



UKRAINE

NATIONAL REPORT

DOCUMENT DEVELOPED IN COMPLIANCE WITH
THE JOINT CONVENTION
ON THE SAFETY OF SPENT FUEL MANAGEMENT AND
ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

KYIV 2003

FOREWORD

Ukraine entered into force the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management on 29 September 1997 in the framework of international activity intended to improve the safety of spent fuel and radioactive waste management under the aegis of IAEA.

Ukraine implemented the Joint Convention by the Law of Ukraine “On Ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management” on 20 April 2000.

Ukraine has completely fulfilled its obligations under Article 18 of the Joint Convention through implementing the Convention and taking appropriate actions.

This First National Report has been developed in full compliance with obligations of the Joint Convention and Guidelines regarding the Form and Structure of National Reports INFCIRC/604.

Ukraine completely fulfilled its obligations under Article 32 of the Joint Convention by submitting this National Report.

This Report incorporates joints efforts of state bodies responsible for spent fuel and radioactive waste management and international cooperation in this field:

- State Nuclear Regulatory Committee;
- Ministry of Health;
- Ministry of Emergencies and Affairs of Population Protection from the Consequences of Chornobyl Catastrophe;
- Ministry of Fuel and Energy;
- Ministry of Foreign Affairs,

as well as licensees:

- National Nuclear Energy Generating Company (NNEGC Energoatom);
- State Specialised Enterprise “Chornobyl NPP”;
- Ukrainian State Association “Radon”.

The goal of the Report is to provide objective and impartial information on the state of spent fuel and radioactive waste management and measures taken to improve protection of the population and environment in Ukraine.

According to the materials presented in the National Report and authorities granted by the President of Ukraine, Chairman of the State Nuclear Regulatory Committee of Ukraine declares the following.

Ukraine establishes the highest priority to radiation safety of workers, the population and the environment. In this context, Ukraine completely fulfilleds its obligations under the Joint Convention as confirmed by the following:

- *appropriate legislative safety requirements have been established;*
- *the State Nuclear Regulatory Committee of Ukraine has been established to undertake licensing and inspections independently from licensees and other State governmental bodies;*

- *licensees in the field of spent fuel and radioactive waste management are obliged to establish priority to safety and take actions to improve protection of the population and environment.*

Kyiv, 29 April 2003.

Vadym Gryschenko

Chairman of the State Nuclear Regulatory Committee of Ukraine

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List of Abbreviations

ChNPP	Chornobyl Nuclear Power Plant
EIA	Environmental Impact Assessment
ICSRM	Industrial Complex for Solid Radioactive Waste Management
KhNPP	Khmelnitsky Nuclear Power Plant
KSC PTI	Kharkiv Scientific Centre “Physics and Technology Institute”
LRW	Liquid Radwaste
MAS waste	Waste resulted from mitigation of accident consequences
NNEGC	National Nuclear Energy Generating Company “Energoatom”
Energoatom	
NPP	Nuclear Power Plant
NRBU	Norms of Radiation Safety of Ukraine
NRI NASU	Nuclear Research Institute of the National Academy of Sciences of Ukraine
OSPU	Main Sanitary Rules of Radiation Protection of Ukraine
PSAR	Preliminary Safety Analysis Report
Radwaste	Radioactive Waste
RNPP	Rivne Nuclear Power Plant
RS	Radiation Source
RWDP	Radioactive Waste Disposal Plant
RWTSP	Radioactive Waste Temporary Storage Plant
SAR	Safety Analysis Report
SSE	State Specialised Enterprises
SFA	Spent Fuel Assembly
SIP	Shelter Implementation Plan
SISP	State Interregional Specialised Plant
SNFSF	Spent Nuclear Fuel Storage Facility
SNINEI	Sevastopol National Institute for Nuclear Energy and Industry
SNRCU	State Nuclear Regulatory Committee of Ukraine
SRW	Solid Radwaste
SUNPP	South Ukraine Nuclear Power Plant
UkrSA Radon	Ukrainian State Association “Radon”
USSE	Uniform State System for Prevention and Response to Man-Induced and Natural Emergencies
WWER	Water-Water Energy Reactor
ZNPP	Zaporizhzhya Nuclear Power Plant

Section A. INTRODUCTION

Spent fuel and radioactive waste management constitutes the final stage in power production at nuclear power plants and utilisation of ionising radiation sources in medicine, agriculture, industry and science.

