhya NPP. The actual daily releases of the main radionuclides are (average daily values):

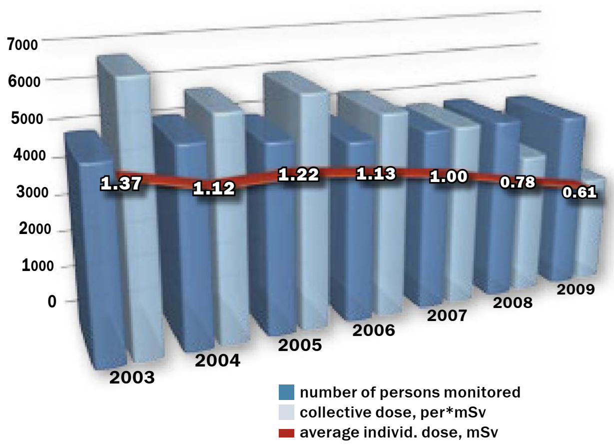
- *0.07% (iodine radionuclides), 7.42% (LLR), 9.03% (IRG) of reference levels and*

- *0.0024% (iodine radionuclides), 0.15% (LLR), 0.11% (IRG) of permissible levels.*

Distribution of external doses for Zaporizhzhya NPP personnel in 2009

Number of persons monitored	Number of persons who received dose in 2009								
	<1 mSv	1-2 mSv	2-6 mSv	6-10 mSv	10-15 mSv	15-20 mSv	20-30 mSv	30-50 mSv	>50 mSv
4717	3980	275	363	76	22	1	0	0	0
	Dose for 2009								
	Collective dose, man·mSv					Average individual dose, mSv			
	2886.35					0.61			

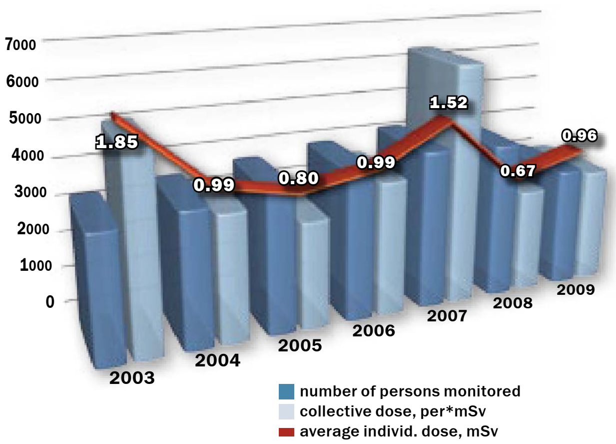
Exposure dynamics for Zaporizhzhya personnel



Distribution of external doses for Rivne NPP personnel in 2009

Number of persons monitored	Number of persons who received dose in 2009								
	<1 mSv	1-2 mSv	2-6 mSv	6-10 mSv	10-15 mSv	15-20 mSv	20-30 mSv	30-50 mSv	>50 mSv
3216	2514	235	335	82	50	0	0	0	0
	Dose for 2009								
	Collective dose, man·mSv					Average individual dose, mSv			
	3090.52					0.96			

Exposure dynamics of Rivne NPP personnel



The impact of radioactive releases from the Zaporizhzhya NPP is limited by the cooling pond. To monitor releases, samples are taken and analyzed using spectrometers.

During 2009, permissible and reference levels of releases into open water bodies at the Zaporizhzhya NPP were not exceeded. The actual releases for the main radionuclides are 7.3% (Cs-137), 5.4% (Cs-134), 8.8% (Mn-54), 9.2% (Co-60), 11.6% (tritium H-3) of reference levels.

During 2009, individual and collective dose limits for personnel were not exceeded at the Rivne NPP.

During 2009, permissible and reference levels were not exceeded at the Rivne NPP. The actual releases of the main radionuclides are (average daily values):

- *0.22% (iodine radionuclides), 1.87% (LLR), 4.47% (IRG) of reference levels and*
- *0.007% (iodine radionuclides), 0.11% (LLR), 0.17% (IRG) of permissible levels.*

The impact of radioactive releases from the Rivne NPP is limited by service water releases to the Styr River, which is a tributary of the Pripyat River.

Continuous on-line monitoring and periodic laboratory analysis of water discharges are carried out.

During 2009, permissible and reference levels of releases into open water bodies at the Rivne NPP were not exceeded. The actual releases for the main radionuclides are: 5.13% (Cs-137), 6.94% (Cs-134), 58.89% (Mn-54), 53.16% (Co-60) of reference levels.

During 2009, individual and collective dose limits were not exceeded at the South Ukraine NPP.

During 2009, permissible and reference levels were not exceeded at the South Ukraine NPP. The actual releases of the main radionuclides are (average daily values):

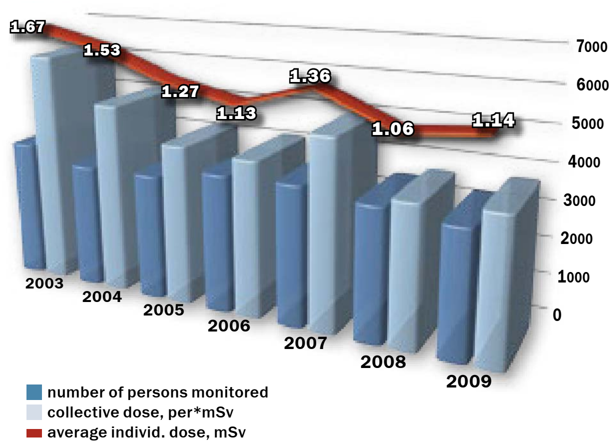
- *0.40% (LLR), 0.47% (iodine radionuclides), 2.35% (IRG) of reference levels and*
- *0.022% (iodine radionuclides), 0.025% (LLR), 0.192% (IRG) of permissible levels.*

Water from the South Ukraine is discharged into the Pivdenny Bug River and cooling pond (Tashlyk wa-

Distribution of exposure doses for South Ukraine personnel in 2009

Number of persons monitored	Number of persons who received dose in 2009								
	<1 mSv	1-2 mSv	2-6 mSv	6-10 mSv	10-15 mSv	15-20 mSv	20-30 mSv	30-50 mSv	>50 mSv
2873	2116	298	308	123	28	0	0	0	0
	Dose for 2009								
	Collective dose, man·mSv					Average individual dose, mSv			
	3276.18					1.14			

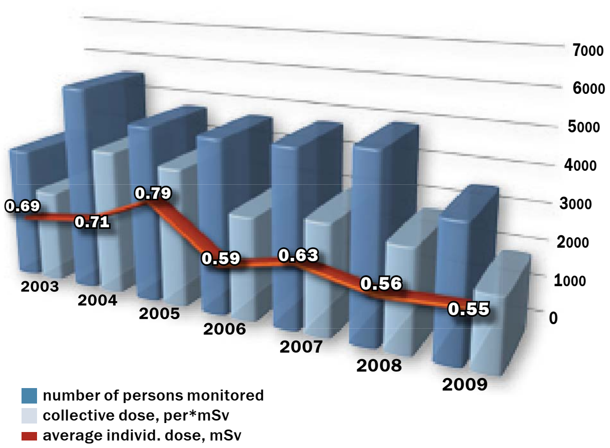
Exposure dynamics of South Ukraine NPP personnel



Distribution of external exposure for Khmelnitsky NPP personnel in 2009

Number of persons monitored	Number of persons who received dose in 2009								
	<1 mSv	1-2 mSv	2-6 mSv	6-10 mSv	10-15 mSv	15-20 mSv	20-30 mSv	30-50 mSv	>50 mSv
2047	1755	169	109	13	1	0	0	0	0
	Dose for 2009								
	Collective dose, man·mSv					Average individual dose, mSv			
	1129.77					0.55			

Exposure dynamics of Khmelnitsky NPP personnel



ter storage basin). To monitor water activity, samples are taken and analyzed in laboratory using radiometric, spectrometric and radiochemical methods.

During 2009, permissible and reference levels of releases into open water bodies at the South Ukraine NPP were not exceeded. The actual releases for the main radionuclides are:

- *7.69% (Cs-137), 2.01% (Cs-134), 0.6% (Mn-54), 30.66% (Co-60), 9.52% (H-3, tritium) of reference levels (average quarter data);*
- *0.12% (Cs-137), 0.03% (Cs-134), 0.002% (Mn-54), 0.1% (Co-60), 0.57% (H-3, tritium) of permissible levels (annual data).*

During 2009, individual and collective dose limits were not exceeded at the Khmelnitsky NPP.

During 2009, the actual radioactive releases to the atmosphere were (average daily data):

- *0.66% (iodine radionuclides), 0.33% (LLR), 3.58% (IRG) of reference levels and*
- *0.0074% (LLR), 0.02% (iodine radionuclides), 0.062% (IRG) of permissible levels.*

Water is discharged from the Khmelnitsky NPP into the cooling pond. To monitor activity, samples are taken and analyzed in laboratory with radiometric, spectrometric and radiochemical methods.

During 2009, permissible and reference levels of releases into open water bodies at the Khmelnitsky NPP were not exceeded. The actual releases for the main radionuclides are:

- *8.09% (Cs-137), 9.38% (Cs-134), 52.38% (Mn-54), 64.95% (Co-60), 54.12% (H-3, tritium) of reference levels (annual data) and*
- *3.96% (Cs-137), 0.89% (Cs-134), 0.004% (Mn-54), 0.06% (Co-60), 2.63% (H-3, tritium) of permissible levels (annual data).*

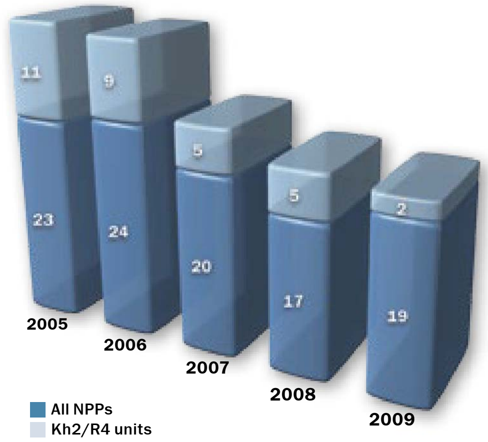
NPP OPERATIONAL EVENTS

Strict account of all NPP operational events, thorough investigation of their causes and measures to eliminate the drawbacks and prevent similar events in future are ef-

INES rating of events at operating NPPs for 2009

NPP	INES RATING OF EVENTS					
	Out of scale (-)	Deviation (0)	Anomaly (1)	Incident (2)	Severe incident (3)	Accidents (4-7)
Zaporizhzhya	2	5	–	–	–	–
Rivne	–	2	1	–	–	–
South Ukraine	5	–	–	–	–	–
Khmelnitsky	–	6	–	–	–	–
TOTAL	7	13	1	–	–	–

Distribution of operational events at Ukrainian NPPs for 2005-2009



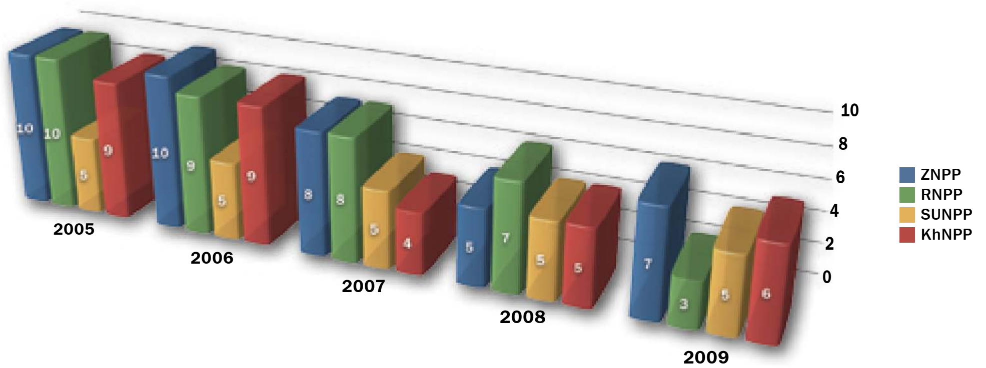
ficient instruments to monitor safety and keep it in compliance with international nuclear safety requirements.

In 2009, 21 events occurred at Ukrainian NPPs, including 7 at the Zaporizhzhya NPP, 3 at the Rivne NPP, 6 at the Khmelnitsky NPP and 5 at the South Ukraine NPP.

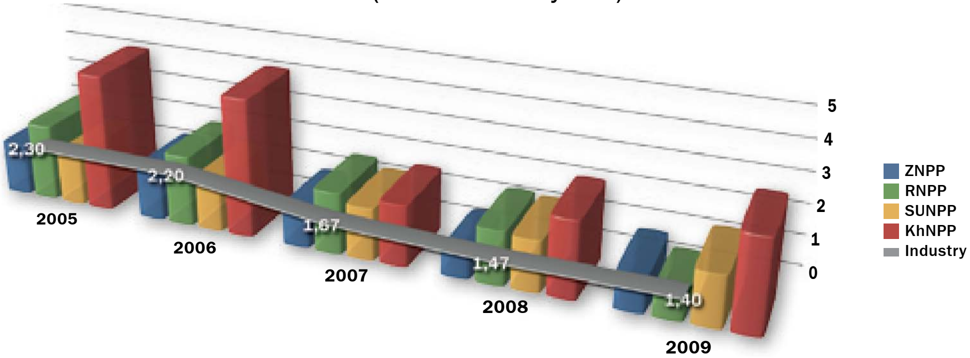
The International Nuclear Event Scale (INES) is widely used in world nuclear energy to inform the public of nuclear events. All events that occurred at Ukrainian NPPs in 2009 were ranked as ‘deviation’ or ‘out of scale’ (events that have no nuclear and radiation safety relevance and, thus, are out of scale), excepting the event that occurred on 22 September 2009 at Rivne-3.

The figures show the distribution of the average number of events per unit for 2005-2009. It should

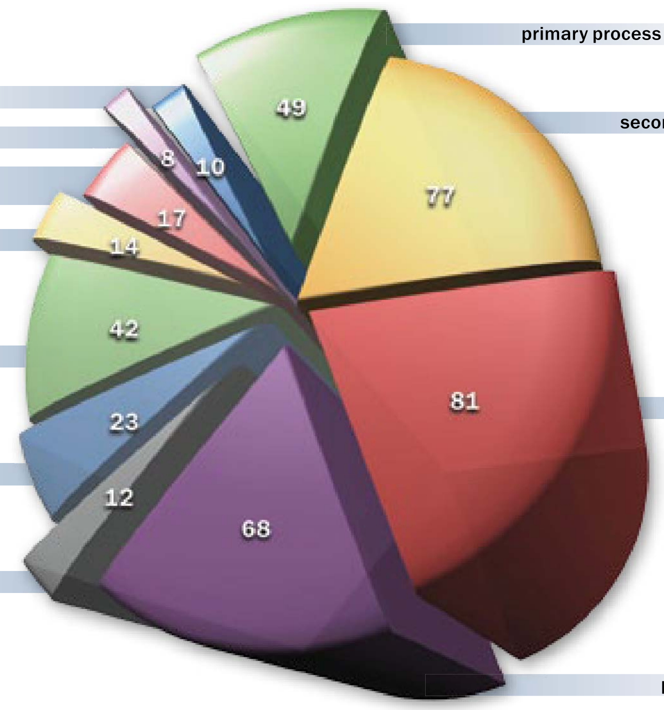
Distribution of operational events at Ukrainian NPPs in 2005-2009



Average number of operational events per unit for 2005-2009 (without Chornobyl NPP)



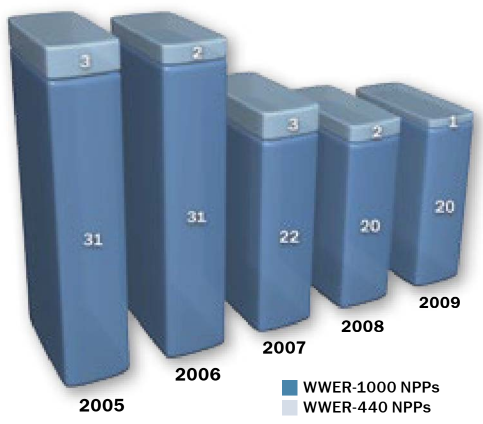
Distribution of NPP operational events by failed systems



be noted that the number of events at Khmelnitsky NPP per unit remained the highest as compared with other Ukrainian NPPs. This indicator for the Khmelnitsky NPP was two to three times higher than that for the industry. In this regard, the SNRCU Board conducted a meeting to discuss operational safety of Khmelnitsky NPP.

The situation at the Khmelnitsky NPP improved after appropriate measures were taken (unscheduled inspection was performed to check the Khmelnitsky NPP quality control system in the area 'management of incompliance and corrective actions', comprehensive inspection and repair and maintenance of Khmelnitsky safety-related systems were conducted, NAEK Energoatom analyzed the effectiveness of the operational experience feedback system, quality of investigations into operational events at Ukrainian NPPs

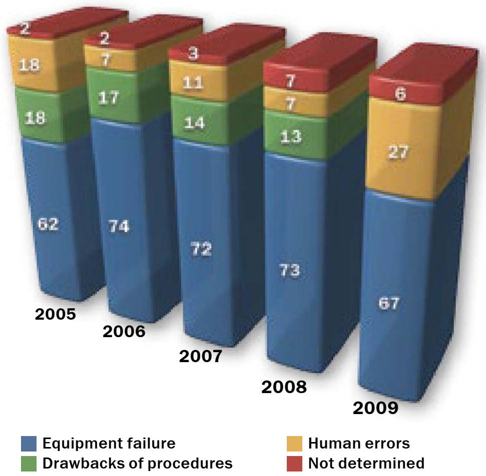
Distribution of operational events for 2005-2009 by reactor type



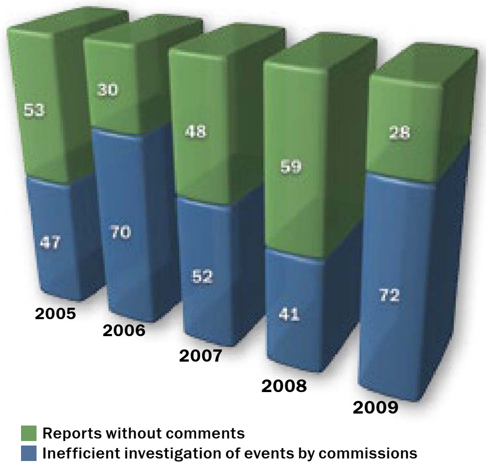
Distribution of operational events for 2005-2009 by categories

	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10
2005	0	2	0	1	15	0	6	6	0	4
2006	0	0	0	0	20	2	8	4	0	4
2007	0	0	0	0	17	0	1	4	0	3
2008	0	0	0	0	9	0	2	6	0	5
2009	0	1	0	0	4	0	7	3	1	4

Distribution of root causes of events



Effectiveness analysis of on-site commissions on event investigation



and performance of the quality system in the areas 'assessment' and 'management of incompliance and corrective actions').

The highest number of events occurred at:

power supply systems:

- *generator and generator voltage network;*
- *off-site power supply system;*
- *in-house power supply system;*

Power supply systems mainly fail because of design and engineering drawbacks.

secondary process systems:

- *turbine with auxiliary systems;*
- *feedwater system;*
- *steam line system;*

The percentage of failures at secondary process systems remains high mainly because of drawbacks in operational and repair documentation and programs to monitor the detection and elimination of malfunctions.

protective safety systems:

- *reactor control and protection rods;*
- *absorber emergency injection system.*

Failures at protective systems are caused by drawbacks in equipment manufacturing, ageing and breakdowns, drawbacks in procedures and NPP administration's neglect to take measures to prevent similar events.

Analysis of root causes of operational events shows that most of them are related to failures of equipment (steam generators, valves, electric circuit components, relay breakers, control rod drives, etc.)

The figure shows a comparative effectiveness analysis of on-site commissions on investigation of events.

The effectiveness analysis of on-site commissions for investigation of events shows that incorrect determination of the cause and/or inadequate corrective actions are the main drawbacks.

To correct the situation upon request of the regulatory body, the operating organization takes measures to improve the quality of event investigation, adhere to the unified technical policy and improve the operational experience feedback system.

Spent Nuclear Fuel Management

SPENT NUCLEAR FUEL MANAGEMENT AT OPERATING NPPS

After its operation in the reactor core, spent nuclear fuel is unloaded to the reactor cooling pools to be stored for 4 to 5 years to decrease residual energy release.

Residual energy release is a process induced by radioactive decay of fission products.

After cooling in the reactor pools, spent fuel is loaded into special containers that ensure its safety in transportation and is sent to a spent fuel storage facility.

The current state of science and technology does not permit the final conclusions on further spent fuel management. Hence, there are several approaches to spent fuel management in the world:

1. **Processing.** There are two types of processing – local or in other countries:
   - ***local processing*** *provides for spent fuel processing to obtain components and substances whose use is economically sound (Great Britain, India, Russia, France, Japan);*
   - ***processing in other countries*** *provides for processing of spent fuel and return of high-level waste to the owner country (Bulgaria, the Netherlands, Switzerland);*

2. **Disposal** is intended for spent fuel cooling and burial in deep geological formations (USA, Finland, Sweden).

3. **Deferred decision** is intended for long-term spent fuel storage that permits a decision on subsequent spent fuel management taking into account future technologies and economic factors. The deferred decision is used by Argentina, Denmark, Spain, Canada, Lithuania, Germany, Norway, South Korea, Poland, Slovakia, Hungary, Czech Republic, and Croatia.

Zaporizhzhya DSFSF site.
First containers

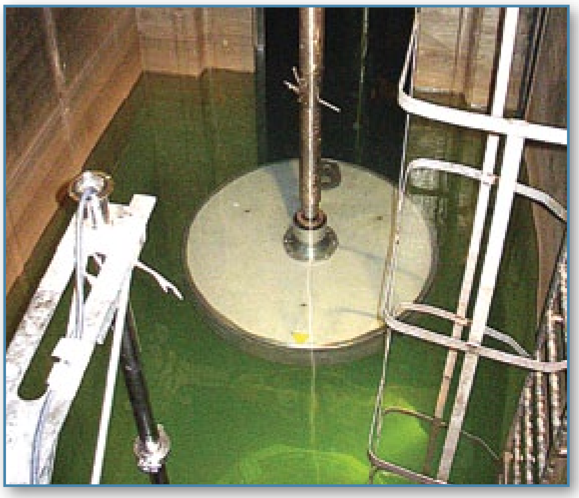
According to design decisions for WWER-1000 NPPs (there are 13 operating units of WWER-1000 type in Ukraine), spent fuel was to be transported to a stationary storage facility to Russia.

However, it became evident, even in the former USSR, that the storage facility had limited capacities, could not be expanded, a spent fuel processing facility could not be constructed in the immediate future and that would significantly affect NPP performance.

Estimates showed that the Zaporizhzhya NPP would be under the most pressing conditions requiring shutdown of the units.

In this connection, the USSR Ministry of Energy issued Order No. 361 of 6 October 1988 to approve the design for the second stage of the Zaporizhzhya NPP, including a spent fuel storage facility.

After the USSR broke up, spent fuel ceased to be transported to Russia in 1993-1995. The Zaporizhzhya NPP analyzed the dynamics of filling the cooling ponds



Loading area

and started a search for alternatives for spent fuel storage in 1993.

In view of the economic part, possibility to purchase components from Ukrainian producers, minimize modernization efforts at power units and use available handling equipment, the project proposed by the US Duke Engineering & Services Inc. (DES), which had obtained a license of the US NRC at that time, was chosen.

In 1996, the Zaporizhzhya NPP started implementing the spent fuel dry storage project.

The project is based on dry ventilated storage casks (VSC) for vertical storage of spent fuel assemblies (SFA). Dry storage is efficient since SFAs are stored in the cooling pool for no less than 5 years where their residual energy release and radioactivity greatly decrease. This fuel can safely be stored on-site in dry VSCs that effectively remove heat from SFAs and ensure adequate shielding from radiation for personnel, the public and the environment.

Prior to commissioning of the dry spent fuel storage facility (DSFSF), the working design, DSFSF Safety Analysis Report and DSFSF Environmental Impact Assessment were developed and reviewed, ecological reviews were carried out and pre-commissioning tests were performed at Zaporizhzhya-1–6.

Following an analysis of pre-commissioning tests and documentation submitted by the Zaporizhzhya NPP, the NAEK Energoatom was granted a license for trial commercial operation of the nuclear installation on 16 July 2001.

On 24 August 2001, the first WWER VSC was placed on the DSFSF site. Since then the trial commercial operation of the DSFSF has stated. On 10 September 2004, the Zaporizhzhya NPP obtained a license for operation of the Zaporizhzhya NPP nuclear installation including the DSFSF.

Storage area

It should individually be noted that the Zaporizhzhya NPP developed more than 270 documents within the licensing procedure. More than 50 reviews and assessments were conducted.

The first stage of the DSFSF, which is intended for 100 WWER-1000 VSCs, has been completed. As of late 2009, 78 WWER VSCs containing 1866 SFAs were placed for storage. Commissioning of the DSFSF second stage, which is intended for 280 WWER VSCs, is in its completion stage. Construction and installation are carried out in compliance with the technical decision 'On DSFSF Completion'.

The spent fuel dry storage system used at the Zaporizhzhya NPP is conditionally divided into three areas:

- *loading area;*
- *transportation area;*
- *storage area.*

The loading area is intended for the safe loading of SFAs into a basket, handling operations in sealing, drainage, vacuum drying and filling of a multi-place sealed basket with helium and loading of the basket into a ventilated concrete cask. The loading area is located directly in reactor compartments.

Available handling equipment is used for DSFSF components.

The transportation area is a network of paths for WWER VCS transportation to the storage area with a storage cask transporter.

The storage area is intended for safe storage of WWER VSCs for no less than 50 years. The storage area includes the storage site formed with a reinforced concrete plate for WWER VSCs. The storage area has its own physical protection fence.

To ensure safe operation of the dry spent fuel storage system, the ventilated storage casks, equipment used and buildings and structures of the storage system are continuously monitored.

Regular radiation monitoring is conducted in compliance with regulatory and production documentation at all handling and transportation stages, beginning from spent fuel transfer for storage at the DSFSF and to storage on the DSFSF site.

The WWER VSCs are placed for storage on the DSFSF site under individual SNRCU permits. Each cask is placed so as to minimize the dose rate at the site boundaries and to minimize radiation on construction personnel during installation and construction. After the shielding structure outside the site perimeter to ensure radiation protection of personnel, the public and the environment had been completed in December 2005, it was no longer needed to calculate the location of WWER VSCs on the DSFSF site.

Transportation area

The dry spent fuel storage system is designed for 380 ventilated storage casks that can hold more than 9000 SFAs.

The storage site can house spent fuel for the entire operational period of the Zaporizhzhya NPP. The license permits storage of spent fuel only from the Zaporizhzhya NPP.

The main components of the dry spent fuel storage system are:

- *multi-assembly sealed basket (MSB);*
- *transfer cask (TC);*
- *ventilated concrete cask (VCC);*
- *ventilated storage cask (WWER-VSC), including SFA in MSB placed into VCC.*

For information:

The gamma dose rate at reference points at a distance of 50 meters from the site external fence is 0.11-0.12 µSv/h (11-12 µR/h), which corresponds to background radiation.

Radiation monitoring of samples of well water, atmospheric precipitations and atmospheric air for the entire operational period shows that the content of radionuclides in the DSFSF area corresponds to the background and global contamination level.

The radiation state around the casks is generally stable. Since spent fuel loaded into the casks has different characteristics, the total dose rate and neutron radiation from the center of inlet ventilation ducts varies from 13.4 to 155.9 µSv/g in casks. The neutron dose rate from the VSC lateral surface is detected at no more than one meter. The absence *of radioactive contamination, inert gases and aerosols confirms that the casks are hermetically sealed.*

Radiation monitoring on the DSFSF site established that maximally permissible values were not exceeded.

Dose analysis, which was carried out after WWER VSCs were loaded and stored on site, showed that administrative process levels of external (15 mSv/y) and internal (3700 Bq/y) exposure were not exceeded.

Visual examination and inspection of the WWER VSC outer surface showed that there were no inadmissible defects in concrete for the entire DSFSF operation.

Plugging of inlet and outlet WWER VSC ventilation channels was not observed during the entire DSFSF operational period.

Indirect parameters, such as the difference between the air temperature at the WWER VSC ventilation outlets and ambient temperature, are used to monitor the state of fuel stored at the DSFSF.

Temperature monitoring over the entire DSFSF operational period has shown that the maximum difference between the air temperature at the ventilation outlets and ambient temperature was 59°C for WWER VSC No. 73, which is lower than normal operation limit 61°C justified in SAR.

Spent fuel of the Rivne, Khmelnitsky and South Ukraine NPPs is shipped to Russia. WWER-1000 spent fuel is sent for storage and WWER-440 spent fuel (Rivne-1, 2) for processing.

To implement the Plan of Measures for 2006-2010 under the Energy Strategy of Ukraine up to 2030 (approved by Cabinet Resolution No. 427 of 27 July 2006), the NAEK Energoatom concluded a contract with the Holtec International (USA), after a tender, to construct a centralized dry spent fuel storage facility (CSFSF) for the Rivne, Khmelnitsky and South Ukraine NPPs based on the dry storage technology proven at the Zaporizhzhya NPP.

Based on state comprehensive review, Cabinet Resolution No. 131-r of 4 February 2009 agreed the feasibility study for investments into the construction of CSFSF for WWER fuel of national NPPs. Item 2 of this Cabinet Resolution obliged the Ministry for Fuel and Energy of Ukraine and NAEK Energoatom to incorporate SNRCU recommendations based on the state nuclear and radiation safety review in the development of CSFSF construction project.

The draft Law On Siting, Design and Construction of Centralized Storage Facility for WWER Spent Fuel of National Nuclear Power Plants has been developed, approved and submitted to the Verkhovna Rada of Ukraine.

The main equipment for the storage facility (casks) is being designed and safety cases are being developed. After completion of the technical design of equipment, working design will be started and prototype casks will be manufactured.

SPENT FUEL MANAGEMENT AT THE CHORNOBYL NPP

Spent fuel at the Chornobyl NPP is managed under SNRCU Licenses EO No. 000040 'Chornobyl NPP Decommissioning' (issued on 22 March 2002) and EO No. 000859 'Operation of Chornobyl NPP ISF-1 Nuclear Installation' (issued on 25 June 2008).

As of late 2009, the cooling pools of units 1 to 3 stored 3735 spent fuel assemblies. The unit 1 cooling pools held 1365 SFAs, unit 2 cooling pools 1219 SFAs and unit 3 cooling pools 1151 SFAs.

Spent fuel has to be removed from units 1 to 3 to implement measures under the State Program for Chornobyl NPP Decommissioning and Shelter transformation into an Ecologically Safe System.

However, it seems to be impossible to remove spent fuel from the Chornobyl NPP units before ISF-2 project is implemented. In this connection and in view of radioactive waste stored at the reactor pools, the Chornobyl NPP have made efforts in the recent years to extend the lifetime of systems and components of units 1 and 2 for spent fuel storage and radioactive waste management.

It should be noted that spent fuel removal is especially pressing for unit 3 since this is required for extensive construction and mounting efforts associated with the New Safe Confinement, including efforts at facilities included in unit 3 (dismantling of the existing ventilation stack and construction of a new one and simultaneous reconstruction of the ventilation and radiation monitoring systems). Moreover, removal of spent fuel from unit 3 will permit its decommissioning.

In March 2009, to ensure the implementation of measures under the State Program for Chornobyl NPP Decommissioning and Shelter transformation into an Ecologically Safe System, the Chornobyl NPP made a decision to remove spent fuel from the unit 3 cooling pools and agreed it with the SNRCU.

During the second half of 2009, the Chornobyl NPP transferred some part of spent fuel from the unit 3 cooling pools to vacant places in the cooling pools of units 1 and 2.

According to SNRCU Board Decision No. 27 of 24 December 2009 and Individual Permit OD No. 000040/02 of 19 January 2010, the Chornobyl NPP transfers spent fuel from the unit 3 cooling pools to the firth compartment of the ISF-1 cooling pool.

Chornobyl NPP wet spent fuel storage facility (Chornobyl NPP ISF-1)

ISF-1 is operated under SNRCU License EO No. 000859 'Operation of Chornobyl NPP ISF-1 Nuclear Installation' issued on 26 June 2008.

As of the end of December 2009, 17549 SFAs were stored in the ISF-1 cooling pools.

According to the above License, the Chornobyl NPP takes measures under the 'Plan of Measures for ISF-1 Safety Improvement' and 'Plan of Measures for Improvement of the Chornobyl NPP Quality Control System for 2008-2010'. In particular, the Chornobyl NPP has taken the following measures to improve ISF-1 safety:

- *strengthening of ISF-1 structures;*
- *implementation of a standby makeup water system for the ISF-1 cooling pool;*
- *strengthening of the bottom in the ISF-1 reception compartment for transport covers of the cooling pool.*

ISF-1

Completion Design for the Chornobyl Dry Spent Nuclear Fuel Storage Facility (ChNPP ISF-2)

License EO No. 000124 'Construction of Nuclear Facility' issued by the SNRCU on 13 May 2003 provides for construction of ISF-2 only after SNRCU approves the revised ISF-2 Construction Design according to the established procedure and agrees upon the ISF-2 Preliminary Safety Analysis Report.

In compliance with the schedule for 2009, the Chornobyl NPP developed the following documents and submitted them to the SNRCU for review:

- *Package of technical documentation on a prototype double-wall dry shielded canister (DSC);*
- *Package of technical documentation on the forced gas drying system;*
- *Preliminary safety analysis report 'Chernobyl NPP. Dry Spent Fuel Storage Facility (ISF-2). Construction Completion Project';*
- *Package of design documents 'Chornobyl NPP. Dry Spent Fuel Storage Facility (ISF-2). Construction Completion Project'.*

All the above documents are under state nuclear and radiation safety review at the SNRCU.

ISF-2

Radwaste Management

In 2009, the Strategy for Radwaste Management in Ukraine was approved by the Cabinet Resolution. The Strategy is developed for 50 years. The tasks and measures of the first stage of the Strategy till 2017 are identified in the National Target Ecological Program for Radwaste Management (hereinafter referred to as the National Program). To solve tasks and measures of the National Program, in 2009, the mechanism for accumulating costs for the State Fund of Radwaste Management pursuant to the so-called principle: 'who contaminates must pay' was established. In accordance with the adopted regulations, all enterprises and organizations at the territory of Ukraine whose activities result or may result in radwaste must pay fees to the Fund and receive guaranties that the State will ensure further safe management of generated radioactive waste, including its disposal.

The Strategy and the National Program provide for 2 methods of radwaste treatment and conditioning:

- *at sites of enterprises whose activity results in waste generation (for great volumes of radioactive waste, Ukrainian NPPs);*
- *at the facilities of regional engineered enterprises designed for non-nuclear radwaste management.*

Radwaste has to be disposed in centralized disposal facilities. To construct and operate these facilities, it is provided for that the national infrastructure for radwaste management be developed. To dispose long-lived and high-level radioactive waste, the Strategy provides for construction of disposal facilities in deep geological formations.

A complex of centralized disposal facilities intended for disposal and long-term storage of radwaste is under construction at the Vector site in the Exclusion Area.

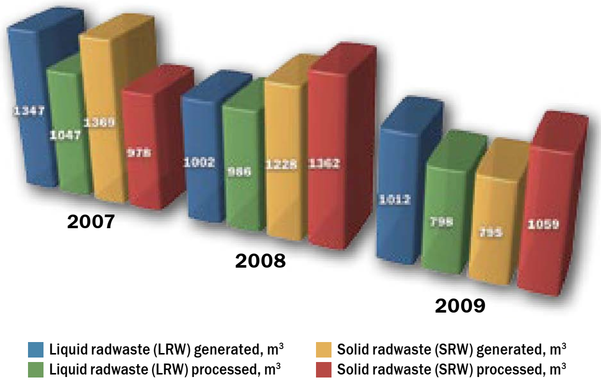
RADWASTE MANAGEMENT AT OPERATING NPPS

Solid and liquid radwaste results from operation of NPP units and scheduled repairs.

Liquid radwaste is treated at active water treatment systems, then treated water returns to the technological process, and final treatment products (secondary radwaste such as evaporation bottoms, slurry, spent sorbents and salt fusion cake) are transferred to liquid radwaste storage facilities for cooling and temporary storage. For this purpose, NPPs use storage facilities in the form of iron tanks, from 100 to 750 m^3, located in individual rooms of special buildings.

To collect and store temporarily solid radwaste resulting from operation of NPP units, special storage facilities located in special buildings are used.

Dynamics of radwaste generated and processed at ZNPP



ZAPORIZHZHYA NPP

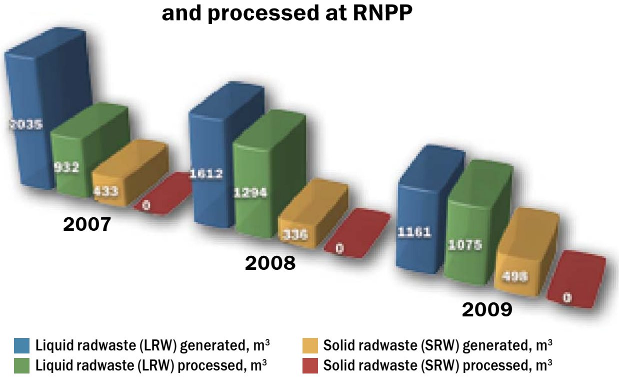
Volumes of liquid radwaste generated at ZNPP in 2009 by categories (in accordance with OSPU, item 15.1.7):

- salt fusion cake – 16.0%;
- evaporation bottoms – 82.0%;
- spent sorbents – 2.0%

Volumes of solid radwaste generated at ZNPP in 2009:

- I category – 97.0%;
- II category – 2.9%;
- III category – 0.1%

Dynamics of radwaste generated and processed at RNPP



Nowadays, ZNPP operates the following radwaste processing facilities:

- *2 deep evaporators (processing of evaporation bottoms);*
- *solid radwaste incinerator (processing of solid low-level radioactive waste);*
- *solid radwaste compactor unit (processing of solid low-level radioactive waste);*
- *solid radwaste sorting unit (processing of solid low-level radioactive waste).*

In the framework of the international assistance, it is planned that a radwaste processing complex will be commissioned at ZNPP. Now, the incinerator, the compactor unit and the defragmentation unit are under designing.

The Zaporizhzhya NPP solid radwaste storage facility has been 70% filled. To extend capacities of storage facilities, a hangar storage facility intended for storage of containers with salt fusion cake to be removed from storage facilities is being constructed to increase their capacities by 30%.