The importance of this stage for environmental protection, public health and safety can be hardly overestimated. The future of nuclear energy in Ukraine and worldwide depends upon effective state policy and successful practices in the safe management of spent nuclear fuel and radioactive waste. Taking into account the complexity and urgency of some problems related to spent nuclear fuel and radioactive waste management, international cooperation in this field, establishment of common criteria and principles of nuclear and radiation safety takes on specific significance.

In compliance with the principle of priority of protection of the public and environment against ionising radiation and sharing the basic provisions of international cooperation in the peaceful use of nuclear energy, Ukraine entered into the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in Vienna (Austria) on 29 September 1997 and ratified it by the Law of Ukraine on 20 April 2000.

This document is the First Report of Ukraine concerning the implementation of obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. In conjunction with the First and Second National Reports of Ukraine under the Convention on Nuclear Safety, it comprehensively represents the status of nuclear energy and nuclear and radiation safety in Ukraine.

Priority to safety in spent fuel and radioactive waste management has been given by the Law of Ukraine "On Nuclear Energy Utilization and Nuclear Safety" and the Law of Ukraine "On Radioactive Waste Management".

The very special place among the nuclear installations of Ukraine belongs to Chernobyl power unit 4 («Shelter» Object), destroyed during the severe accident in April 1986. The undertaken emergency operational measures allowed decreasing the hazards of the Object to the society and environment. This was confirmed in the special report «Shelter» Safety Analysis and the Prospective Estimate of Situation Development (September 1996), on the basis of which the State Nuclear Regulatory Committee issued a license to Chornobyl NPP for «Shelter» operation. The main peculiarity of the «Shelter» is its potential hazard, which greatly exceeds that permitted by standards and regulations established for the facilities containing nuclear hazardous fissile and radioactive materials.

Transformation of the «Shelter» into an ecologically safe system requires significant financial and material resources, utilisation of non-standard innovative science and engineering solutions. This Report does not address specific problems related to the «Shelter» safety. At the same time it should be mentioned that the Shelter Implementation Plan (SIP) aimed to assure "Shelter" safety was developed by experts of Ukraine and «G-7» countries and approved by respective governments. The main goals of the SIP are to enhance nuclear, radiation and ecological safety, improve working conditions of personnel in transforming the «Shelter» into an ecologically safe system.

This Report has been developed in compliance with the Guidelines INFCIRC/604 dated 10 June 2002 regarding the form and structure of national reports. The Report sets forth the main principles of the State policy, describes practices of spent nuclear fuel and radioactive waste management, identifies criteria applied to characterize and classify radioactive waste, and describes legislative and regulatory framework and national safety requirements concerning spent nuclear fuel and radioactive waste management. Basic actions taken to protect individuals, society and environment against radiological risks pertaining to spent

nuclear fuel and radioactive waste management have been highlighted. Examples are given on operating and proposed facilities, those to be commissioned and closed facilities. The safety level is assessed, safety issues are identified and activity planned to eliminate safety deficiencies is described.

Section B. POLICIES AND PRACTICES (Article 32, Paragraph 1)

B.1. Spent fuel management policy

The Law of Ukraine "On Nuclear Energy Utilisation and Radiation Safety", National Energy Programme till 2010 approved by the Verkhovna Rada of Ukraine on 15 May 1996 and "Programme on Spent Fuel Management at Nuclear Power Plants" approved by the Order of the Ministry for Fuel and Energy dated 13 January 2000 have established the main principles of spent fuel management state policy:

- priority to human and environmental protection against ionising radiation;
- minimization of radioactive waste generation in spent fuel management;
- prohibition of any activity which is liable to result in and obviously greater adverse impact on future generations as compared to that permitted for the present generation;
- safety assurance of spent fuel management;
- openness and accessibility of appropriate information,
- social and economic measures of interest to the local authorities on the territory of which nuclear installations are sited;
- partition of state management functions in nuclear energy utilization and state regulation of nuclear and radiation safety;
- prohibition of any activity if its benefit is less than possible harm;
- compliance with personnel and population dose limits established by standards, rules and regulations pertaining to nuclear and radiation safety.