RIVNE NPP

Volumes of liquid radwaste generated at RNPP in 2009 by category (in accordance with item 15.1.7 of OSPU):

- salt fusion cake – 21.0%;
- evaporation bottoms – 77.0%;
- slurry – 0.2%;
- spent sorbents – 1.8%

Volumes of solid radwaste generated at RNPP in 2009:

- I category – 94.0%;
- II category – 5.0%;
- III category – 1.0%

Nowadays, ZNPP operates the following radwaste processing facilities:

- *centrifugation system (processing of floor drains);*
- *2 deep evaporators (processing of evaporation bottoms).*

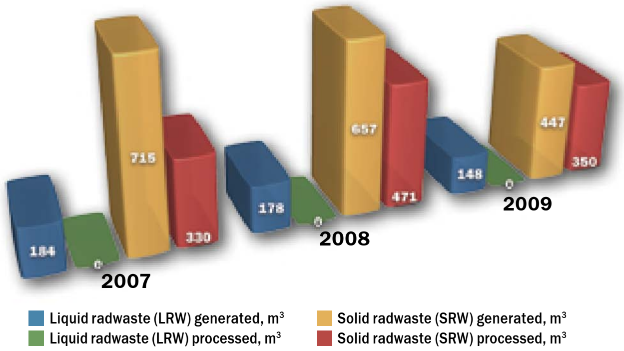
Activities on designing of the solid radwaste processing plant are underway, in particular:

- *retrieval facility;*
- *fragmentation and sorting facility;*
- *super-compactor;*
- *radiation monitoring system in radwaste management.*

SOUTH UKRAINE NPP

Volumes of liquid radwaste generated at SUNPP in 2009 by the category (in accordance with item 15.1.7 of OSPU):

Dynamics of radwaste generated and processed at SUNPP



- evaporation bottoms – 94.0%;
- spent sorbents – 6.0%

Volumes of solid radwaste generated at SUNPP in 2009:

- I category – 98.0%;
- II category – 1.9%;
- III category – 0.1%

The South Ukraine NPP operates only the low-level radwaste compactor.

KHMELNITSKY NPP

Volumes of liquid radwaste generated at KhNPP in 2009 by category (in accordance with item 15.1.7 of OSPU):

- salt fusion cake – 19.0%;
- evaporation bottoms – 81.0%;

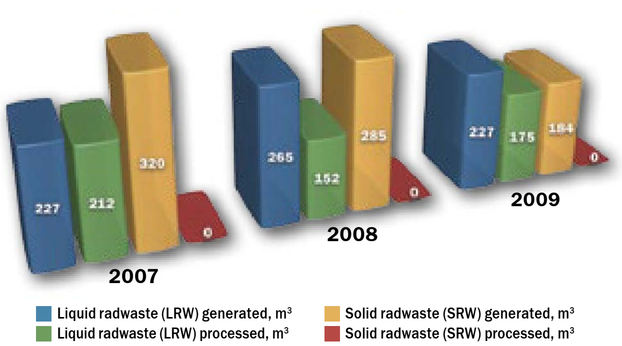
Volumes of solid radwaste generated at KhNPP in 2009:

- I category – 99.0%;
- II category – 0.9%;
- III category – 0.1%

The Khmelnitsky NPP operates:

- *deep evaporation facility (processing of evaporation bottoms);*
- *radioactive oil incinerator;*
- *centrifugation unit (processing of flood drains).*

Dynamics of radwaste generated and processed at KhNPP



In total, NPP storage facilities house about 13 000 m^3 of liquid radwaste and 37 000 m^3 of solid radwaste of all categories.

Resulting from the safety assessment of radwaste management at NPPs, the following conclusions can be made:

1. Radwaste is managed at NPPs in accordance with the current regulatory requirements on nuclear and radiation safety.
2. The operating NPPs have technical capacities to store temporarily solid and liquid radwaste (also for extension of power unit operation lifetime) and to monitor its storage.
3. The interaction with specialized enterprises dealing with disposal of radwaste should be expedited with regard to the development, approval and agreement of NPP radwaste acceptance criteria for storage/disposal.

RADWASTE RESULTING FROM USE OF RADIATION SOURCES

The state interregional specialized plants (hereinafter referred to as SISP) of the State Corporation Ukrainian State Radon Association UkrDO (henceforth is referred to as UkrDO Radon), in particular: Kyiv, Odessa, Kharkiv, Dnipropetrovsk, Lviv, and Donetsk SISPs deal with management of radwaste resulting from the use of radiation sources in the national economy.

Solid radwaste and spent radiation sources are transported to radwaste storage facilities located in radwaste disposal sites of specialized plants.

The shielded radiation sources are stored in solid radwaste storage facilities and unshielded radioactive sources are stored in specialized well-type storage facilities designed for such radiation sources.

The specialized plants do not accept liquid radwaste. The waste is preliminary solidified and then stored as solid radwaste. The liquid radwaste produced by the specialized plants is stored in the dedicated tanks.

All specialized plants operate stations for decontamination of overalls and individual protection means, contaminated radioactive materials (active laundries).

UkrDO Radon manages radwaste in accordance with the SNRCU licenses issued for processing and storage of radioactive, for transport of radioactive materials.

Redesigning of specialized plants into temporarily radwaste storage sites is underway. There are the following priority measures to implement radwaste storage technologies: to avoid ingress of atmospheric precipitations, hangar-type coverings were constructed over the non-preserved storage facilities, SISP are provided with containers for temporary storage of radioactive waste, standard technological procedures for temporarily storage of radwaste and spent radiation sources were developed. Subsequent measures to re-equip and redesign specialized plants are established in the National Target Ecological Program for Radwaste Management (Task 5).

In 2009, the specialized enterprises accepted for storage

Radon SISP	Solid radwaste (including shielded radioactive sources)			Radiation sources (unshielded)			Total activity to the date of acceptance, Bq
	Mass (*), T	Quantity of radiation sources, pcs.	Mass biological/shielding, kg	Activity, Bq	Number, pcs.	Activity, Bq	
Dnepropetrovsk	15.360	2303	8726.5	1.03 E+13	0	0	1.03 E+13
Kyiv	18.072	2812	4053	6.82 E+12	0	0	6.82 E+12
Lviv	14.625	379	13 826.2	8.32 E+12	79	1.12 E+05	8.32 E+12
Odessa	0.135	447	936	2.55 E+11	0	0	2.55 E+11
Khmelnitsky	66.182	6572	40 670	1.14 E+14	778	6.70 E+12	1.21 E+14
TOTAL	114.374	12 513	68 211.7	1.40 E+14	857	6.70 E+12	**1.46 E+14**

In total, 10 308 spent sealed radioactive sources and radio metering devices were accepted for storage and disposal.
Mass (*) of solid radwaste considering mass of biological shielding of spent sealed radioactive sources.

The Kharkiv, Lviv, Odessa, Dnipropetrovsk and Kyiv specialized plants accept low- and intermediate-level radwaste for long-term storage. The Donetsk special plant collects radwaste in the region, takes emergency response measures in the event of an accident but it does not operate radwaste storage facilities.

In so doing, the decision on planning and implementing specific measures under redesigning (in particular, with regard to construction, technical re-equipment, modernization of storage facilities to ensure their further safe operation or removal and repackaging of housed radwaste with subsequent decommissioning of storage facilities) should be based on safety assessment results of storage facilities. In particular, this refers to storage facilities that house historical radioactive waste.

In 2009, individual equivalent doses of the SISP staff and monitored levels of permissible radionuclide concentration in air of working rooms in the UkrDO Radon were not exceeded.

Radiation monitoring and the environmental monitoring carried out within the observation area according to the established regulations allow on-line assessment of the radiological situation around facilities. The radiation monitoring results for 2009 confirm that impact of the specialized plants on the public and the environment does not exceed the level established in regulations.

RADWASTE MANAGEMENT IN THE EXCLUSION AREA

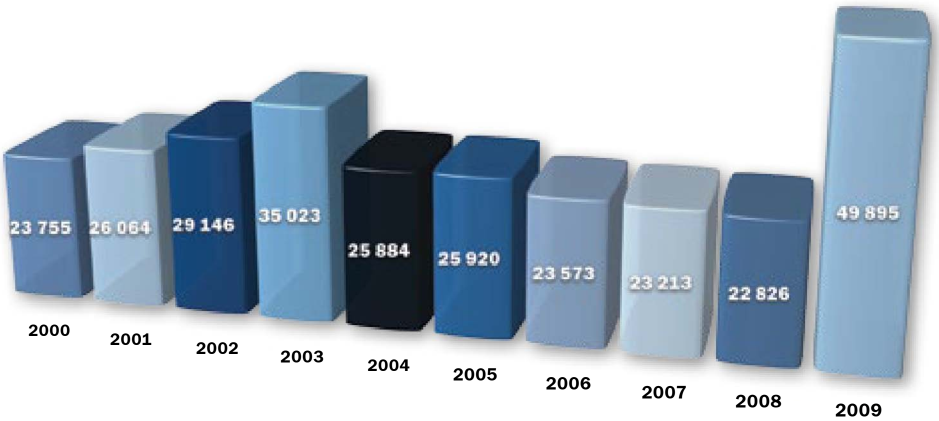
The Chornobyl Exclusion Area (for unconditional (obligatory) public resettlement) is a part of Ukrainian territory contaminated with radionuclides as a consequence of the Chornobyl disaster.

The total volume of radwaste (Shelter excluded) is about 2.8 million m^3 including over 2.0 million m^3 of radwaste with a total activity of 7*10^{+15} Bq that is located in radwaste disposal sites (RWDS) and radwaste interim confinement sites (RICS) constructed under post-accident conditions.

The main radwaste management enterprises in the Exclusion Area are the State Specialized Enterprises Complex, Tekhnocenter and the Chornobyl NPP.

The Complex collects and transports radwaste in the Exclusion Area operates the Buryakivka RWDS, monitors inactive Pidlisny RWDS and ChNPP Stage III RWDS and RICS pursuant to the SNRCU’s license.

Dynamics of solid radwaste transfer to the Buryakivka RWDS from 2000-2009
mass, t



RWDS and RICS in the Exclusion Area were established in extreme post-accident conditions in 1986 and do not meet regulatory requirements in force for these radwaste management facilities.

To enhance safety in storage of radwaste located in these storage facilities, the SNRCU licenses for operation of these facilities provide for measures, including compliance with deadlines for conservation of Buryakivka RWDS; developing and implementing conservation projects for Pidlisny RWDS and ChNPP III Stage RWDS to slow degradation and maintain necessary confining functions of engineering barriers; transferring the Naftobaza RWDS territory to an ecologically safe state. Deadlines of these measures are continuously supervised by the SNRCU in accordance with the Plan of Measures to Comply with Special Conditions of License Series EO No. 000144 approved by the Ministry of Emergencies of Ukraine. However, shortcomings in planning and management result in slowdown of the considered priority measures because of permanent lack of financial, technical and human resources for the operating organization.

Buryakivka RWDS has been operated since 1987. The Buryakivka RWDS is a near-surface trench-type disposal site. The total quantity of trenches is 30. The total capacity of the Buryakivka RWDS is 600-690 thousand m^3. The design volume of each filled trench equals to 22 000 m^3. As of the end of 2009, the Buryakivka RWDS housed low- and intermediate-level waste with a total mass of about 1180.4 thousand tons (601.359 thousand m^3) and with a total activity of 2.479*10^{+15} Bq (evaluation data). The Buryakivka RWDS remaining capacity is about 35 thousand m^3 (7-11%). During 2009, RWDS disposal facilities accepted 49.895 thousand tons (33.581 thousand m^3). Volumes of radwaste to be disposed in the facility increased in 2009 because of preparatory activities to construct the Shelter New Safe Confinement.

Since the Buryakivka RWDS design capacities are exhausted, the operating organization State Specialized Enterprise Complex plans to modernize the Buryakivka RWDS to create additional capacities to dispose low-level radwaste to be generated at Chornobyl NPP and in the Exclusion Area. To make a positive decision on reasonability for Buryakivka RWDS modernization, its operational and long-term safety should be re-assessed taking into account all radwaste disposed (or planned to be disposed) and state of protective barriers.

At the **Pidlisny RWDS** (operated from December 1986 to 1988) modules A-1 and B-1 with a total capacity of 22 880 m^3 are partially filled with long-lived high-level radwaste (volume – 3960 m^3, activity – 10^{+15} Bq) and low- and intermediate-level radwaste (volume 7040 m^3, activity 2.5*10^{+12} Bq).

At the **ChNPP Stage III** RWDS (operated till the end of 1986) radwaste with a total volume of about 26 200 m^3 and activity 3.91*10^{+14} Bq is placed.

The Complex performs routine safety activities at the sites. Radwaste disposed in the considered RWDS is high-level and long-lived waste. Therefore, this waste has to be disposed in a deep geological repository. The National Target Ecological Program till 2017 provides for siting of such a disposal facility. Safety of the above RWDS has to be ensured prior to construction of a disposal facility in Ukraine.

In accordance with the above Plan of Measures to Comply with Special Conditions of License Series No. 000144, the Complex has to develop and implement projects for closure (preservation) of ChNPP Stage III RWDS and the Pidlisny RWDS.

Nine **RICS**: Yaniv Station, Naftobaza, Pischane Plato, Rudy Lis, Stara Budbaza, Nova Budbaza, Prypyat, Kopachi, Chystogalivka are located within the Exclusion Area.

Nowadays, for a part of RICS, exact location and characteristics of the disposed radwaste are unknown. During previous years, the Naftobaza RICS and Pischane Plato RICS were completely examined, the Rudy Lis RICS and Yaniv Station RICS were examined partially. In 2009, radiometric inspection of the Stara Buda RICS was carried out and samples were taken to determine radionuclide composition of radioactive waste.

In 2009, radiation and environmental monitoring of the RWDS territories showed that reference levels for radionuclide contamination of air and soils were not exceeded.

The reference level of annual individual dose for the Complex staff directly involved in RWDS and RICS operation is 8 μSv/year (external exposure is 5 μSv/year, internal exposure is 3 μSv/year). In 2009, one case of exceeding the reference levels of the Complex expert external dose was observed. The Enterprise investigated the exceeding of reference levels. The average annual dose of personnel exposure is 1.45 μSv/year.

The State Specialized Enterprise Technocenter performs activities on construction of the Vector Complex I Stage Start-up System and infrastructure facilities that are technologically related to these disposal facilities in accordance with the license for designing and construction of a radwaste disposal facility.

The complex for decontamination, transport, processing and disposal of radwaste from the territories contaminated as a result of the Chornobyl NPP disaster (code name Vector) is constructed in two stages:

The Vector Stage I is to dispose short-lived radwaste resulting from the Chornobyl disaster. The Start-up system, separated from Stage I, includes two radwaste storage facilities: TRO-1 (for disposal of radwaste in ferroconcrete containers), and TRO-2 (for disposal of radwaste in bulk) and the required infrastructure facilities.

The infrastructure facilities of the Start-up system of the Vector Stage I should also provide operation of the engineered near-surface storage facility to dispose ChNPP conditioned radwaste (ENSDF), constructed within the Chornobyl NPP industrial complex for solid radwaste management.

The construction of TRO-1 and TRO-2 is under completion. To obtain a license for operation of these storage facilities, Technocenter has to assess safety and submit a safety analysis report. The safety assessment has to justify both operational and long-term safety of disposal facilities. Moreover, taking into account location of three radwaste disposal facilities – ENSDF, TRO-1 and TRO-2 at one site, the total impact of these disposal facilities on human and the environment should be identified.

To ensure target use of facilities of the Vector Start-up System Stage I, the Ministry of Emergencies, as the state regulatory body in the field of radwaste management, has to arrange a planned activity to collect, remove, sort, process, condition, and certify radwaste to be disposed. First of all, this activity has to be aimed at rehabilitation of the Exclusion Area, liquidation of post-accident radwaste interim confinement sites that are in critical state (uderflooding, washing out, etc.), and liquidation of decontamination sites located outside the Exclusion Area that were used during the accident. Nowadays, the planned activity to rehabilitate the Exclusion Area and liquidate radwaste emergency storage sites is not ensured adequately.

The Vector Stage II provides for construction of radwaste management facilities for:

- *processing of low- and intermediate-level radioactive waste, including long-lived waste at compactor, incineration, and cementation units;*
- *disposing of short-lived low- and intermediate-level waste both of the Chornobyl origin (including waste generated during Shelter operation and SIP) and conditioned radwaste (resulting from operation and decommissioning of Ukrainian NPPs);*
- *disposing or long-term storage of radwaste generated at industrial enterprises, medical, scientific and research and other establishments;*
- *long-term storing of long-lived and high-level radioactive waste;*
- *long-term storing of high-level waste to be generated in processing of nuclear fuel of Ukrainian NPPs in the Russian Federation;*
- *processing and long-term storing of high-level spent radiation sources.*

At the end of 2009, the Cabinet of Ministers of Ukraine endorsed the feasibility study of Stage II.

Before developing the design, the SNRCU requires that the operating organization Technocenter submits:

1) assessments of the permissible radiation burden on the Vector Site taking into account the constructed facilities and those to be constructed;
2) updated data on scopes, main characteristics of radwaste and terms of their delivery to the Vector Site;
3) an integrated interaction scheme of radwaste management facilities at the Vector Site indicating their main design capacities and production performances.

Shelter Transformation into an Ecologically Safe System. Chornobyl NPP Decommissioning

SHELTER SAFETY

Shelter activities are carried out under the license that establishes the scope and conditions of the Shelter transformation into an ecologically safe system, particularly, within the international Shelter Implementation Plan (SIP). The license is valid till the New Safe Confinement (NSC) is commissioned at the Shelter.

During 2009, within SIP designs and routine Shelter operation, the SNRCU reviewed and agreed upon a number of projects and documents based on which the Chornobyl NPP started the following activities:

- *excavation of trenches for the NSC foundation in the Shelter local area;*
- *preparation of the site for mounting the arch on the Shelter industrial site;*
- *development of the Shelter fire protection system (activities in unattended rooms and in those with water, dismantling of ventilation components).*

For the NSC design stage, the SNRCU agreed upon the following documents:

- *additional design criteria and requirements for design of the first NSC startup complex;*
- *design criteria and requirements on the NSC infrastructure for dismantling of unstable Shelter structures.*

In 2009, the SNRCU agreed upon a technical decision on operation of Shelter structures after stabilization completion and a number of changes to the Shelter operating procedure.

These regulatory decisions are intended to ensure nuclear and radiation safety at work, protect personnel, the public and the environment and constitute the SNRCU's contribution to the state strategy for Shelter transformation into an ecologically safe system.

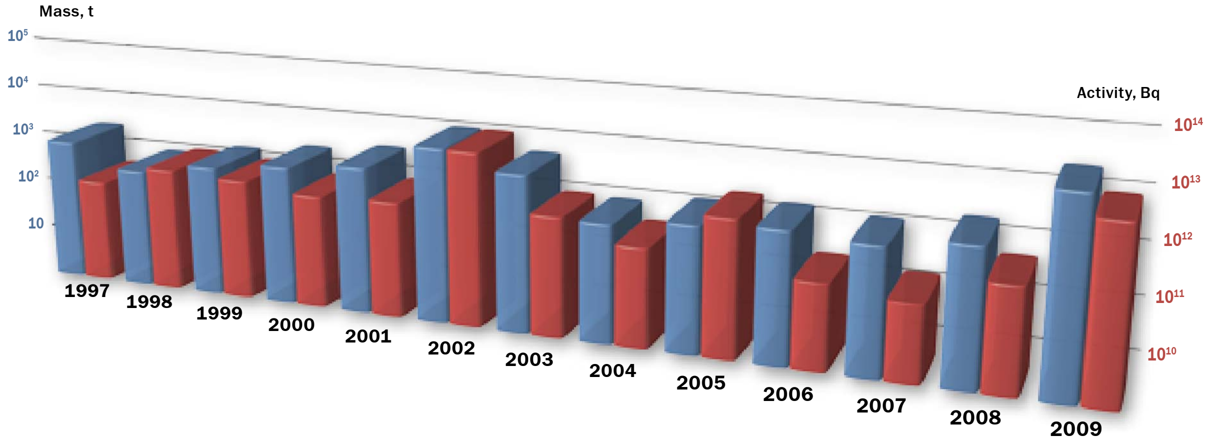
Shelter nuclear and radiation safety is ensured through a system of administrative and technical measures: neutron-absorbing solutions (gadolinium nitrate) are used to prevent a self-sustained chain fission reaction, Shelter structures are monitored, water that penetrated through untight areas of the confining structure is removed, etc.

Shelter nuclear and radiation safety is assessed by routine measurements of parameters that characterize fuel-containing materials (FCM), radiation situation at workplaces and on the surrounding territory, activity of water accumulation and floor drains of the Shelter. Shelter releases to the atmosphere and discharges into the geological environment are also monitored.

During 2009, the reference levels of regulated parameters were not exceeded. There is a general tendency to the stabilization of radiation parameters.

In Shelter activities, radiation and dosimetric monitoring is ensured and doses of ChNPP and contractual personnel are recorded.

SRW generation dynamics during activities at the Shelter



In 2009, the average individual dose for ChNPP personnel who worked at the Shelter decreased by about 11% and was 1.83 mSv as compared with 2008.

The average individual doses of contractual personnel decreased by about 17% and were 3.74% mSv as compared with 2008.

Solid radioactive waste (SRW) was basically generated during SIP designs in 2009: NSC preparatory work, dismantling work to construct the Shelter fire

protection system, installation of penetrations and cable routes for the Shelter automated monitoring system, etc. Soil, scrap metal, mixed construction waste were the primary waste and used individual protection means and decontamination waste were the secondary.

In 2009, much more SRW was generated during SIP and routine Shelter operation than in 2008: 18 166.2 m^3 (27 905.74 t) of low- and intermediate-level SRW with the total activity of 7.3*10^{+12} Bq.

When trenches for the NSC foundation were excavated on the Shelter industrial site and local area, 0.427 m^3 (0.391 t) of high-level SRW with the total activity of 1.45*10^{+12} Bq was detected and removed.

The relative increase in the amount of SRW is due to the extensive preparatory activities on the Shelter site, basically excavation of trenches for the NSC foundation that involved the removal of great amounts of soil, which relates to SRW and constitutes their basic weight (above 90%).

The excavation of NSC foundation trenches is quite complex and cumbersome since it involves the extensive territory of the Shelter industrial site and local area. Soil and technological materials removed during excavation are transported to disposal, depending on radiation contamination, either to the Buryakivka RWDS or a site for temporary storage of these soil and materials.

Unexpected situations sometimes occur during work. For example, heavy equipment (crane, earthmov-

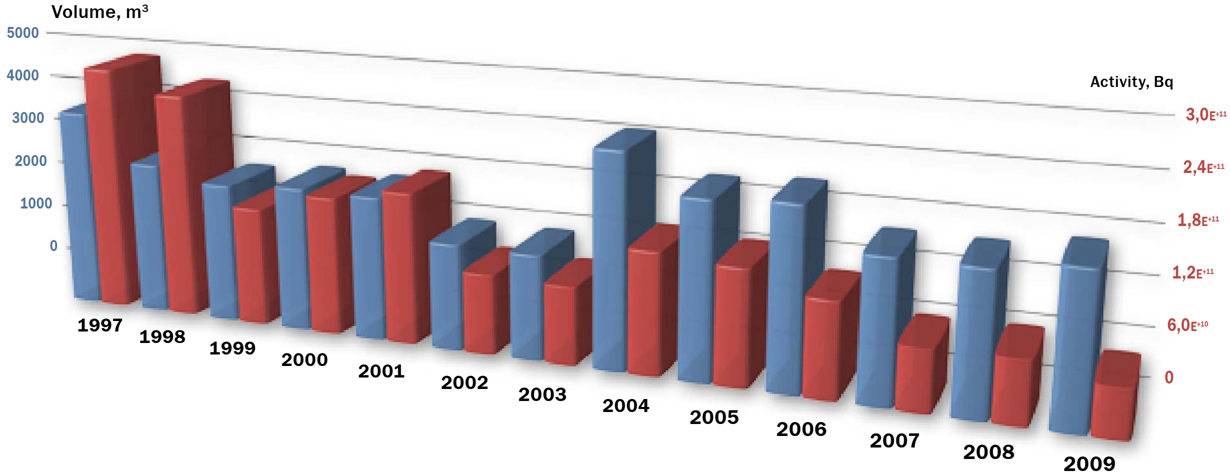
ing machine, other mechanisms) that was buried during the accident mitigation in 1986 was several times found in the excavation of trenches, and so were individual high-level sources (high-level waste). The removal of heavy equipment and high-level waste requires additional efforts and time and takes place in accordance with ChNPP procedures.

The SNRCU pays special attention to safety measures in the management of contaminated materials and high-level waste. Owing to joint efforts of the SNRCU and ChNPP, doses for personnel are not exceeded during excavation.

Liquid radwaste (floor drains) of the Shelter results from the decontamination of rooms, equipment and tools, dust-suppression, operation of air locks and natural factors, such as penetration of precipitations through Shelter untight places and moisture condensation.

During 2009, to prevent radioactive release into groundwater and improve radiation situation, 3015 m^3

Volume and total activity dynamics of sump water removed from the Shelter



of floor drains with the total activity of $5.845*10^{+10}$ Bq was collected and pumped out from the Shelter turbine hall and deaerator stack for further processing; this is higher in volume by 197 m^3 and lower in activity by $1.69*10^{+10}$ Bq than in the previous year.

In 2008, the ChNPP repaired the light roof under the Shelter central hall to decrease the volume of water that penetrated inside the Shelter and airborne releases through untight places in the roof.

According to the calculations, uncontrolled release of radioactive aerosols through untight places in Shelter structures decreased by 1.56 times as of December 2009 as compared with that in 2008. The lower airborne releases in the reporting period result from the repair of the light roof under the Shelter central hall.

The repair also reduced the volumes of uncontrolled water accumulations, in particular, in the suppression pool. The total volume of water in the suppression pool reduced by more than 40% in December 2008 against 2007, and measurements in 2009 showed that the water volume actually stabilized.

SHELTER NEW SAFE CONFINEMENT

The New Safe Confinement for the Shelter (NSC) is one of the main SIP designs.

The Novarka Consortium, including VINCI Construction Grands Projects and Bouygues Travaux Publics, is the ChNPP contractor and deals with the development of the detailed design for the first NSC start-up complex* (NSC SC-1) and its construction and commissioning. Ukrainian design and scientific organizations are also involved as subcontractors into the work.

In 2009, the Novarka Consortium continued developing the detailed design for the NSC SC-1 and conducted initial studies.

In the design process, the SNRCU provided advisory support and explanations upon ChNPP request for regulatory requirements, approaches to design safety justification, etc. In particular, this support was provided in the development of additional design criteria and requirements for NSC SC-1 related to impacts of snow/ice melting, class 3 tornado and wind loads on the NSC protective structures and requirements on materials of steel sheets and welding pipes of NSC bearing structures, etc.

During 2009, ChNPP prepared the site for NSC construction: clearing of the territory, dismantling and transfer of structures, excavation for NSC foundations on the Shelter industrial site and local area in compliance with designs for these activities agreed with the SNRCU.

The licensing process for the construction of the Shelter New Safe Confinement is top priority in the SNRCU's activity.

The SNRCU carries out review on nuclear and radiation safety of NSC designs, conducts state supervision over compliance with safety requirements and ensures coordination and interaction of other regulatory bodies: the Ministry of Health, Ministry for Construction and Municipal Economy, Ministry for Environmental Protection and Nuclear Safety, State Committee for Health and Safety at Work, and State Fire Safety Department of the Ministry of Emergencies of Ukraine involved in the review and agreement of designs and other safety areas.

The SNRCU actively interacts with all particles involved into SIP designs and NSC SC-1. This interaction

** The first startup complex of NSC (NSC SC-1) is a protective structure with life support process systems and necessary infrastructure (strategy for further implementation of NSC further implementation).*

is aimed to solve problems that occur during activities, decrease regulatory risks, and ensure effective and high-quality implementation of the project.

During 2009, the SNRCU conducted and participated in meetings of the Joint Coordination Group for ChNPP licensing: SNRCU (JCG), Interagency Regulatory Task Force for licensing Shelter activities and ChNPP decommissioning (IRTF), Donor Assembly of the Chornobyl Shelter Fund (CSF) and EBRD International Advisory Group (IAG).

The special attention and recommendations of this group was focused in 2009 on the compliance of the NSC SC-1 design with Ukrainian regulations, optimization of proposed design decisions and elimination of delays in the implementation of the designs. In 2009, the SNRCU agreed a technical decision on operation of Shelter structures after their stabilization and changes to the Shelter operational procedure.

CHORNOBYL NPP DECOMMISSIONING

Chornobyl units 1, 2 and 3 are at the stage of operation cessation. Power unit 1 was shut down in November 1996, unit 2 in October 1991 and unit 3 in December 2000.

For information: *operation cessation is the final stage in operation of a nuclear installation during which fuel is completely removed from it and placed into spent fuel storage facilities intended for long-term safe storage of spent fuel.*

The design lifetime of Chornobyl-1 expired in September 2007 and of Chornobyl-2 in 2008. The cooling pools (CP) of these units hold spent fuel that can be removed after the new spent fuel storage facility (ISF-2) has been commissioned. In the last years, the ChNPP kept operable and extended the lifetime of systems and components for spent fuel storage and radioactive waste management.

The lifetime of unit 2 systems and components related to spent fuel storage and radioactive waste management has been extended to 21 December 2018.

The lifetime of unit 1 systems and components related to spent fuel storage and radioactive waste management has been extended to 26 September 2017.

Preparation for lifetime extension of Chornobyl-3 systems and components for spent fuel storage and radioactive waste management whose service life expires on 8 December 2011 is underway at the Chornobyl NPP.

The Chornobyl NPP Decommissioning Program agreed by the SNRCU is based on the Chornobyl NPP decommissioning strategy, deferred decision, with the following stages:

- *final closure and preservation of reactors – 2013-2022;*
- *safe storage of reactors – 2022-2045;*
- *dismantling of reactors – 2046-2064.*

Under the IAEA technical cooperation project, an expert mission took place in 2008 to review and discuss ChNPP proposals on the structure and content of the ‘Decommissioning Design. Stage of Final Closure and Preservation of Chornobyl-1, 2 and 3’. After the mission, IAEA experts provided a report with recommendations. The design is to be implemented by 2011.

RADIOACTIVE WASTE MANAGEMENT AT THE CHORNOBYL NPP

Radioactive waste accumulated during Chornobyl NPP operation, mitigation of accident consequences in 1986 and during the operation cessation of units 1, 2 and 3 and Shelter transformation into an ecologically safe system is stored in the radwaste storage facilities on the ChNPP site: solid radwaste storage facility, liquid radwaste storage facility and liquid and solid radwaste facility, or is transferred for disposal to the Buryakivka RWDS in the Exclusion Area (operated by the SSE Complex).

The liquid radwaste storage system constitutes special interconnected piping for waste pumping from the storage facilities:

- *liquid radwaste storage facility designed to hold 26 000 m^3 of waste, including 5 stainless-steel reception tanks of 5000 m^3 and 2 reception tanks for 500 m^3;*
- *liquid and solid radwaste storage facility, where only liquid waste is stored, designed to hold 12 000 m^3 and includes 12 stainless-steel reception tanks for 1000 m^3;*
- *temporary storage of spent radioactive oil designed to hold up to 144 m^3 of oil and includes two vessels for 72 m^3.*

The liquid radwaste placed in these storage facilities is low- and intermediate-level and constitutes:

- *evaporation bottoms;*
- *pulp of spent ion-exchange resins;*
- *pearlite pulp.*

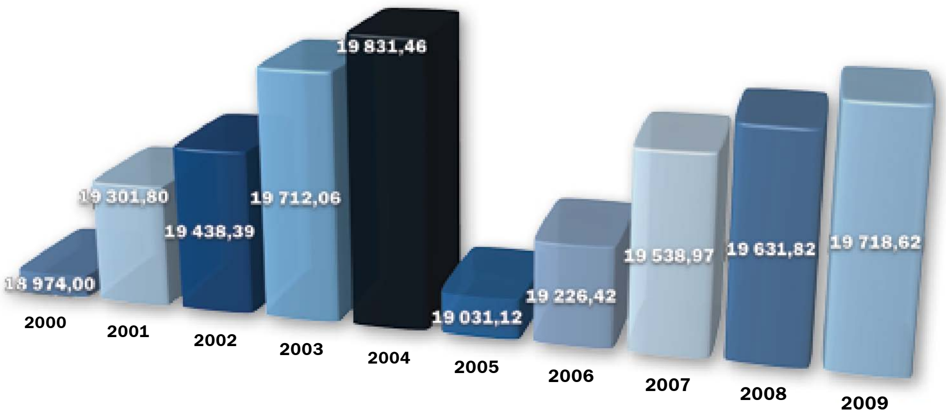
During 2009, 82.5 m^3 of evaporation bottoms, 0.3 m^3 of spent ion-exchange resins and 3.45 m^3 of pearlite pulp was generated at the ChNPP and sent for storage, no radioactive oil was generated. As of late 2009, 13 296.5 m^3 of evaporation bottoms, 4055.2 m^3 of spent ion-exchange resins, 2261.77 m^3 of pearlite pulp and 104.8 m^3 of spent radioactive contaminated oil were accumulated at the ChNPP liquid radwaste storage facilities. The total volume of accumulated liquid radwaste is 19 718.62 m^3

Low- and intermediate-level solid radwaste generated during operation cessation of the power units and during Shelter transformation into an ecologically safe system is transferred to the Buryakivka RWDS for disposal. During 2009, 19 197.50 m^3 (28 714.11 t) of low-level and 6.0 m^3 (4.9 t) of intermediate-level waste was transferred to the Buryakivka RWDS for disposal.

High-level waste is collected into special containers (KTZV-0.2) for transport and storage of group 3 solid radwaste and is placed into the temporary high-level solid radwaste storage facility on the ChNPP site. During 2009, 0.4243 m^3 (0.3877t) of waste was transferred into the temporary storage facility for solid high-level waste.

In general, the temporary storage facility for high-level solid waste holds about 1.2329 m^3 of high-level

Dynamics of liquid radwaste accumulation in ChNPP temporary liquid radwaste storage facilities
Volume, m^3



The amounts of radwaste decreased in 2005 because ChNPP took measures to additionally evaporate 1168 m^3 of bottoms to release volumes for liquid radwaste storage

ChNPP solid radwaste is temporarily stored at the storage facility for solid radwaste of activity groups 1, 2 and 3 (according to the classification of SP AS-88). In 2003, the storage facility was closed and the compartments were preserved. The industrial complex for solid radwaste management is currently under construction. The facility for solid radwaste retrieval has been constructed within the complex (Lot 1). The total volume of accumulated solid radwaste to be retrieved and further processed includes 1096 m^3 of group 1 waste,

926.5 m^3 of group 2 and 506.93 m^3 of group 3. The processed radwaste will be disposed of in the engineered near-surface disposal facility (ENSDF) commissioned in 2009.

and long-lived solid radwaste with the total activity of about 0.5 TBq.

INFRASTRUCTURE FOR RADIOACTIVE WASTE MANAGEMENT AT THE CHORNOBYL NPP

The ChNPP has currently no operating facilities for radwaste processing to immobilize waste and convert it into the state suitable for safe disposal in a near-surface disposal facility.

In the framework of international assistance provided to Ukraine for ChNPP decommissioning, a number of international projects were underway in 2009 to construct the ChNPP radwaste management system, from processing to disposal, consisting of the liquid radwaste treatment plant (LRTP) and industrial complex for solid radwaste management (ICSRM). These facilities are constructed at the ChNPP site to remove accumulated radwaste from the ChNPP storage facilities, process this waste and that generated during ChNPP decommissioning and Shelter transformation. Additional capacities are also planned for the storage of long-lived and high-level radwaste that cannot be disposed of in near-surface facilities. Delays in activities permanently occur during the designs. According to the current ChNPP plans, the ICSRM facilities on the ChNPP site can be commissioned only in the first half of 2010 and the LRTP no sooner than in 2011.

In general, one of the main ChNPP tasks is to develop an integrated, optimized system for radwaste management at the ChNPP to take into account all activities on ChNPP operation cessation and decommissioning and Shelter transformation into an ecologically safe system.

To ensure safe management with all types of radwaste to be generated in ChNPP decommissioning and Shelter transformation, a number of additional facilities shall be developed including a facility for manufacturing of containers and packages for radwaste, whose design has been started; areas for storage, fragmentation and decontamination of dismantled equipment and other radwaste; facility for preliminary treatment of liquid radwaste to remove transuranium and organic substances for processing of Shelter radwaste at the LRTP; complex for processing of contaminated metal, etc.

Liquid Radwaste Treatment Plant

The LRTP is designed for treatment of radwaste accumulated in ChNPP liquid radwaste storage facilities during ChNPP operation, mitigation of the 1986 accident consequences, operation cessation and waste to be generated during ChNPP decommissioning and Shelter transformation into an ecologically safe system.

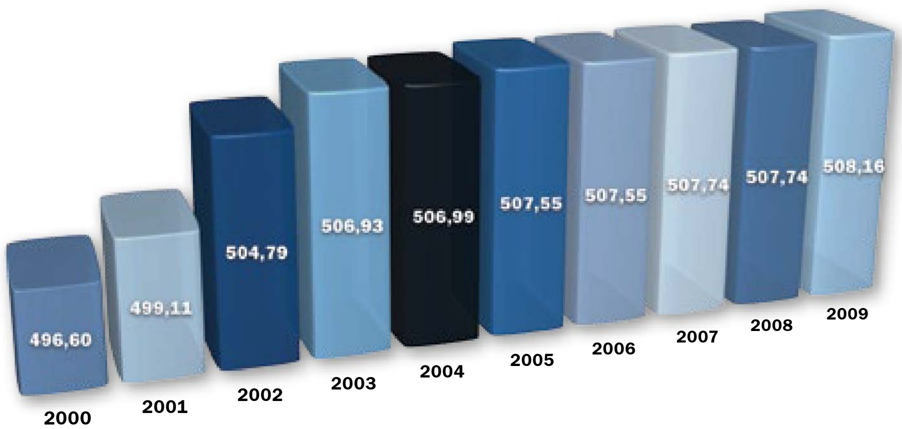
The design is funded by donor countries from the EBRD Nuclear Safety Account.

In 2006, the contract with the western subcontractor, international consortium Belgatom/SGN/Ansaldo was broken. In 2007, the Assembly of Donors to the Nuclear Safety Account approved the Strategy for Completion of the Liquid Radwaste Treatment Plant, according to which the activities are divided into four packages and are to be completed by national subcontractors after tendering and contracting in compliance with EBRD rules.

During 2009, the SNRCU agreed changes to the LRTP regarding the liquid radwaste back unloading system.

The ChNPP tested the separator for processing of pearlite and ion-exchange resins and confirmed that the separator was no longer suitable and the technology for processing this type of radwaste needed to be modified. The equipment is to be modified also under completion of the design.

Dynamics of solid radwaste accumulation in ChNPP solid radwaste storage facilities
Volume, m³



Industrial Complex for Solid Radwaste Management includes:

- ***Lot 1*** *– facility for retrieval of solid radwaste is intended for waste removal from the ChNPP solid radwaste storage facility (based on which Lot 1 is constructed) and transfer of radwaste for processing to Lot 2.*
- ***Lot 2*** *– solid radwaste treatment plant is intended for sorting of radwaste of all categories and processing (fragmentation, incineration, pressing, cementing) of low- and intermediate-level short-lived solid radwaste retrieved from Lot 1 and waste resulting from ChNPP decommissioning and Shelter transformation into an ecologically safe system. Lot 2 also provides for packing of long-lived and high-level waste to be generated in sorting and transport of these packages to the Lot 0 temporary storage facility.*
- ***Lot 0*** *– temporary storage facility for low- and intermediate-level long-lived and high-level waste is intended for interim (for 30 years) storage of long-lived and high-level waste to be generated during sorting at Lot 2 and preparation for the construction of the Shelter New Safe Confinement. This storage facility is created by the modernization and reequipment of room 138 of the liquid and solid radwaste storage facility that has not been operated.*
- ***Lot 3*** *– ENSDF – engineered near-surface disposal facility is intended for disposal of solid radwaste (conditioned radwaste from the ChNPP liquid and solid radwaste treatment plants) and is located at the Vektor site. It has been completed and the SSE Tekhnocenter obtained a license in 2009 to operate two disposal compartments for ChNPP radwaste packages.*

The design is funded by the European Commission within the TACIS program and from the State Budget of Ukraine. The contactor is the German NUKEM Technologies GmbH.