The strategy of WWER spent fuel management known as “deferred decision” is realized in Ukraine. The most perspective and economically feasible solution for management of spent fuel generated by water-cooled water-moderated power reactors of Ukrainian NPPs in the next 50-100 years is to store this fuel on the territory of Ukraine in dry interim spent nuclear fuel storage facilities (SNFSF). Ultimate decision on further processing or disposal of this fuel in deep geological repositories will be taken later.

In accordance with the above strategy the following tasks are denoted:

- Construction of on-site SNFSF;
- Siting for construction of a centralized SNFSF;
- Research, development and exploration for radioactive waste disposal in geological repositories;
- Development of research-engineering and design infrastructure to support spent fuel management.

B.2. Spent fuel management practices

National practices pertaining to spent fuel management are as follows:

- WWER-440 and WWER-1000 spent fuel is cooled in reactor ponds not less than 5 years and after that is transported to the Russian Federation for reprocessing;
- RBMK-1000 spent fuel is stored in reactor decay pools and site pool storage facility for spent fuel at the Chornobyl NPP.

A dry interim spent fuel storage facility is being commissioned at ZNPP. A dry interim storage facility for Chornobyl NPP is being constructed in the 30-km zone.

Exploration is under way to site a centralized dry interim storage facility for spent fuel generated by Ukrainian nuclear power plants (CSNFSF).

B.3. Radioactive waste management policy

The Law of Ukraine “On Radioactive Waste Management” and State Programme on Radioactive Waste Management approved by the Resolution of the Cabinet of Ministers of Ukraine No. 2015 dated 25 December 2002 establish the main principles of state radioactive waste management policy.

First of all they are as follows:

- priority to protection of personnel and population life and health and environment against the impact of radioactive waste in compliance with national radiation safety standards;
- reliable and assured isolation of radioactive waste from the environment;
- regulatory control of radioactive waste management;
- separation of the regulatory functions and radioactive waste management functions;
- separation of the functions of State Authorities that are responsible for different stages of radioactive waste management;
- responsibility of radioactive waste producers for safety of radioactive waste handling before transfer to specialized enterprises for radioactive waste management;
- time limitation on-site storage of radwaste and further transfer to specialized enterprises for radioactive waste management;
- decisions on siting of new storage facilities for radioactive waste taking into account opinions of the society, public associations and the local authorities;
- prohibition of radioactive waste transfer to Ukraine for storage or disposal;
- international cooperation in the field of radioactive waste management.

According to the principles of national policy the main directions of activity were defined as follows:

- centralization of radioactive waste storage and management facilities;
- disposal of long-lived and high-level radioactive waste in geological repositories;
- establishment of the State Enterprise Chernobyl NPP with responsibility to conduct decommissioning activities for all NPPs of Ukraine;

- construction of new confinement of the “Shelter” as a processing facility equipped for radioactive waste management and removal of fuel-containing materials;
- development of new and implementation of existing technologies for radioactive waste management;
- establishment and operation of the State system for radioactive waste accounting and control;
- scientific, technical and information support to activities in field of radioactive waste management;
- development of regulations for Radwaste management;
- expansion of international cooperation in the field of radwaste management.

B.4. Radioactive waste management practices

Radioactive waste management practices are as follows:

Each NPP constructs a processing complex facility for radioactive waste treatment. Radioactive waste is collected, sorted and preliminary treated and stored for a long period prior to transfer to specialized enterprises for radioactive waste management.

Chernobyl NPP has also started construction of processing complex facilities for liquid and solid radwaste treatment.

UkrSA Radon State Interregional Specialised Plants (SISP) (Dnyepropetrovsk, Kyiv, L’viv, Odessa and Kharkiv) deals with collection, transportation, storage and disposal of radioactive waste from Ukrainian enterprises, medical and research institutions including ionising radiation sources to be disposed.

State Specialised Enterprise (SSE) “Complex” undertakes radioactive waste management activities in the exclusion Chornobyl zone. These activities include: radioactive waste collection in the most contaminated locations of the exclusion zone, monitoring and operation of the existing radioactive waste disposal point (RWDD) “Buryakivka”, monitoring of non-operated RWDP “Pidlisny” and “ChNPP III Stage”, and Radioactive Waste Temporary Storage Plants (RWTSP), decontamination of metal, plastic items, cables, scrap metal, machines and mechanisms.

The priority activities of SSE “Complex” is aimed at bringing the RWDP and RWTSP existing in the exclusion zone into compliance with the current requirements, standards, and rules on nuclear and radiation safety. The reasons of the fact are that RWDP and RWTSP were constructed in extreme after-accident conditions and do not meet the radiation safety requirements, therefore they are potentially dangerous for the environment. The SSE “Complex” deals with the re-disposal of radioactive waste from the RWTSP.

According to the Comprehensive Programme on Radioactive Waste Management, the State Specialized Enterprise for Processing and Disposal of Man-Made Waste “Tekhnocentre” (SSE “Tekhnocentre”) is constructing “Vector” complex facility in the exclusion zone to be the basis for establishing a centre for processing and disposing of radioactive waste to provide for:

- disposal of short-lived radioactive waste generated as a result of “Shelter” operation and those that will be generated during the Shelter transformation into an ecologically safe system;
- disposal of short-lived radioactive waste generated as a result of ChNPP operation and those that will be generated in ChNPP decommissioning;

- disposal or long-term storage of radioactive waste generated at industrial enterprises, medical, research and other institutions;
- storage of high-level radioactive waste that will be generated during Ukrainian spent nuclear fuel reprocessing in Russian Federation.

B.5. Criteria used to define and categorize radioactive waste

According to the Law of Ukraine “On Radioactive Waste Management” and State health and safety regulations DGN 6.6.1.-6.5.061.–2000 “Norms of Radiation Safety of Ukraine. Supplement: Radiation Protection from Potential Ionising Radiation Sources” (NRBU-97/D-2000), the materials and substances are categorized as radioactive waste under the following conditions:

- these materials can be used neither at present nor in the future or;
- at present time it is not decision how these materials can be used within present or future processes, and
- activity of radionuclides in these materials exceeds levels for radioactive waste exemption from regulatory control, which are established by State health and safety rules DSP 6.074.120 - 01 "Main Sanitary Rules of Radiation Protection of Ukraine" (OSPU).

Below it is presented radioactive waste classification according to OSPU Section 9, which is effective since 1 July 2002.

According to NRBU-97/D-2000 requirements and depending on the classification goals, radioactive waste is divided into types, groups and categories.

Three types of radioactive waste have been defined:

- short-lived waste – level of exemption from regulatory control is achieved prior to 300 years after disposal of this waste;
- long-lived waste – level of exemption from regulatory control is achieved in 300 and more years after disposal of this waste;
- waste defined upon agreement with the Regulatory Bodies.

This classification is based on criteria of acceptability (unacceptability) of radioactive waste disposal in near-surface (surface) storage facilities or geological repositories.

Table B.5.1 denotes radioactive waste classification based on criteria of acceptability (unacceptability) of radioactive waste disposal in different facilities.

Table B.5.1. Radioactive waste classification based on criteria of acceptability (unacceptability) of radioactive waste disposal in different facilities

Radioactive waste type	Potential exposure doses in 300 years after disposal	Type of possible exemption within 300 years after disposal	Acceptable type of radioactive waste disposal
Short-lived	Below level B	Ultimate, limited	Surface, near-surface
Determined upon agreement with state regulatory bodies	Above level B but below level A	Limited is permitted	Determined upon agreement with state regulatory bodies
Long-lived	Above level A	Not considered	Deep stable geological formations

Note. Reference potential exposure A – 50 mSv/year;
Reference potential exposure B – 1 mSv/year.

Depending on physical state, radioactive waste is divided into solid, liquid and gaseous. Solid radwaste covers any solid objects or materials (including components of machines and mechanisms, materials, products, biological object, solidified liquid radwaste) provided that they have one of the following radiation characteristics:

- specific activity of waste more than
 - 10 kBq/kg for gamma-radiation sources;
 - 10 kBq/kg for beta-radiation sources;
 - 1 kBq/kg for alpha-radiation sources;
 - 0.1 kBq/kg for alpha-radiation sources of transuranium radionuclides;
 - airborne dose rate of gamma-radiation exceeding
 - $1.0 \mu\text{Gr}\times\text{h}^{-1}$ at the distance of 0.1 m from waste surface;
 - radioactive contamination on the area of 0.01 m^2 of accessible surface exceeding:
 - $150 \text{ part}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$ for beta- and gamma-radiation sources;
 - $1,5 \text{ part}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$ for transuranium alpha radionuclides;
 - $15 \text{ part}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$ for other alpha radionuclides.