During 2009, construction activities at Lot 1 and Lot 2 were completed, all equipment was assembled and individual and comprehensive tests of systems and equipment were performed. On 24 April, Lot 1 and Lot 2 were handed over from the Contractor (NUKEM) to the Client (ChNPP). Preparation for hot tests of Lot 1 and Lot 2 using the active product (commissioning) is underway.

Among the major issues to be solved prior to operation of Lot 1 and Lot 2 is compliance of the final product with acceptance criteria for disposal in Lot 3 (ENSDF).

The contractor has carried out all activities and conducted ‘non-active’ comprehensive pre-commissioning tests.

The reliability of containers for specific radwaste (165- and 200-L drums) is one of the major safety issues in operation of the temporary facility, taking into account conditions of storage and lifetime of the facility. The ChNPP is going to produce drums for radwaste at the facility for manufacturing waste containers and packages to be located near the town of Slavutich.

Lot 3 (ENSDF) on the Vektor site for 50 250 m^3 is intended for the disposal of conditioned ChNPP waste: concrete containers from Lot 2 and 200-L drums from the LRTP.

In 2008, the ENSDF was completed, and so were parts of infrastructure facilities of stage I of the Vektor complex for ENSDF operation.

During 2009, the SNRCU Board considered twice the issuance of an operating license for the disposal facility to the SSE Tekhnocenter.

At the meeting of 2 July 2009, taking into account the status of the Plan of Measures to Solve Safety Issues for the First Stage of ENSDF Operation implemented by the SSE Tekhnocenter (developed taking into account the decisions of the SNRCU Board of 5 February 2009), findings of the state review on nuclear and radiation safety of the revised safety case for the ENSDF and inspection, it was decided to issue the operational license for the ENSDF to the SSE Tekhnocenter in the scope for loading of two modules of the facility with radwaste packages from the LRTP and ICSRM Lot 2.

License EO No. 000894 of 2 July 2009 was issued for 5 years to the SSE Tekhnocenter. According to special terms of the license, the SSE Tekhnocenter is to take all necessary measures to ensure and demonstrate safe operation of the disposal facility in full scope through: revealing and eliminating the cause of water penetration under the facility, analyzing the performance of design functions by facility structures and systems, implementing up-to-date safety assessment methods, realistic analysis of long-term safety of the disposal system, optimizing acceptance criteria, etc.

Use Of Radiation Sources

The use of radiation technologies in Ukraine started in the 1930s. There is a continuous tendency to their wider application in different areas and increase in types of radiation sources and generating devices. The management of radiation sources in every field has its specificity and different levels of potential hazard.

Most of all radiation sources are applied in medicine. Ukraine has about 3000 medical establishments (excluding dental rooms) that use radiation sources. The up-to-date radiation technologies, in particular positron emission tomography with cyclotrons to prepare radio pharmacological medications, linear accelerators, also as part of robotic therapeutic facilities, intervention radiology, brachytherapy, etc., are quickly developed just in this area. In 2009, East Europe's first Private Clinic was opened near Kyiv. This Clinic uses one of the latest developments in high medical radiation technologies based on the up-to-date and technical advances in robotic, computer navigation and ray surgery, in particular, a CYBERKNIFE G4 radio surgery system.

The safety of using the up-to-date radiation technologies depends on the use of radiation sources whose level of nuclear and radiation safety meets Ukrainian regulatory requirements, standards, rules and regulations on nuclear and radiation safety, safety principles and criteria.

In licensing and state supervision, the SNRCU pays special attention to comprehensive assessment of all factors affecting radiation safety, including state reviews on nuclear and radiation safety of documents for construction or modernization of rooms, structures and buildings for radiation sources.

In 2009, the SNRCU carried out 7 state reviews on nuclear and radiation safety of documents submitted by medical establishments for construction or modernization of rooms, buildings and structures to check sufficiency of biological shielding to ensure radiation safety of radiation sources.

The licensing of the use of radiation sources was introduced in 1996 in Ukraine when the Law of Ukraine On Nuclear Energy Use and Radiation Safety took effect. In 2009, the State Inspectorates for Nuclear and Radiation Safety issued (reissued) 658 licenses for the use of radiation sources. The SNRCU issued 20 licenses for production of radiation sources, in particular 4 licenses were issued in 2009.

Eight SNRCU State Regional Inspectorates for Nuclear and Radiation Safety are in charge of the state supervision and licensing of the use of radiation sources. The state of safe use of radiation sources according to the administrative and territorial division is presented in Section 14.

The state accounting for and control of radiation sources is implemented by registration of radiation sources in the State Register according to the Procedure for the State Registration of Radiation Sources approved by Cabinet Resolution No. 1718 of 16 November 2000. As of December 2009, 26 685 radiation sources, including 12 501 generating devices and 14 184 radionuclide devices, were entered into the State Register of radiation sources.

The safe use of radiation sources and (or) their disposal at the end of their lifetime is an important condition for safe use of radiation sources.

Resulting from the state supervision and licensing, a considerable quantity of spent radiation sources inherited from the Soviet era was detected in users of radiation sources. As a result of bankruptcy of enterprises, cessation of defense programs, changes in forms of property, etc., the indicated radiation sources are not transferred to special enterprises for radwaste management that ensure their protection (physical protection) in accordance with the safety requirements.

Since 2006, the SNRCU has monitored the State Program for Safe Storage of Spent High-level Radioactive Sources approved by Cabinet Resolution No. 1092 of 3 August 2006. In 2009, under the economic crisis, individual measures of this Program were deferred. Therefore, the SNRCU maximally concentrates its efforts on priority tasks such as the state supervision of safety at these facilities and involvement of international technical assistance in removal and transfer of spent radiation sources into a safe state.

The regulatory body found ways to solve nearly all potentially vulnerable spent radiations sources, in particular:

1. The Federal Ministry of Germany for Ecology, Environmental Protection on Safety of Reactors (BMU) provides technical assistance in safe storage of spent radiation sources in scientific establishments and bankrupt enterprises of Ukraine by removing and transferring

Nuclear and radiation safety state assessment

No	Establishment	Documents and radiation sources to be placed
1	Lviv State Oncologic Regional Treatment and Diagnostic Center	Modernization of radiological building rooms to install a linear accelerator and a stimulator at the Lviv State Oncologic Regional Treatment and Diagnostic Center (placement of a Varian Clinac 2100 C/D linear accelerator with an energy to 16 MeV and Acuity X-ray simulators)
2	Adonis Company Ltd.	Calculation of biological shielding for a treatment room for a CYBERKNIFE G4 radio surgery system and a treatment computer tomograph (placement of a Toshiba Activion 16 computer tomograph with 125 kV/300 mA X-ray tube and a LINAC 6 MeV linear accelerator incorporated into a CYBERKNIFE G4 radio surgery robotic system)
3	Medic's-ray Group International Ltd.	Radiation shielding calculation in stationary building structures, room 109, the first floor in the ambulant building of the Medic's-ray International Group Ltd. Modern Oncologic Care Hospital and a set of measures to protect personnel against radiation sources in the use of I-131 in radiotherapy (use of I-131 in radiotherapy)
4	Regional Clinic Oncologic Center, Ivano-Frankovsk	Calculating a 'Kobalt-60' screen gamma-therapeutic device (Co-60 source, $3.7*10^{+14}$ Bq) of the therapeutic room, the annex to the Radiological Building of the Regional Clinic Oncologic Center, 17 Medychna St., Ivano-Frankovsk (placement of a Kobalt-60 gamma-therapeutic device with Co-60 source, $3.7*10^{+14}$ Bq)
5	Charitable Foundation Children's Hospital of Future	Calculating radiation protection of rooms in the All-Ukrainian Center for Health Protection of Mother and Child radiological center and calculating radiation protection of a standard compartment to house X-ray diagnostic equipment of the All-Ukrainian Center for Health Protection of Mother and Child (placement of two Elekta Limited 18 MeV linear electron accelerators and location of a 125 kV computer tomographic scanner)
6	Central Service of the State Building Review in the Autonomous Republic of Crimea	Modernization of the existing radiological building with installing a linear accelerator, Simferopol, and Calculating biological shielding of rooms to place a VARIAN CLINAC 2100C linear accelerator and an ACUITY simulator (placement of a VARIAN CLINAC 2100C linear simulator with a maximum 20 MeV energy of electrons and a maximum 10 MeV energy of bundle of photons and a ACUITY simulator to model treatment of patients, the maximum voltage is 150 kV).
7	Medical Clinic 'Innovation' Ltd	Calculating biological shielding to ensure radiation safety in rooms to place a VARIAN CLINAC 2100C linear accelerator Medical Clinic 'Innovation' Ltd (placement of a VARIAN CLINAC 2100C linear accelerator with a maximum 20 MeV energy of electrons and a maximum 10 MeV energy of bundle of photons)

these sources for further safe storage to specialized enterprises for radioactive waste management. During 2009, 7184 radiation sources from 7 bankrupt enterprises of different regions of Ukraine were inspected, removed and transferred to safe storage.

In 2010, these efforts will be continued. It is supposed that appropriate technologies for removal of radiation sources will be developed, necessary containers will be produced and radiation sources will be removed from radiation facilities of the Institute of Biology of Southern Seas, Sevastopol and at the State Enterprise RADMA, Kyiv.

2. In the framework of the project Improving the Security of Spent Radiation Sources in Ukraine financed within the international technical support of the US Department of Energy, further safe storage of radiation sources of the following scientific establishments and enterprises of Ukraine will be ensured:

- *The Institute of Physics of the National Academy of Sciences of Ukraine, Kyiv, Project on Removal of Radiation Sources, Type GIK-7-4, from the K-100000 Facility and GIK-3 from the MPX-γ-25M Facility, Their Placement in a Shipping Cask, Transport to the Radwaste Storage Site of the Kyiv State Interregional Specialized Plant and Reloading into Storage Casks obtained a favorable conclusion of the state review on nuclear and radiation safety. Appropriate containers and equipment were designed, their acceptance tests are underway;*
- *The Kavetsky Institute for Experimental Pathology, Oncology and Radiobiology, Kyiv, the project for Removal of Spent Radiation Sources from the IGUR-1 Facility was developed. The state review on nuclear and radiation safety of this project by the SNRCU is underway. Necessary equipment and containers are under designing;*
- *The Public Corporation Elektron-GAZ, Zhovti Vody, the Working Project for Removal of Intermediate- and High-level Radiation Sources Stored at the Public Corporation Elektron-GAZ obtained a favorable conclusion of the state review on nuclear and radiation safety. The required quantity of containers for radiation sources was produced. The construction of the storage facility to house radiation sources of the Elektron-GAZ Public Corpora-*

tion will be completed at the State Interregional Engineered Complex UkrDO Radon.

- *Working documentation has been developed, the physical protection system of storage facilities for radiation sources of radioactive waste disposal facilities of the Dnipropetrovsk, Kyiv, Lviv, Odessa and Kharkiv State Interregional Engineered Complexes has been modernized and its trail operation is underway.*

3. In accordance with the Agreement with the Ministry of Energy and Climatic Changes of the Great Britain, the program for construction of a centralized storage facility for high-level radiation sources within the second stage of the 'Vector' Production Complex has been developed, its state investment review is underway.

During the state supervision and licensing of the use of radiation sources, it should be checked that the licensees of radiation monitoring services have radiation monitoring procedures, dosimetric equipment, also for individual dosimetric monitoring in place. One should also verify their compliance, sufficiency and databases on individual exposure doses, as well as storage of appropriate records, including preliminary measurement results. In 2009, the SNRCU systematized the information on individual dosimetric monitoring services that monitor the use of radiation sources.

The results of the state supervision of the above aspects confirm that the dosimetric monitoring services in Ukraine require fundamental improvement and upgrading with regard to the listing of dosimetric values and accuracy in dose identification ensuring high quality of measurements and storage of preliminary results. Therefore, the analysis demonstrates urgency of implementing a state system for monitoring and accounting of the public individual doses. Nowadays, territorial dosimetric services operate in 13 regions of Ukraine. The existing systems for individual dosimetric monitoring are able to identify only doses of hard gamma-radiation, while the Radiation Safety Standards of Ukraine (NRBU-97) provides for dosimetry of neutron and beta-exposure for certain activities. The existing dosimetric devices should be reequipped. In so doing, unification of methodological approaches, databases, analytical systems, possibility to carry out independent dosimetric monitoring are the most important factors.

In 2009, the SNRCU signed the Memorandum of Understanding between the SNRCU and the State Center of Radiation Medicine of the Academy of Medical Sciences of Ukraine on cooperation, partnership and interaction on radiation safety and radiation protection, in particular on arrangement and implementation of the unified state system for monitoring and accounting of individual doses in Ukraine and revision of the main requirements, means and methods of dosimetric monitoring (including individual dosimetric monitoring).

Priority measures cover the important functions such as quality inspection of individual dose measurement and dosimetric monitoring, keeping the state register of individual doses, monitoring of all dosimetric values for which dose limits, etc., are established. The individual dosimetric monitoring in Ukraine should be immediately upgraded and optimized to meet the modern infrastructure to enable measurement of doses, storage and exchange of information on doses, introduction of the up-to-date unified approaches to reliable identification of individual doses.

Personnel skills and knowledge of radiation safety is an important element of the radiation protection and safety infrastructure.

Today, more than 44 000 persons deal with radiation sources and require appropriate training on radiation safety, in particular: 25 000 in medicine, about 7000 in the industry and approximately 12 000 in sciences.

Training and examination of knowledge of radiation safety is an integral part of issuing a license for the use of radiation sources.

In December 2009, the SNRCU arranged and carried out the workshop Up-to-date Quality Assurance Aspects of Professional Training, Retraining and Development of Staff with Respect to Radiation Safety with the assistance of the Ministry of Health Protection, the State Committee of Health and Safety at Work, the State Nuclear Regulatory Committee of Ukraine (SNRCU) and 12 representatives of 11 training centers that deal with professional development of experts on radiation safety. This was the first workshop on this subject in Ukraine.

According to the decision of the workshop and on initiative of the Shevchenko Kyiv National University, standard requirements for training/retraining and professional development on radiation safety and compliance criteria of training centers in this area are under development.

Documents that justify periodic training and examination of radiation safety knowledge of the licensee's personnel and responsible staff are verified during the state supervision and licensing.

The SNRCU agrees 14 training programs developed by training centers dealing with professional development on nuclear and radiation safety and 8 programs for examining knowledge of radiation safety by commissions created in the Central Regional and Municipal Kyiv and Sevastopol Administrative Boards for Health Protection. These establishments and commissions are listed at the SNRCU website.

The results of the state supervision and licensing as regards the use of radiation sources for 2009 confirm that the absence or poor quality of periodic maintenance and untimely repairs of equipment and devices with radiation sources performed by licenses is one of the causes of violating safety requirements.

Maintenance services should be of high quality and should be provided by licensed organizations listed at the SNRCU website.

In 2009, by the SNRCU request, the Marzeev Institute for Radiation Hygiene and Medical Ecology of the Academy of Medical Sciences of Ukraine carried out the statistical and technological analysis of radiation accidents occurred at the territory of Ukraine from 1989 to 2009.

The SNRCU will use the summarized analysis results (Appendix 1) in 2010 to implement corrective and preventive measures to minimize loss of regulatory control over radiation sources to enhance radiation safety in Ukraine.

Accident prevention is one of the main radiation safety principles. In the event of a radiation accident, the SNRCU analyzes it, develops preventive measures, sends the list of these measures to all licensees who have radiation sources of such a type to prevent similar events in future.

To minimize risks of radiation accidents and incidents, the SNRCU has intensified the state oversight of the most vulnerable radiation sources, issues licenses for the use of all radioiodine sources; provides for the state registration of radiation sources that are not exempt from regulatory control. During this activity, special attention is paid to:

- *proper designing of radiation sources taking into account their safety;*
- *physical protection of radiation sources in their use, transport and storage;*
- *marking both radiation sources or a shielded container and directly a device or facility with the preventive sign trefoil;*
- *appropriate personnel training and retraining on radiation safety;*
- *appropriate keeping of the system for accounting for and control of radiation sources;*
- *safe completion of activities and appropriate management of spent radiation sources;*
- *development of emergency plans, emergency training;*
- *updating of the radiation sources accounting system, including lost radiation sources, search measures to renovate the regulatory control over these radiation sources;*

In accordance with the international practice, radiation accidents may occur even in countries with well-developed infrastructure which essentially influences the risk minimization. Actions (intentional or unintentional) of persons who deal with radiation sources may result in accidents, in particular:

- *violation of appropriate safety procedures (a person wants to finish quickly his work, fatigue, insufficient competence of staff);*
- *too active operation of equipment (output but not safety parameters are a priority);*
- *at work, radiation sources are not supervised and are accessible for unauthorized persons;*
- *there is no appropriate radiation monitoring during and after work;*
- *radiation sources are left on-site without interlocks;*
- *lost radiation sources are not reported and/or measures to find them are not taken;*
- *vehicles that transport radiation sources are left aside during rest or lunch of transporters in transit;*
- *signs of damage of locks within the territory of a storage facility are not reported;*
- *personnel are not trained in the use of new equipment with radiation sources and dosimetric monitoring devices;*
- *there is no possibility to maintain all equipment operable, which results in hazardous conditions of operation;*
- *personnel, at their own discretion, try to solve extraordinary situation to look proactive;*
- *there is no information on previous radiation accidents, and so appropriate conclusions are not drawn.*

In 2009, the SNRCU analyzed the practice and legislation of Ukraine and EU concerning radiation protection of personnel and patients during medical use of radiation sources. The analysis results are summarized in Appendix 5.

Emergency Preparedness And Response

The Law of Ukraine On Protection of the Public and Territories against Man-induced and Natural Emergencies of 18 June 2000 sets forth the organizational framework for the Unified State System of Prevention and Response to Man-induced and Natural Emergencies (henceforth – USSE) that is established in Ukraine.

According to Cabinet Resolution No. 1198 of 3 August 1998, the SNRCU is responsible for the establishment and operation of the USSE functional subsystem Safety of Nuclear Power Facilities.

USSE FUNCTIONAL SUBSYSTEM ‘SAFETY OF NUCLEAR POWER FACILITIES’

The USSE functional subsystem Safety of Nuclear Power Facilities operates at national, regional and facility levels. Facility-level activities are carried out by on-site State Nuclear Safety Inspectorates; regional-level activities are carried out by State Regional Inspectorates for Nuclear and Radiation Safety.

At the national level, the SNRCU Emergency and Information Centre (EIC) is the key element of the subsystem. The EIC is staffed with the most skilled experts of SNRCU departments and subordinated organizations.

Each expert takes up the assigned position in one of the following EIC groups:

Emergency staff (ES) is in charge of the EIC, makes decisions within the SNRCU competence, agrees information massages sent outside the EIC.

Emergency staff support team (ESST) interacts with the ES and other teams, arranges execution of ES orders, and limits access to the ES. The ESST also keeps chronology of events, a document where the main decisions made by the ES and other important moments in the EIC activity are recorded.

Data analysis team (DAT) receives technical information about on-site status, analyzes this information and predicts progression of events. As a result, brief summaries are periodically sent to the ES.

Communication team answers phone calls, develops press releases and other information massages based on the ES instructions and DAT technical information, and sends it to external users.

Technical support team eliminates malfunctions in computer equipment and communication means, provides advice to the EIC staff on the use of hardware and software.

During 2009, the EIC operated exceptionally in routine mode, when 24-hour duty was maintained, operational information was received from Ukrainian NPPs, information on NPP events was analyzed and recorded and then entered into the computer database.

The information on the status of the Ukrainian power units and NPP operational events is summarized at the SNRCU website www.snrc.gov.ua.

"Emergency-Technical Center" of NAEK Energoatom

NAEK ENERGOATOM EMERGENCY CENTERS

The NAEK Energoatom emergency preparedness and response system is included in the USSE functional subsystem Nuclear Energy and Fuel and Energy Complex, which is within the competence of the Ministry for Fuel and Energy of Ukraine.