Values of radioactive waste exposure dose rate and surface radioactive contamination can be used for determining radiation characteristics of large-sized objects (components of machines and mechanisms, structural elements etc.), otherwise radioactive waste specific activity can be used.

Solid radwaste is divided into four groups based on “exemption levels” criterion. Table B.5.2 provides radioactive waste classification according to this criterion.

Table B.5.2. Radioactive waste classification based on “removal levels” criterion.

Radioactive waste group	Solid radioactive waste	removal level, kBq·kg ⁻¹
1.	<i>Transuranium</i> alpha radionuclides	0.1
2.	<i>Alpha</i> radionuclides (excepting transuranium)	1
3.	<i>Beta, gamma</i> radionuclides (excluding those in group 4)	10
4.	H-3, C-14, Cl-36, Cf-45, Mn-53, Fe-55, Ni-59, Ni-63, Nb-93m, Tc-99, Cd-109, Cs-135, Pm-147, Sm-151, Tm-171, Tl-204	100

Liquid radwaste includes:

inorganic solutions; pulps of filter materials, sludge; organic liquids (oil, solvents etc.) that have the following radiation characteristics:

- content of individual radionuclides exceeds permissible concentration in household and potable water used by population ($\text{PC}_B^{\text{ingest}}$ according to NRBU-97);
- composition of radionuclide mixture results in that the sum of ratio between specific activity of a radionuclide and its $\text{PC}_B^{\text{ingest}}$ exceeds 1.

Radioactive waste not subjected to removal is divided into three categories. In this case specific activity constitutes the classification criterion for radioactive waste categorization (Table B.5.3).

Table B.5.3. Solid radioactive waste and liquid radioactive waste classification based on “specific activity” criterion.

RW categories	Range of values of specific activity of solid radwaste, kBk·kg ⁻¹				Range of values of specific activity of liquid radwaste in multiplicity units PC _B ^{ingest}
	Group 1	Group 2	Group 3	Group 4	
Low activity	>10 ⁻¹ <10 ¹	>10 ⁰ <10 ²	>10 ⁻¹ <10 ³	>10 ⁻² <10 ⁴	>1 <10 ²
Medium activity	≥10 ⁻¹ <10 ⁵	≥10 ² <10 ⁶	≥10 ³ <10 ⁷	≥10 ⁴ <10 ⁸	≥10 ² <10 ⁶
High activity	≥10 ⁵	≥10 ⁶	≥10 ⁷	≥10 ⁸	≥10 ⁶

For Gamma-radiation radwaste with unknown specific activity the use of classification “low-”, “medium-”, “high-” activity is allowed with the criteria of rate of the air dose at the distance 0,1 m for similar radioactive waste.

Table B.5.4. Classification of radioactive waste with unknown specific activity with the criteria of rate of the air doze at the distance 0,1 m.

Radioactive waste category	Rate of doze, mGr/year ⁻¹
Low active	>1 ≤ 100
Medium active	>100 ≤ 10000
High active	> 10000

Current situation in Ukraine is not fully comply with above classification, therefore the measures are being taken to bring it to the conformity with the new regulations.

Section C. SCOPE OF APPLICATION (Article 3)

Ukraine considers spent fuel and radioactive waste management as defined in Article 2 of the Convention.

There are no facilities for spent nuclear fuel reprocessing in Ukraine.

Ukraine undertakes uranium ore mining and milling, as a result the large amounts of waste are accumulated in the tailing pits of the Eastern Ore Mining and Processing Enterprise. According to NRBU-97 waste of uranium mining processing, as well as waste resulted from mining other mineral products, is related to industrially intensified naturally occurring sources of radiation (NORM) and is not declared as radioactive waste by Ukraine.

Ukraine does not implement military or defence programmes resulting in generation of spent fuel.

Ukraine applies this Convention to the safety of radioactive waste which is resulted from military and defence programmes, but at present time it is ultimately covered by civil programmes, therefore this waste is managed exclusively within such programmes.

Section D. INVENTORIES AND LISTS (Article 32, Paragraph 2)

D.1. A list of spent fuel management facilities subject to this Convention, their location, main purpose and essential features

In Ukraine spent fuel is produced in civil nuclear power plants and research reactors. A list of facilities is provided in Annex 1.