The USSE functional subsystem includes the main and backup emergency centers of the NAEK Energoatom, the separated subdivision Atomremontservis, nuclear power plant support center located at the separated subsidiary of this organization – Technical Center for Emergencies, the village of Bilohorodka of the Kyiv Region.

In the event of an emergency at NPP, experts of the Technical Center for Emergencies and Atomremontservis are assigned to the site and are put at command of the NPP accident mitigation leader. If necessary, the center uses robotics and other unique equipment to assist emergency personnel in radiation and engineering survey, collection and confinement of radioactive waste, decontamination, repair of equipment in NPP reactor, turbine and electric shops, etc.

The NAEK Energoatom main emergency centre is located at the Headquarters in Kyiv and the backup emergency centre is established and operates at the former Chornobyl NPP emergency control centre in the village of Dniprovske, Chernigiv Region.

In addition to the above main and backup emergency centers of the NAEK Energoatom, current regulations provide for on-site and off-site (in the observation area) emergency centers at each NPP.

An on-site emergency centre is intended to manage accident confinement and mitigation actions at the NPP site and in the controlled area. An off-site emergency center is to be involved in the event of such accidents when the on-site centre cannot be used.

To implement provisions of the regulation Requirements for NPP On-site and Off-site Emergency Centers NP 306.2.02/3.077-2003, in 2009, a system for data communication from unit monitoring and control systems and plant systems to the SNRCU EIC was brought into use.

In the event of an emergency at NPP, all emergency centers are activated, if needed, including on-site emergency centers of non-emergency NPPs (engineering and technical support teams).

To ensure a liable video communication link in emergencies, the NAEK Energoatom installed a satellite system that covers the main and backup emergency centers of the Atomremontservis backup emergency center, Technical Center for Emergencies, NPP on-site and off-site emergency centers. Using the communication data system, monitors of emergency centers receive necessary information which specifies the emergency.

In 2009, a fiber optic communication link was arranged between the NAEK Energoatom and the Rosenergoatom emergency center (the Russian Federation).

Reserve emergency center building of NAEK Energoatom

Accounting For And Control Of Nuclear Material

Regarding the state accounting of nuclear material, 2009 was outstanding for Ukraine, in particular for the improvement of the legislation framework in this area. Cabinet Resolution No. 257 of 25 March approved a new revision of the Provisions on the State System for Accounting for and Control of Nuclear Materials.

An important tool to ensure efficient performance of the State System for Accounting for and Control of Nuclear Materials (SSAC) and implement international treaties on non-proliferation of nuclear weapons is issuing licenses to entities in nuclear energy use that apply, produce, store, purchase and sell nuclear material. For nuclear facilities, the requirements for SSAC are established in a license granted to the operating organization for a certain lifecycle of a nuclear facility, for the Specialized Enterprise UkrDO Radon these requirements are established in licenses for treatment, storage and disposal of radioactive waste, for other entities in licenses for the use of radiation sources.

In accordance with the above Provisions, the SNRCU, as a competent body, ministries, other executive bodies ensuring the state policy of Nuclear Non-Proliferation Safeguards, legal entities and individual acting under requirements of international treaties on non-proliferation of nuclear weapons are SSAC subjects. Procedure for Applying Safeguards on Non-proliferation of Nuclear Weapons No. 102 of 2 July 2009 (registered in the Ministry of Justice of Ukraine No. 683/16699 of 23 July 2009) establishes the order for implementing international agreements.

In accordance with the new regulations, ministries and other central executive bodies and the National Academy of Sciences of Ukraine shall develop and issue regulatory acts for entities under their jurisdiction. These regulatory acts meet SSAC requirements and identify the procedure for accounting of nuclear materials, preparation and timely submission of information on access of IAEA inspectors with their equipment and devices within the inspection schedules in accordance with international treaties on non-proliferation of nuclear weapons.

The new acts will compensate for the deficiencies in the legislation in terms of missing requirements for qualification of experts dealing with accounting of nuclear materials. The Licensee shall train staff responsible for accounting for and control of nuclear materials. In 2009, the development of provisions on the state system for skills training of experts in physical protection, accounting for and control of nuclear materials was initiated.

In 2009, NPP took measures to implement the system for measuring nuclear materials, which is a constituent part of the system for accounting for and control of nuclear materials. The SNRCU agreed upon the Standard Program for Measuring Nuclear Materials to develop further measuring programs in any nuclear material balance area. In the framework of the US Technical Support Program, at the end of 2009, the Chernobyl Drum Assay System (CDAS) developed by the Los-Alamos National Laboratory was tested at the ChNPP site. This device is intended to measure the quantity of nuclear material in high-level radioactive waste removed during construction of the New Safe Confinement. In the framework of this Program, the development of Safeguards approaches at the Chornobyl NPP and decrease of IAEA inspection efforts are continued, in particular, the IAEA surveillance system in reactor halls, container cars, development of the system for remote monitoring by means of a satellite communication link.

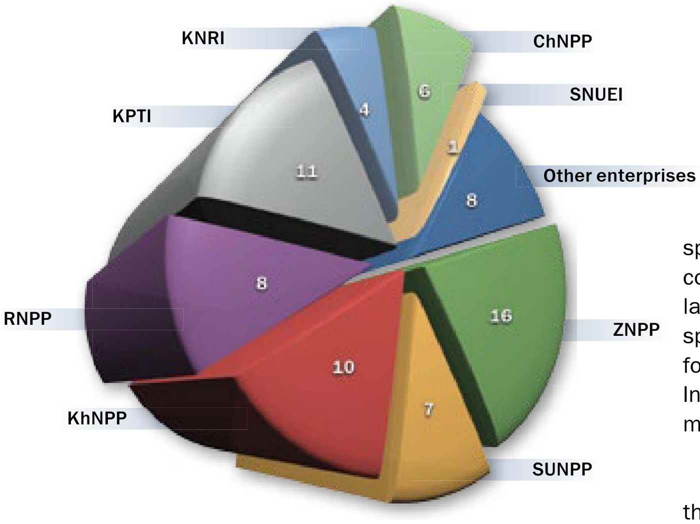
In 2009, to implement the Safeguards Agreement and Additional Protocol, the SNRCU communicated every day with the IAEA: sent information on nuclear materials (134 reports) and information to update Ukrainian's declarations as required by the Additional Protocol (54 declarations), arranged and planed inspections in Ukraine (71 inspections – see Figure 1), submitted schedules for repairs, reactor refueling, transport of nuclear materials, etc., as well as sent preliminary notifications on export/import of nuclear materials (10).

In accordance with the Additional Protocol, information is verified by means of additional access of IAEA inspectors. Distribution of additional accesses for 4 years of applying the Additional Protocol is presented at Figure 2.

At the end of October, the Head of the IAEA Safeguards Department who is directly responsible for implementation of safeguards in Ukraine, headed by the Director of the Division of Operations C, Mr. Nobuhiro Muroya, visited Ukraine.

The IAEA Delegation met the top management of the SNRCU, the Ministry for Fuel and Energy, the Ministry

Figure 1. IAEA inspections in Ukraine

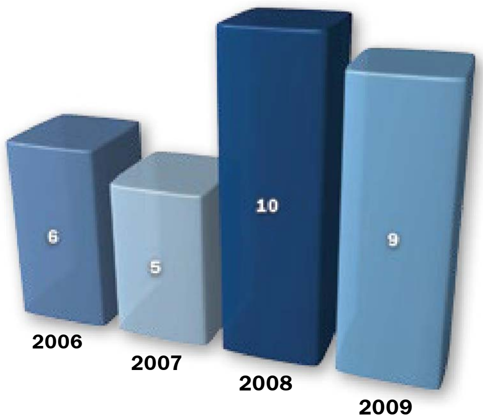


of Foreign Affairs, the Ministry for Emergencies, NAEK Energoatom. During the visit, key issues on implementing the Safeguards Agreement and Additional Protocol were discussed. In particular, in the IAEA's opinion, the information on research and development not related to the use of nuclear materials, on former locations and maintenance of the USSR nuclear weapons should be supplemented.

Changes in the legislation on nuclear non-proliferation will promote the solution of SSAC priority and pressing issues in the next year, in particular:

- *creation of a system for measuring nuclear material at NPPs;*
- *operation of the system for remote monitoring at NPPs to reduce IAEA inspection efforts;*
- *introduction of a system for training and professional development of staff responsible for keeping the system for accounting and control of nuclear materials.*

Figure 2. Number of additional accesses as required in Additional Protocol
(with 2- and 24-hour preliminary notification)



Moreover, improvement of the quality of state inspections to inspect the system for accounting for and control of nuclear materials at enterprises, in particular development of a methodology for SNRCU state inspections is identified to be one of the main activities for the next year. NPP inspectors and SNRCU Regional Inspectorates will be involved in the development of the methodology for state inspections.

In accordance with the Procedure for interaction of the executive authorities with legal entities dealing with nuclear energy use approved by Cabinet Resolution No. 813 of 2 June 2003, when radionuclide radiation sources were detected in illicit use, the SNRCU continued information exchange with the IAEA Database on illicit use of nuclear and other radioactive materials. In 2009, the SNRCU sent information on eight incidents with illicit use of radioactive material in Ukraine to the IAEA Databases: 2 events of detecting nuclear material (product made of depleted uranium), 4 events of

Detected capsule with plutonium used for smoke indicator powering

Cask for radioactive material withdrawn from citizens in the village Zalischyky of the Ternopil region

detecting radiation sources and 2 events of detecting products and scrap metal contaminated by natural radioactive substances.

To improve interaction between enterprises, establishments and the public, when radioactive material is detected in illicit use, in 2009, the SNRCU revised and amended the abovementioned Cabinet Resolution. In so doing, both the experience gained in Ukraine and recommendations of international experts presented in the Report of the IRRS Mission carried out by the IAEA in Ukraine in 2008 were taken into account.

Transport
Of Radioactive Material

Radioactive material is transported for energy, industrial and medical needs, during radioactive waste management and transit of nuclear fuel (henceforth – NF) through the territory of Ukraine territory.

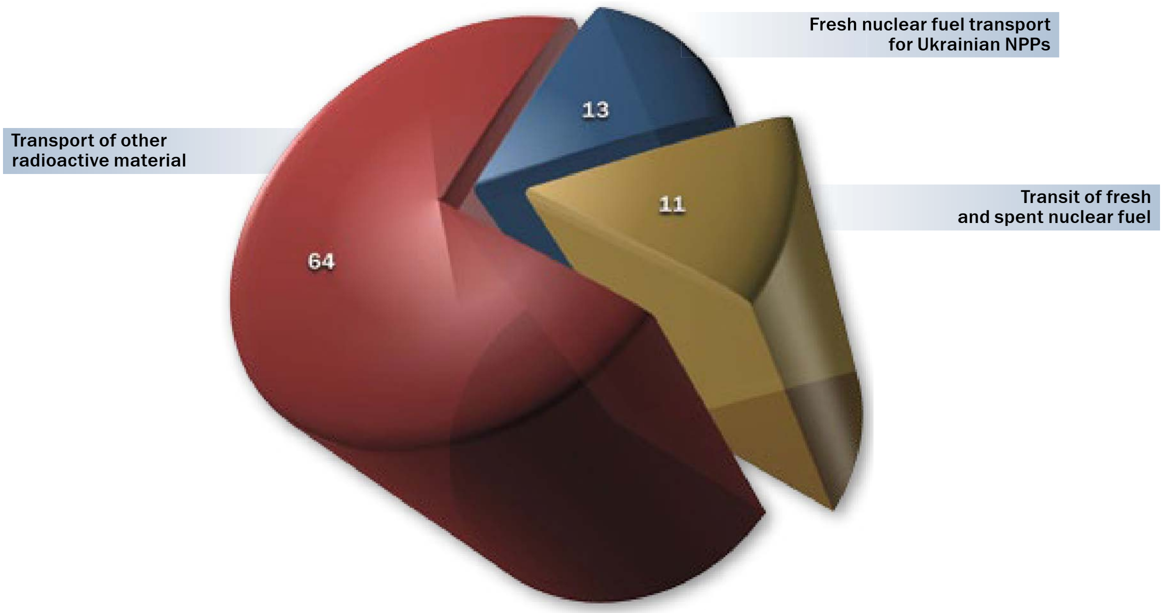
In 2009, the SNRCU issued 88 permits for international transport of radioactive material, in particular:

- *transport of fresh NF for Ukrainian NPPs – 13 (including 1 permit for transport of defective fresh fuel from ChNPP to Russia);*
- *transit of fresh nuclear fuel from Russia to Slovakia, Hungary and Bulgaria and spent nuclear fuel from Bulgaria to Russia – 11;*
- *transport of other radioactive material – 64.*

The SNRCU issues licensees for transport of nuclear material. As of the end of 2009, 40 enterprises and organizations in addition to its main activities transport radioactive material and obtained appropriate licensees. As of the end of 2009, 40 enterprises and organizations received licenses for transport of radioactive material: nuclear energy – 1 enterprise; gamma-ray flow detection – 4; radioactive waste management – 11; geological research – 10; scientific activity – 3; ports – 2; medicine – 1; others – 8 enterprises. The following enterprises undertake the greatest scope of radioactive material transport: NAEK Energoatom, Eastern Ore Mining and Milling Enterprise, Ukrainian State Isotope Production Enterprise, State Interregional Specialized Enterprises of Ukrainian State Radon Association, Ukrgeofizyka State Enterprise, State Complex Specialized Enterprise. In 2009 the State Nuclear Regulatory Committee of Ukraine granted and reissued 11 licenses.

In 2009, eight certificates on approval of packaging design and special shipments of radioactive material transport were granted and reissued.

In 2009, one incident occurred during uranium ore transport, when railway transport ran off the rails. This incident had no detriment to the public health and did not cause environmental containment.



International Cooperation

Ukraine's international cooperation in the peaceful use of nuclear energy and nuclear and radiation safety is aimed at attaining world standards in safe operation of power units throughout their lifecycle based on multilateral and bilateral international treaties and agreements.

Multilateral international cooperation is conducted within international organizations to which Ukraine is a member, multilateral international treaties, conventions, agreements, etc., signed or joined by Ukraine, and also international programs and projects.

COOPERATION WITH IAEA

During 2009, in the framework of Technical Cooperation Program for 2009-2001, Ukraine implemented five national projects on decommissioning of the Chornobyl NPP power units and radioactive waste management on its site, including the Shelter; implemented plans on long-term NPP operation; modernized radiotherapy services with the purpose to implement the tree-dimensional radiotherapy and plan medical treatment with the help of visualization; improved nuclear and radiation safety infrastructure, improved knowledge management in the nuclear field.

The national training course Radiation Protection and Safety of Resources was conducted in the framework of the national project for improvement of nuclear and radiation infrastructure in Ukraine. 25 representatives of SNRCU regional inspectorates for nuclear and radiation safety participated in it.

Projects in the field of nuclear medicine are successfully implemented. So, new up-to-date equipment, such as a rotating gamma camera with two OFET detectors, dosimetric calibrator and packing unit for radiopharmaceuticals, was installed and commissioned at the National Institute of Cancer in 2009.

Equipment for Chornobyl NPP (pumps, filters, thermostats, heat exchanger and auxiliary equipment) has been received in the framework of the national IAEA project on Chornobyl decommissioning.

Ukraine takes part in 52 regional and inter-regional IAEA projects in all strategic areas of regional cooperation:

- *nuclear and radiation safety;*
- *nuclear energy;*
- *human health;*
- *application of isotope and radiation technologies.*

Jointly with the IAEA, Ukraine carried out a number of measures during 2009 in the framework of the above projects. So, a seminar PSA Harmonization organized by the NAEK Energoatom took place in February. The regional seminar Self-Assessment Process for Continuous Improvement of Regulatory Authorities was carried out in June with support of the SNRCU. The training course Use of Electronic Registry of Heavily Contaminated Territories, co-organized by the National University of Biological Resources and Nature Use, was conducted in September. During this training course, the issues related to rehabilitation of the territories affected by consequences of the Chornobyl accident were highlighted.

During 2009, around 180 representatives of Ministries and authorities of Ukraine, state enterprises and medical institutions took part in IAEA measures (technical meetings, seminars, conferences, training courses, etc.) conducted in Ukraine and abroad.

COOPERATION WITH EC

An important role in international cooperation belongs to international technical assistance provided by the European Commission in the framework of Technical Assistance to the Commonwealth of Independent States (TACIS) Program.

Projects in areas such as development of regulatory documents and inspection procedures for commissioning new nuclear facilities, support to the regulatory authority in assessing safety analysis reports for operating NPP units, support to the regulatory authority in licensing activity as regards projects financed by TACIS/NSA, construction of Chornobyl NPP decommissioning facilities, support to the regulatory authority in assessing probabilistic safety analysis (PSA) of NPP units, assistance in licensing of activity on processing of NPP radioactive waste, etc., were implemented in 2009 in the framework of the above-mentioned program.

During the reporting period, a new project aimed at institutional and technical cooperation with the SNRCU to develop its capabilities on the basis of the European safety principles and practices was started.

In order to summarize interim results of TACIS projects, the annual meeting of TACIS program participants Summer Event was held in July. In the course of the meeting, the status of each project was analyzed, appropriate changes to current plans and schedules were made, redistribution and allocation of additional funds to finance the projects were discussed.

The procedure of signing the Agreement on financing the Annual Action Programme for Nuclear Safety under the new instrument for nuclear safety cooperation (INSC), which replaced the TACIS program, was completed in 2009. According to the Agreement, a number of projects aimed at licensing of radioactive waste facilities and validation of soft on-site assistance (NPP level) and introduction of the RODOS system in the Information and Technical Center of Ukraine will start in 2010.

TAIEX (Technical Assistance Information Exchange) is an important instrument of external assistance provided by the European Commission for information exchange to develop institutional capabilities needed for adapting the national legislation to aquis communautaire.

The SNRCU conducted three seminars in the framework of TAIEX in 2009:

1. Preparedness and response to nuclear and radiation accidents, GR-2 and Directive of the European Community Council of 27 November 1989 86/618/EURATOM on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency.

2. Familiarization with EC approaches and experience on NPP design lifetime extension.

3. Familiarization with EC approaches and experience in licensing new NPP units. European safety requirements for new NPP units.

Experts from regulatory authorities and technical support organizations of France, Germany, Bulgaria, Hungary, Czech Republic, Romania, and Finland took part in the seminars. They familiarized Ukrainian audience with the legislative framework of their states and with the gained experience in nuclear and radiation safety.

97 Ukrainian representatives of central executive bodies and research institutions took part in the seminars.

COOPERATION WITH GERMANY

Cooperation between Ukraine and Germany in the field of nuclear and radiation safety regulation continues for many years.

The project Scientific and Technical Experience Exchange with Regulatory Authorities of Central and Eastern Europe and Middle Asia is being implemented jointly with GRS and BMU. During 2009, international working meetings were carried out to exchange experience in important issues such as interaction of authori-

ties, financial and organizational support of national systems for training and professional development of personnel of nuclear research organizations; comparison of approaches and experience exchange on NPP safety reviews; rehabilitation of old radiological contamination from mining plants, etc.

A project for improvement of physical protection of the Isotop Company and creation of a hot chamber was prepared during the reporting period in the framework of the Global Partnership Initiative to reduce the number of transportations of radiation sources. The project activities will be started in 2010 under support of the German Ministry for Foreign Affairs.

The project Decommissioning of Radiation Installations and Assurance of Safe Storage of Radiation

Sources in Ukraine was performed in 2009 with support of the Federal Ministry of Germany for Ecology, Environment Protection and Reactor Safety (BMU) and with participation of experts from the Association for Installation and Reactor Safety (GRS mbH)

In the framework of this project, technical assistance to specialized enterprises UkrDO Radon and UDVP Isotop is provided for removal, dismantling, packing, transportation and acceptance of spent radiation sources from bankrupt enterprises for long-term storage.

COOPERATION WITH FRANCE

In February 2009, the SNRCU Chairperson visited France with a working visit to discuss further cooperation with the nuclear regulatory authority (ASN) of the French Republic. The SNRCU Chairperson, Olena Mykolaichuk, and the ASN President, Andre-Claude Lacoste, signed the Agreement on technical information exchange and cooperation in the field of nuclear safety and radiation protection.

The SNRCU Chairperson Olena Mykolaichuk and the ASN President Andre-Claude Lacoste signed the Agreement

In February 2009, a working meeting was held, and the Agreement on cooperation in the field of nuclear safety and radiation protection was signed between the SNRCU and Institute of Radiation Protection and Nuclear Safety of France (IRSN).

To fulfill agreements reached in December 2009, IRSN experts conducted a seminar Safety of Nuclear Fuel Cycle Facilities in Kyiv, in which representatives of the regulatory authority and scientific organizations took part.

COOPERATION WITH SWEDEN

Cooperation with Sweden is carried out on the basis of the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Kingdom of Sweden on Early Notification of Nuclear Accidents and Information Exchange on Nuclear Installations and the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Kingdom of Sweden on General Terms of Technical and Financial Cooperation.

The SNRCU takes part in projects on improvement of Ukrainian legislation in the field of nuclear safety; reduction of risks caused by radon and natural radiation; improvement of regulatory documents in the field of physical protection; quality assurance control in medical radiology; emergency response.

The SNRCU Chairperson Mrs. Mykolaichuk and the National Nuclear Energy Commission of Brasil Chairperson Mr. Gonsalvesh are signing the Protocol on intentions

During 2009, in order to initiate and implement joint projects, the SNRCU and SSM experts conducted a number of working meetings, in particular:

- *a working meeting was held in Kyiv in February involving representatives of regulatory authorities of both countries to discuss results of the joint projects implemented in 2008 and plans of cooperation for 2009-2010 in the radiation safety field;*
- *delegation of the Swedish International Development Cooperation Agency (SIDA) visited Kyiv in May. The objective of the visit was to discuss issues related to Sweden's assistance and support in bilateral cooperation with Ukraine in the field of radiation protection of the environment;*
- *in October 2009, Ukrainian delegation took part in a seminar and scientific visit in Sweden to review long-term safety and monitoring of radioactive waste and spent nuclear fuel repositories in deep geological formations;*
- *from 30 November to 4 December 2009, the second training course Practical Training on Methods of Safe Management, Identification and Measurement of Nuclear, Radioactive Materials, Radiation Sources Using Devices and Non-destructive Analysis Methods was held at the George Kuzmich Training Centre for Physical Protection, Accounting and Control of Nuclear Materials with assistance of SSM.*

COOPERATION WITH BRAZIL

Meeting with delegation of the National Nuclear Ener gy Commission of Brazil headed by its Chairperson, Mr. Gonsalvesh, took place during the visit of the President of Brazil to Ukraine in November 2009.

During the meeting between the SNRCU and the National Nuclear Energy Commission of Brazil, protocol on intentions on cooperation in the field of nuclear safety and radiation protection has been signed, in which the main areas of cooperation and ways of their implementation are defined.

The parties intend to exchange regulatory documents on nuclear and radiation safety, radiation protection, including nuclear fuel cycle issues, decommissioning of nuclear facilities, radioactive waste and spent fuel management, security of radiation sources, use of radiation sources in medicine, industry and research, management of spent sources; regulatory procedures and methods of safety assessment, approaches to regulatory oversight and inspection of nuclear facilities, emergency preparedness and response in case of a nuclear accident.

This document has become the first step in development of Ukrainian-Brazilian relations in the field of nuclear energy use.

COOPERATION WITH THE UNITED STATES OF AMERICA

Cooperation with the United States of America in the field of nuclear and radiation safety regulation is based on the Agreement between the Government of Ukraine and the Government of the United States on Operational Safety Enhancement, Decreasing Risk of Operation, and Strengthening the System of Regulation of Civil Nuclear Installations in Ukraine of 25 October 1993.

The objective of cooperation in accordance with the Agreement is to develop consistent and effective safety standards and procedures to be used by the regulatory authority of Ukraine. Cooperation involves study of regulatory methods and procedures, technical means of inspection and assessment, regulatory legislation; improvement of regulation effectiveness by developing corresponding regulatory standards, requirements, procedures etc.

Measures under the modernization program for physical protection systems at radioactive waste management enterprises and in medical institutions using radiation sources for medical treatment of oncological patients lasted in 2009. The program is implemented in Ukraine with the assistance of the Department of Energy in accordance with the Implementing Agreement between the US Department of Energy and SNRCU on cooperation for safety of useable radiation sources in Ukraine of 23 June 2006.

COOPERATION WITH THE REPUBLIC OF AZERBAIJAN

In 2009, cooperation with the Republic of Azerbaijan was invoked. It is conducted to fulfill the Agreement between the State Nuclear Regulatory Committee of Ukraine and the Ministry for Emergencies of Azerbaijan on Cooperation in the Field of Radiation Safety of 7 September 2006 and Memorandum on Cooperation and Mutual Assistance in Nuclear and Radiation Safety between Member Countries of the Organization for Democracy and Economic Development GUAM of 19 June 2007.

So, in April 2009, the SNRCU Chairperson together with IAEA experts visited Azerbaijan (Baku) to take part in bilateral consultations, including those in the framework of the above-mentioned agreements.

In October 2009, representatives of the State Agency on Regulation of Nuclear and Radiation Activity of the Ministry for Emergencies of the Republic of Azerbaijan visited Ukraine. The delegation was headed by the Chairperson of the State Agency, Siyavush Azakov. The visit was aimed at familiarization with nuclear and radiation safety regulation system in Ukraine, existing regulatory framework; organization of international cooperation; strategic areas in development of nuclear and radiation safety; bilateral cooperation issues, including information and experience exchange on a permanent basis; participation of Azerbaijan specialists in conferences, seminars, round tables organized by the SNRCU, and also training for Azerbaijan regulatory authority experts in the SNRCU.

COOPERATION WITH THE RUSSIAN FEDERATION

Cooperation between the regulatory authorities of Ukraine and the Russian Federation entered into a new phase in 2009.

During the working visit to the Russian Federation of the SNRCU Chairperson, Olena Mykolaichuk, a meeting with the Head of the Federal Service for Environmental, Technological, and Nuclear Oversight, Mykola Kutyin, was held in March. During the meeting, the promotion of bilateral cooperation, determination of priority areas for information exchange and consultations at the level of technical support organizations were discussed.

The discussion of priority areas of cooperation continued during the visit of Rostekhnadror Head, Mykola Kutyin, to Ukraine in June 2009.

In November, a working meeting between representatives of the State Scientific and Technical Center for Nuclear and Radiation Safety of Ukraine and the Russian Scientific and Technical Centre was held in Kyiv to discuss the safety of operating and new nuclear power units and was the first measure in pursuance of the reached agreements.

The technical meeting conducted on 3 December 2009 between a greater number of Ukrainian and Russian experts to discuss WWER lifetime extension was an important stage in development of the cooperation.

Public Relations

In 2009, the Pool Basic Issues of Nuclear and Radiation Safety, Awareness and Information Needs of People from Different Regions of Ukraine was carried out to study the public opinion on the state of nuclear and radiation safety. On SNRCU request, the Public Organization Analytical Center Sotsiokonsalting interviewed people residing near facilities with nuclear and radiation technologies.

During the poll, the method of focus group discussions (FGDs) was used. In general, 18 FGDs were carried out in which 128 people of focus inhabited areas were involved.

The poll showed, in particular, that information needs of the public regarding the state of nuclear and radiation safety and other issues under the SNRCU competence were not covered.

Although the public have free access to information on the state of nuclear and radiation safety according to the legislation in force, the knowledge of most people on nuclear and radiation safety is somehow outdated and is affected by imagination and fear caused by the Chornobyl disaster.

Moreover, the public less and less trust the government in connection with social and economic issues, corruption and irresponsibility of state and local bodies.

Taking into account the above factors, the public opinion on nuclear and radiation safety and its assurance at operating NPPs is contradictory, too emotional and critical.

Hence, the poll results demonstrate that most people object to the construction of new power units. Moreover, the inhabitants of the Khmelnitsky and Rivne Regions (with operating NPPs) are most skeptical.

The key arguments of the respondents in favor of construction are new well-paid employment opportunities, greater social benefits and lower electricity rates.

The public are also negative about the intentions to extend lifetime of operating nuclear power units.

The FGD participants have doubts that governmental decisions concerning the development of nuclear energy can actually be influenced.

At the same time, the public show interest in prospective energy sources, advantages and risks of the existing energy production methods, state of nuclear and radiation safety, safety rules in the event of radiation releases/contamination, etc.

The results confirm that the state policy in informing and involving the public in the decision-making process is inefficient and has to be revised.

Based on the analysis, experts developed recommendations to improve the existing situation. After familiarizing with the results, the SNRCU developed and started measures to update the system of informing the public on nuclear and radiation safety.

To analyze the quality of services provided in 2009, the SNRCU introduced a questioning procedure for its licensees, entities that deal with nuclear energy use. On 13 August 2009, the SNRCU issued Order No. 124 On Analyzing Licensees' Satisfaction. This Order establishes the format of a questionnaire for the licensees and determines the questioning procedure.

From August to December 2009, 15 questionnaires were submitted by licensed entities and 4 by licensed individuals. All licensees involved in questioning assessed the SNRCU licensing efforts as 'good' and 'very good'. Licenses are issued within a time period established in regulatory and legal documents. No comments were made on the SNRCU's advice provided to personnel to obtain licenses. All licensees were satisfied with the objectivity of the Licensing Commissions for entities and individuals.

On 5 December 2009, the SNRCU traditionally celebrated its 9th anniversary by conducting the International Annual Topical Meeting on Nuclear and Radiation Safety.

In 2009 the Meeting took place in cooperation with the Swedish Radiation Safety Authority (SSM).

Presentations of the public occupied the central place. In particular, Ms. Valйrie Demet, a representative of the French National Association of Local Information Commissions (ANCLI), opened the Meeting with the presentation Aarhus Convention and Nuclear Energy.

Four panel discussions took place at the Meeting, in particular:

- *Lessons Learnt from Comprehensive Safety Evaluation Using IAEA Safety Review Services*
- *Emergency Preparedness*
- *Safety of Spent Fuel*
- *Lifetime Extension of NPP Units.*

In the first discussion, the Deputy Minister for Fuel and Energy of Ukraine,

Ms. Nataliya Shumkova, presented the prehistory, lessons and results of the Ukraine-EU-IAEA joint project. The Director General of the Khmelnitsky NPP, Mr. Mykola Panaschenko, expressed his opinion on lessons, finding and future actions of the operating organization resulting from the IAEA safety assessment missions. The regulator's opinion in this regard was expressed by Mr. Sergii Bozhko, SNRCU Deputy Chairperson. Mr. Antonio Godoy, an IAEA representative, expressed the Agency's opinion on the efficiency of the approach to comprehensive safety assessment of NPPs and prospects of its use.

While discussing the NPP safety assessment results using IAEA missions, the participants pointed out that this was the first time such an effort was carried out at all Ukrainian NPPs. Owing to the missions, Ukrainian experts and IAEA representatives gained invaluable experience, which will undoubtedly contribute to the improvement of nuclear safety culture.

Speeches under the discussion on emergency preparedness were presented under the common topic Lessons Learnt from the Chornobyl Accident. The representative of the Chornobyl Center, Mr. Valery Glygalo, informed on early public notification of the Chornobyl accident, the system of emergency response in the former USSR and causes that prevented the actuation of this system in 1986. The Director of the Institute for Hygiene and Medical Ecology, Prof. Andrii Serdyuk, informed about medical actions after the Chornobyl accident and analyzed the lessons learnt. The findings of the All-Russian Medical Center of Catastrophes concerning the modernization of the medical component of the emergency response system were presented by Mr. Grygorii Avetysov.

The Head of the SNRCU Emergency and Response Center, Mr. Oleksii Ananenko, analyzed lessons of the last incidents in view of efficiency of the emergency preparedness system. Mr. Steve Gussin, a representative of the Swedish Radiation Safety Authority (SSM), shared the relative Sweden experience.

The discussion on spent nuclear fuel safety started with the presentation of Zaporizhzhya NPP experience. Ms. Gabriela Bejarano (SSM) shared the Sweden experience in safety and responsibility for storage of spent nuclear fuel over a long period. Mr. Volodymyr Bronnikov, Director General of Atomproektengineering, a representative of NAEK Energoatom, presented the strategy and medium-term plans of NAEK Energoatom to ensure spent nuclear fuel safety.

The audience was very impressed by the speech of Mr. Sergiy Kurykin, Head of the SNRCU Public Council. He explained why Ukrainian people worry about spent nuclear fuel. The main conclusion of his speech was that the public were not sufficiently informed of this issue and that a continuous dialogue with the community and its leaders was needed.

The panel discussion on NPP lifetime extension logically unified the issues raised in the three abovementioned discussions.

Mr. Andriy Dementiev, a representative of the Rosenergoatom Concern, shared experience of the Russian Federation in extension of VVER lifetime. The SNRCU representatives illuminated the regulatory policy in lifetime extension of NPP power units. Experts of the Rivne NPP provided preliminary results and prospects for extending the operation of Rivne NPP units 1 and 2 beyond the design lifetime.

Mr. Dmytro Khmara, the coordinator of the National Ecological Center of Ukraine, expressed the public opinion about NPP lifetime extension. A frank and interesting discussion with public representatives demonstrated that society expected more openness and transparency on the raised issues from the operating organization and state bodies.

The Forth International Meeting on Nuclear and Radiation Safety will focus on the use of nuclear energy in the light of the Aarhus Convention. All interested public organizations are invited to prepare the program and participate in further discussions. Proposals and questions are welcomed by phone (044) 254-34-49 and e-mail kozulko@hq.snrc.gov.ua.

Annex

Appendix 1

RADIATION ACCIDENTS AND INCIDENTS WITH RADIATION SOURCES

In 2009, according to SNRCU request, the O.M.Marzeev Institute for Hygiene and Medical Ecology, Academy of Medical Sciences of Ukraine, carried out a statistical and technological analysis of radiation accidents and incidents in Ukraine since 1989 to 2009.

381 radiation accidents and incidents in 22 administrative territories of Ukraine were recorded within this period. Table 1 shows the distribution of radiation accidents and incidents for administrative territories and indicate their causes.

Most radiation incidents (52.6%) are related to detection of contaminated scrap metal (or detection of radiation sources in scrap metal). Other cases are related to theft of radiation sources (30.7%), loss of radiation sources (5.5%), improper operation of equipment with radiation sources (4.9%) and illicit circulation (3.6%) of radiation sources.

The cases of detecting contaminated scrap metal are most often related to probable entrance of equipment from oil and gas processing facilities (pump compressor pipes contaminated with natural radionuclides),

Table 1

Administrative territory	Accidents and incidents in total	Theft	Loss of source	Contaminated scrap metal	Illicit circulation	Loss of source integrity	Absence of reliable physical protection system	Improper operation of equipment with radiation sources
AR of Crimea	1	1	–	–	–	–	1	–
Vinnytsya Region	11	7	–	1	2	–	–	1
Dnipropetrovsk Region	31	7	2	17	–	3	–	2
Donetsk Region	169	38	7	113	1	4	–	6
Zhytomyr Region	5	1	–	3	1	–	–	–
Zaporizhzhya Region	31	4	–	26	–	–	–	1
Kyiv Region	4	2	–	–	2	–	–	–
Luhansk Region	25	17	–	4	1	–	–	3
Mykolayiv Region	8	5	2	1	–	–	–	–
Odesa Region	9	–	–	7	1	1	–	–
Poltava Region	18	2	2	9	–	–	–	5
Rivne Region	1	1	–	–	–	–	–	–
Sumy Region	3	3	–	–	–	–	–	–
Kharkiv Region	14	3	2	8	1	–	–	–
Kherson Region	9	–	2	5	2	–	–	–
Khmelnytsky Region	1	1	–	–	–	–	–	–
Cherkasy Region	9	6	1	1	–	–	–	1
Chernivtsi Region	4	3	–	–	1	–	–	–
Chernihiv Region	11	5	2	2	–	1	–	–
The city of Kyiv	15	6	–	4	2	1	2	–
Ternopil Region	–	–	–	–	1	–	–	–
Luhansk Region	–	–	–	–	1	–	–	–
Total	**381**	**112**	**20**	**202**	**16**	**9**	**3**	**19**

coal mines (water discharge piping) and former uranium mining and milling enterprises (equipment contaminated by uranium radionuclides) into scrap metal.

Unfortunately, overexposure of people occurred in the radiation accidents in Ukraine within the above period, namely:

1. In 1989, mother and two children died in the family that was the first to get an apartment in the town of Kramatorsk. Another family that settled in that apartment lost an 11-year-old son because of cancer and a younger son and father became seriously ill. Doctors could not reveal the cause of their illness. The radiation accident was detected only after a resident of the apartment made a request to the local health and epidemiological station. A radiation source with cesium-137 was detected in a wall in the apartment. The gamma exposure dose rate on its surface was 1800 R/h. After removing a part of the wall, gamma background in these apartments was 25 to 30 μR/h.

As of 12 December 1989, activity of the detected cesium-137 source of IGI-Ts-4 type was $4.22 \cdot 10^{+10}$ Bq. It was established that radiation sources of this type were used in radioisotope monitoring devices. The radiation source fell out of the level meter that was lost 10 years ago at the Karansky open pit mine and was packed together with crushed rock into a panel plate of the wall.

The main cause of this accident is failure to assure radiation source account and control and to follow physical protection rules and poor safety culture at the enterprise.

2. In 1989, a radiation source with cesium-137 with activity of 0.2 TBq fell out from a radioisotope device at the Mykolayiv Silicate Plant. This caused exposure of three individuals to radiation (hands – up to 5 Sv, body – up to 0.03 Sv).

3. In 1992, interlock of power supply to the x-ray tube of an SRM-18 multi-channel device failed at the Volnogorsk Ore Mining and Milling Enterprise (concentration plant, laboratory of automated process control system); this resulted in exposure of one individual (acute radiation damage of the left hand).

4. In 1992, a radiation accident was recorded in the village of Moyivka in the Vinnytsya Region. It resulted in exposure of 8 people, their dose rate was 6 to 78 mSv. The cause of this accident was contamination of buildings and territories of two farms with cesium-137, which was contained in the radioisotope devices stolen in 1969 at the Moyivka Sugar Mill. The detected sources were transferred to the UkrDO Radon Kyiv Interregional Specialized Plant for disposal. The contaminated territory was decontaminated with partial removal of soil.

5. In 1998, a Phillips Polydiagnost x-ray unit was in operation for 6 years in the Donetsk Region, Diagnostic Center DOLKO, in the Endovascular Surgery Department without permission of the state health and safety bodies and appropriate protection. Personnel doses at workplaces exceeded the permissible levels by 50 to 100 times.

6. In 1998, two radiation sources were detected in the city of Zhmerinka. One individual was exposed to 3 mSv.

7. Exposure of patients over boundary levels was revealed at the Zaporizhzhya Regional Oncologic Center in 1995 due to the missing filter on the rontgenotherapy apparatus.

8. In 1998, personnel exposure over boundary levels was detected at the Zaporizhzhya NPP because a source was stuck in the guide tube of a gamma flaw detector.

Adverse effect of radiation accidents on the environment:

1. A radiation accident that affected the largest area in Ukraine was recorded on 15 July 1989 in Taromske (the city of Dnipropetrovsk) at Shevchenko Street. A group of geologists from the Kirovgeologiya Production Association detected several locations of contaminated soil with activity from 120 to 40 000 μR/h at the area of about 800 m^2 on the roadway and territory of seven private farms. The roadway, front gardens, homestead lands and yard structures of houses No. 36 and 38 were within the area of radioactive contamination by cesium-137. The contamination was mainly caused by the loss of integrity of two cesium-137 sources, which were delivered together with blast-furnace slag in 1964 or 1965. At a distance of 10 cm from the surface of the source, the dose rate was 50 R/h (according to the Dnipropetrovsk Regional Health and Epidemiological Station). These sources were transferred to the UkrDO Radon Dnipropetrovsk Interregional Specialized Plant.

Resulting from decontamination, about 900 m^3 of contaminated soil was transferred to radioactive waste disposal points. Non-military civil protection groups, chemical protection company, motor transport enterprises and experts of radiological departments of local and regional health and epidemiological stations were involved to mitigate the accident.

Medical examination of 273 people revealed no radiation pathologies.

2. In the Kharkiv Region in 1995, local radioactive soil contamination was detected at the territories of the former Medik and Lisovi Zori pioneer camps near the

Kharkiv–Belgorod highway. The exposure dose rate was in a range from 300 μR/h to 26 mR/h. Soil samples taken for analysis contained radium-226. About 20 m^3 of contaminated soil was transferred to the Kharkiv State Interregional Specialized Plant. No exposure of personnel and the public was recorded.

3. A radiation contamination spot up to 1 m^2 was detected in the Poltava Region at the territory of the Ukrainian Medical Stomatological Academy. Gamma spectrometry revealed radium-226 with activity up to 5500 Bq/kg in the soil sample. During the decontamination of the territory carried out by radiological department experts, up to 3 m^3 of contaminated soil was removed. The radioactive contamination of this territory was probably because an oncologic center that used radium drugs was previously located there. The radioactive soil was transferred to the Kharkiv Specialized Plant.

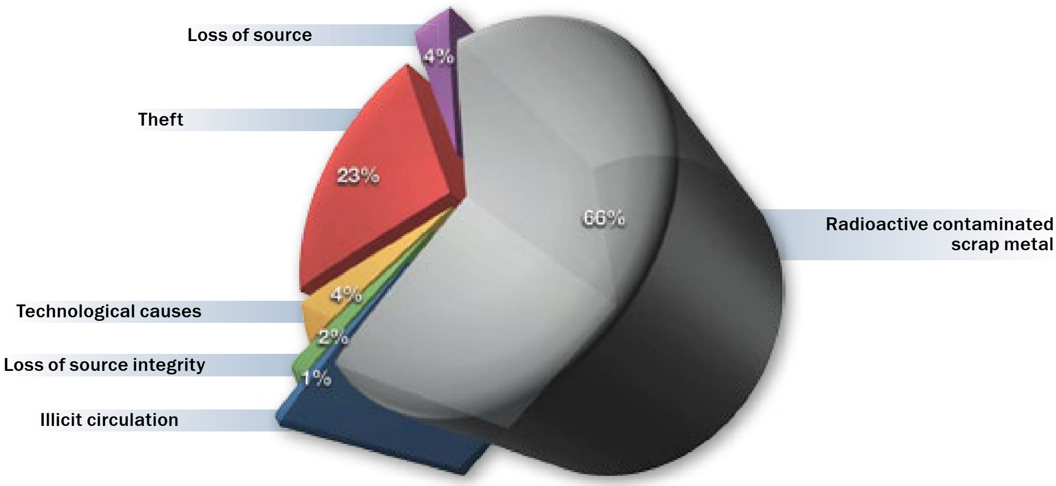
4. On 17 April 2007, areas with gamma radiation of 3 mR/h were detected at the unauthorized industrial waste disposal dump located near the village of Illichivka in the Kostyantyniv District, Donetsk Region. The source of contamination was cesium-137.

In 2008, UkrDO Radon experts, with participation of departments of the Ministry of Emergencies of Ukraine, made efforts to bring this industrial waste disposal dump into a safe state. Experts of the UkrDO Radon Donetsk, Kyiv, Dnipropetrovsk and Kharkiv Specialized Plants were involved in the work.

During these activities, 36 containers KZ TRV-1-2-04 and one container KTNS-2 (37 containers in total) were filled. The total weight of contaminated slag from this disposal dump is about 100 tons with the total activity of $3.46 \cdot 10^{+11}$ Bq. The removed slag was loaded into certified containers and sent to the UkrDO Radon Dnipropetrovsk Specialized Plant for disposal. The average specific activity of the radioactive slag is 10^{+5}-10^{+7} Bq of cesium-137.

These activities were performed both with use of a remote control system and manually. The remote control system was used in places of the highest contamination.

Figure 2



Most radiation incidents were registered in the Donetsk Region. Figure 2 shows the distribution of causes of these radiation accidents and incidents (169 cases) in the Donetsk Region.

In 66% of these cases, contaminated metal scrap was detected at metallurgical plants in the Donetsk Region with the help of RPS Kordon dosimeters. 38% of the cases are related to theft of radiation sources, which is evidence of inadequate/improper physical protection of the sources, liquidation of industrial enterprises, unsatisfactory radiation safety at coal mines, etc.

Increase in the number of radiation accidents related to the loss of integrity or other technological causes in gamma therapy units using high-level radiation sources is of special concern. Such cases were recorded in 2007-2009 in medical establishments in the Donetsk, Ivano-Frankivsk, Kryvy Rih, Chernihiv Regions, the city of Kyiv and the Autonomous Republic of Crimea. These accidents are primarily caused by the failure to assure timely replacement, repair and periodical maintenance of gamma therapy units.

Appendix 2

RECOMMENDATIONS FOR THE PUBLIC IN CASE OF DETECTING A SUSPICIOUS ITEM THAT MAY BE A RADIATION SOURCE TO MINIMIZE THE RISK OF EMERGENCY EXPOSURE

- *Never take an attractive metal item and hold it in hands. Any equipment that may look valuable can be lethally hazardous if it contains a radiation source;*
- *In detecting suspicious items with radiation hazard signs, do not dismount them, inform immediately law-enforcement bodies, state inspectorates on nuclear and radiation safety, local health and epidemiological station and local executive authorities;*
- *Apply to the SNRCU or state inspectorates on nuclear and radiation safety for consultation regarding the interpretation of caution signs, labels and marking on suspicious items;*
- *If your skin is burnt without an obvious cause, consult a doctor.*

Radiation sources are marked as follows:

'Trefoil' – an official international symbol of radiation used for marking of sources, casks or devi ces. In addition to the trefoil symbol, the word 'radioactive' may be written. Other inscriptions that inform on the level of radiation or the type of protective cask for transport of sources may be given.

A new caution sign that warns of radiation hazard is a red triangle with radiation waves, a skull and a running man. This sign was introduced by the IAEA in 2007 in addition to the conventional international symbol of radiation hazard, the black-and-yellow trefoil.

This caution sign is intended for sources of categories 1, 2 and 3 according to the IAEA classification. They cover hazardous sources that may cause death or severe injury of health, including equipment for irradiation of food stuff, radiotherapy equipment for cure of cancer and industrial equipment containing radiation sources.

This sign should be placed on equipment containing such a source to warn of the risk in dismounting the device or approaching it. It will remain invisible in normal operation of the equipment and will prevent an attempt to dismount it. The sign will not be put on entrance doors in buildings, transport packages or casks.

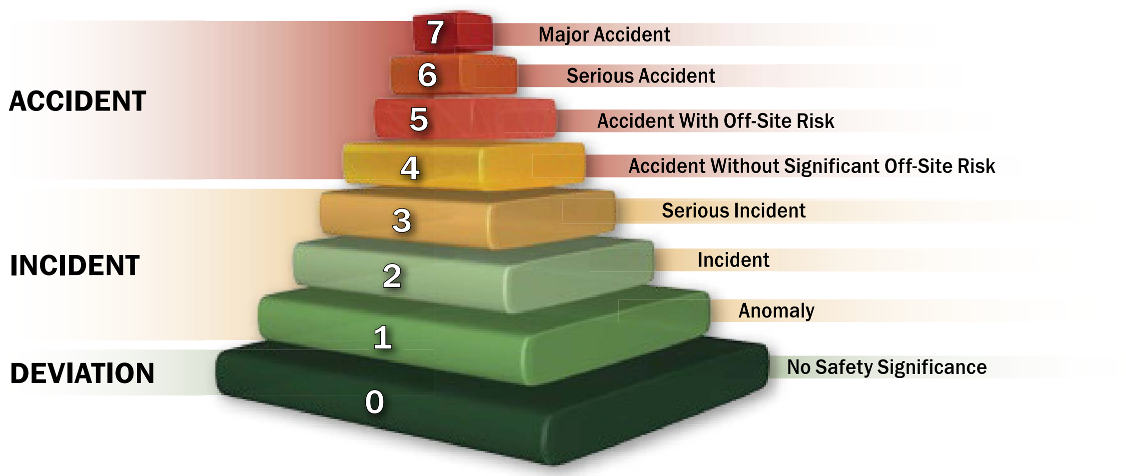
Appendix 3

RECOMMENDATIONS FOR PERSONNEL TO MINIMIZE THE RISK OF EMERGENCY EXPOSURE

- *During activities in rooms with radiation sources, perform periodic measurements of radiation at workplaces;*
- *Never hold a radiation source without shielding in hands;*
- *Always check the dose rate and contamination before activities with radiation sources;*
- *At the territory with probable presence of a radiation source, always carry a direct-reading dosimeter with audible alarm with you;*
- *Make sure that you are aware of the correct use of dosimetric monitoring devices;*
- *Be especially careful with radiation sources, especially those that have signs of damage;*
- *During activities with a radiation source, make sure that the area around the source is fully isolated and controlled;*
- *During activities with radiation sources, make sure, through radiation measurement, that its interlocking device is operable and the source is shielded;*
- *Never violate safety rules and established procedures for activities with radiation sources;*
- *Do not leave a radiation source without supervision. The rooms where radiation sources are used and stored must be provided with an authorized access system;*
- *Place caution signs written in the local language when radiation sources are transported, stored or used;*
- *Use time, distance and shielding protection as much as possible.*

Appendix 4

THE CLASSIFICATION OF THE EVENTS ACCORDING TO THE INES



According to the INES, events are classified as 7 levels. Events pertaining to lower levels (1-3) are termed 'incidents' and events of upper levels (4-7) are termed 'accidents'. Events of no safety significance are classified at level '0' and are called 'deviations'. Events which are not related to safety are not included into the scale and are considered as 'out of scale'.

For example, the Chornobyl accident in 1986 is classified by level 7 according to the INES, the accident at the Three Mile Island NPP (USA) in 1979 by level 5. The accident that occurred at the Saint Laurent NPP (France) in 1980 resulted in core damage but had no radioactive releases. This event is classified by level 4.

Information on events in different countries may be found on the IAEA website (http://www-news.iaea.org/news), which was developed in 2001 to exchange information within the international information system INES.

Appendix 5

RADIATION PROTECTION OF PERSONNEL AND THE PUBLIC IN MEDICAL USE OF RADIATION SOURCES

In 2009, the SNRCU conducted research and development to analyze national and foreign regulatory and legal framework on radiation protection in medical use of radiation sources, to study the practices of radiation protection in medical establishments of Ukraine and to compare the practice and legislation of Ukraine with those of EU countries.

50 medical establishments with radiological practices, 47 medical establishments with departments of nuclear medicine and radionuclide diagnostics and over 750 medical establishments with radiodiagnosis departments (consulting rooms) were examined.

These activities have been carried out in medical establishments of six administrative territories of Ukraine through dosimetric measurements and analysis of the following:

- *quality control programs during radiotherapy and diagnostics: compliance with radiation protection principles – justification and optimization of medical exposure;*
- *training programs for personnel regarding radiation safety;*
- *development and implementation of standard procedures (sheets) of radiotherapy and diagnostics;*
- *development of national dosimetric sheets for radiotherapy;*
- *national diagnostic (reference) levels in radiodiagnostics and nuclear medicine;*
- *monitoring of medical equipment technical state to carry out procedures of radiotherapy and diagnostics.*

The analysis indicates that there are potential risks related to unsatisfactory radiation protection in medicine.

These risks are due to the use of old therapeutic and diagnostic equipment (over 72%), failure to assure monitoring of dose-related parameters of radiodiagnostic equipment, insufficient training of radiologists, failure to assure quality monitoring of diagnostic and therapeutic equipment, absence of reference levels for diagnostic procedures, failure to assure measurements of doses during radiodiagnostic procedures (the analysis shows that the standard exposure dose may be exceeded by more than 125 times), failure to perform timely maintenance, inadequate qualification in implementing new technologies, etc.

Based on the analysis, proposals regarding the improvement of radiation protection in medical use of radiation sources were prepared and placed on the SNRCU website for public and expert discussion. Urgent issues of radiation protection in medicine are of great importance for the whole international community*.

In 2009, the SNRCU ensured that 21 representatives of medical establishments participated in international workshops, training courses and conferences that took place in different countries to familiarize with international standards and guidelines and international medical community.

A priority area of SNRCU activity in 2009 was observance of recommendations and proposals of the IRRS mission** concerning improvement of radiation protection for personnel and patients in medical use of radiation sources, which was approved by Cabinet Resolution No. 1307-r On Approval of the Plan of Measures on Implementing the Recommendations and Proposals of the IAEA Mission of 8 October 2008.

* *In cooperation with international organizations, particularly, the World Health Organization, the European Commission and the International Radiation Protection Commission, the IAEA developed the website 'Radiation Protection of Patients' http://rpop.iaea.org/RPoP/RPoP/Content/index.htm on pressing radiation protection issues in medicine to inform doctors, patients and technical personnel on the need for radiation protection in case of medical exposure.*

** • *Improving interaction between the SNRCU and the Ministry of Health concerning state radiation safety regulation;*
- *Bringing health and safety rules into compliance with IAEA standards and Euroatom Directives;*
- *Developing state standards for medical equipment with radiation sources, procedures and guidelines for tests for this equipment;*
- *Implementation of a uniform state system for monitoring and account of individual doses.*

Appendix 6

ABBREVIATIONS

ChNPP – Chornobyl NPP
CMU – Cabinet of Ministries of Ukraine
DO – State Association
DSFSF – Dry Spent Fuel Storage Facility
EIC – Emergency and Information Center
ETC – Emergency Technical Center
FE – Fuel Element
HES – Health and Epidemiological Station
IAEA – International Nuclear Energy Agency
ICSRM – Industrial Complex for Solid Radioactive Waste Management
INES – International Nuclear Event Scale
KhNPP – Khmelnitsky NPP
LRTP – Liquid Radioactive Waste Treatment Plant
MFA – Ministry of Foreign Affairs of Ukraine
MFE – Ministry for Fuel and Energy of Ukraine
MHU – Ministry of Health of Ukraine
MIP – Ministry for Industrial Policy of Ukraine
MJU – Ministry of Justice of Ukraine
MUE – Ministry of Ukraine for Emergencies and Public Protection against Chornobyl Catastrophe Consequences
NAEK Energoatom – State Enterprise National Nuclear Energy Generating Company Energoatom
NASU – National Academy of Sciences of Ukraine
NI – Nuclear Installation
NM – Nuclear Materials
NPA – Regulatory Act
NPP – Nuclear Power Plant
NRBU – Radiation Safety Standards of Ukraine
NSC – New Safe Confinement
PSA – Probabilistic Safety Analysis
Radwaste – Radioactive Waste
RNPP – Rivne NPP
RS – Radiation Source
RWDS – Radioactive Waste Disposal Site
SAR – Safety Analysis Report
SE – State Enterprise
SEIAS – State Emergency Informational and Analytical System
SFA – Spent Fuel Assembly
SFSF – Spent Fuel Storage Facility
SIP – Shelter Implementation Plan
SISP – State Interregional Specialized Plant
SNF – Spent Nuclear Fuel
SNRCU – State Nuclear Regulatory Committee of Ukraine
SO – Scheduled Outage
SRW – Solid Radioactive Waste
SSAC – State System for Accounting for and Control of Nuclear Material
SSE – State Specialized Enterprise
STC – Scientific and Technical Council
SUNPP – South Ukraine NPP
UAAS – Ukrainian Agrarian Academy of Science of Ukraine
USSE – Unified State System of Prevention and Response to Man-induced and Natural Emergencies
VSC – Ventilated Storage Container
WWER – Water-Cooled Water-Moderated Power Reactor
ZNPP – Zaporizhzhya NPP

Appendix 7

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. +380 67 695 5350 Tel./fax +380 44 292 0195	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. +380 67 695 5361 Tel./fax +380 362 236 185 Tel. +380 362 637 327	41 S. Bandery Street, 33028 Rivne, Ukraine nordwest_insp@ukr.net
Western State Inspectorate Ivano-Frankivsk	Oksana V. Dzhuranyuk	Carpathian, Ivano-Frankivsk, Lviv, Chernivtsi	Tel. +380 67 695 5347 Tel./fax +380 342 713 426	77 S. Bandery Street, office 103, 76014 Ivano-Frankivsk, Ukraine wsinrs@ukr.net
Southern State Inspectorate Odesa	Serhiy V. Kobylinsky	Mykolayiv, Odesa, Kherson	Tel. +380 67 695 5325 Tel./fax +380 482 344 308	P.O. box 115, 69044 Odesa, Ukraine sginrs@ukr.net
South-Eastern State Inspec-torate Donetsk	Borys P. Zemsky	Donetsk, Zaporizhzhya, Luhansk	Tel. +380 67 695 5427 Tel./fax +380 62 385 8446 Tel. +380 62 385 8447	2 Razenkova Street, 83003 Donetsk, Ukraine sesinrc@ukr.net
Central State Inspectorate Dnipropetrovsk	Olga L. Anischenko	Dnipropetrovsk, Kirovohrad	Tel. +380 67 695 5374 Fax +380 56 377 6499	52 Komsomolska Street 49000 Dnipropetrovsk, Ukraine , Dnepr_insp@i.ua
Eastern State Inspectorate Kharkiv	Viktor T. Pravdyuk	Poltava, Sumy, Kharkiv	Tel. +380 67 695 5358 Tel./fax +380 57 705 4527 Tel. +380 57 705 4528	P.O. box 4619, 61022 6 Svobody Square, Kharkiv, Ukraine vostok_inspect@ukr.net
Crimean State Inspectorate Simferopol	Alla I. Pashentseva	Crimea, Sevastopol	Tel. +380 67 695 5330 Tel./fax +380 652 601 945 Tel. +380 652 543 819	P.O. box 1446, 95000 40M K.Mrksa Street, Semferopol, Ukraine, crimInspyad-besp@ukr.net

Appendix 8

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. +380 44 528 3104	Borys S. Horemykin
1	Registration centre in Rivne	Rivne, Ternopil, Khmelnytsky, Volyn	1 Soborna Street, office 310, 33028 Rivne, Ukraine tel. +380 362 636 181	Larysa O. Khabarova
2	Registration centre in Kyiv	Zhytomyr, Cherkasy, Kyiv, Vinnytsya, City of Kyiv	152 Gorkoho Street, 03680 Kyiv, Ukraine tel. +380 44 528 31 04	Natalia N. Mikhailenko
3	Registration centre in Dnipropetrovsk	Dnipropetrovsk, Kirovohrad	of.442, 52 Komsomolska Street, 49000 Dnipropetrovsk, Ukraine tel. +380 56 372 8013	Dmytro H. Hazhev
4	Registration centre in Donetsk	Donetsk, Zaporizhzhya, Luhansk	10 Mira ave., office 901-a, 83000 Donetsk, Ukraine tel. +380 62 305 0552	Serhiy V. Podolsky
5	Registration centre in Kharkiv	Kharkiv, Poltava, Sumy	7/8 Povstannya Sq., office 0802, 8th floor, 61001 Kharkiv, Ukraine, p/box 11775 tel. +380 57 732 8949	Serhiy K. Bastanzhyyan
6	Registration centre in Simferopol	Crimea Sevastopol	1 Kirova Street, office 607, 95015 Simferopol, Ukraine, tel. +380 65 254 3822	Kateryna L. Zaonehina
7	Registration centre in Ivano-Frankivsk	Lviv, Carpathian, Ivano-Frankivsk and Chernivtsi	77 Bandery Street, office 304, 76014 Ivano-Frankivsk, Ukraine, tel. +380 342 520 561	Oksana I. Olenych