There are WWER-1000 reactors (11 units) and WWER-440 reactors (2 units) at nuclear power plants under operation. Spent fuel management systems of these two designs are similar and include the following handling equipment:

- equipment for loading and refuelling of reactors;
- equipment for loading and unloading of transport casks;
- spent fuel decay pools used as process systems for loading and refuelign reactors and transport casks and for spent fuel cooling prior its transfer for treatment or storage to dry storage facilities;

Zaporizhzhya NPP, unlike to the other NPPs, has handling equipment at all power units for loading and unloading of dry storage casks stored in the Spent Fuel Storage Facility (SFSF) on the ZNPP site.

There are three RBMK-1000 power units at Chornobyl NPP, which is under decommissioning. Spent fuel management systems include the following handling equipment:

- equipment for loading and refuelling of reactors;
- equipment for loading and unloading of transport casks;
- spent fuel decay pools used as process systems for loading and reloading of reactors and transport casks and for spent fuel cooling prior to its transfer to the pool storage facility on the ChNPP site.

The “Shelter” facility, located on ChNPP site, contains damaged spent fuel.

A dry spent fuel storage facility is under construction nearby ChNPP.

The system for management of spent fuel from the research reactor of NRI NASU includes:

- handling equipment for fuelling and refuelling of the reactor;
- spent fuel decay pools are used as a process system for loading and reloading of the reactor and temporary storage of nuclear fuel.

D.2. An inventory of spent fuel that is subject to this Convention and that is being held in storage and of that, which has been disposed

Pursuant to the Law “On Nuclear Energy Utilisation and Radiation Safety”, spent fuel accounting is carried out under the Provisions on the State Nuclear Material Control and Accountancy System (SCAS) established by the Resolution of the Cabinet of Ministers of Ukraine No. 1525 dated 18 December 1996.

There are no spent fuel disposal facilities in Ukraine, therefore the inventory list is not presented.

D.3. A list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features

There are long-term storage facilities for low-, intermediate- and high-level solid radwaste, long-term storage facilities for liquid radwaste, solid radwaste sorting facilities, solid radwaste and oil incineration facilities, solid radwaste compaction facilities, liquid radwaste deep evaporation facilities and equipment decontamination facilities on the sites of NPP. More detailed information is provided in Annex 2.

There are solid radwaste trench storage facilities, Radioactive Sources (RS) vault storage facilities and liquid radwaste storage tanks at sites of UkrSA Radon SISP.

Radwaste of Chernobyl exclusion zone are classified by their radiation, technical features and radioactive waste storage conditions as follows:

- radioactive waste disposal points (RWDP);
- radioactive waste temporary storage points (RWTSP);
- sites for storage of radioactive contaminated equipment.

Storage facilities are classified by the specific activity waste of decontamination as follows:

- storage facilities for low-level radioactive waste resulted from decontamination (SLLRd);
- storage facilities for contaminated radioactive waste resulted from decontamination (SCRd).

Storage facilities are divided into two types by their design features:

Type I – SLLRd and SCRd which were constructed and closed down in 1986 -1989 in the period when consequences of the ChNPP accident were mitigated. Facilities of this type were constructed according to recommendations of the USSR Civil Defence Headquarters, without design documentation and with violation of SPORO-85 requirements;

Type II - SCRd – engineering structures, which were constructed in 1991-1995 and designed for disposal of radionuclide-contaminated materials. They prevent radionuclide release to the environment, ensure monitoring of the condition and are equipped in accordance with design documentation elaborated by the STC CMRW.

More detailed information is provided in Annex 2.

D.4. An inventory of radioactive waste that is subject to this Convention

Ukraine carries out radioactive waste accounting pursuant to the requirements of the Law of Ukraine «On Radioactive Waste Management» dated 30 June 1995, Resolution of the Cabinet of Ministers of Ukraine dated 29 April 1996 No. 480 “On State Programme of Radioactive Waste Management” (with changes and amendments introduced by the Resolutions of the Cabinet of Ministers of Ukraine No. 1543 dated 23 December 1996, No. 542 dated 5 April 1999 and No. 1481 dated 28 September 2000), “Comprehensive Programme on Radioactive Waste Management” approved by revised Resolution of the Cabinet of Ministers No. 2015 dated 25 December 2002.

Ukraine is implementing a system for centralized accounting and control of radioactive waste transfer and storage. This system shall be obligatory for all enterprises, establishments and organizations irrespective of their ownership.

The State system for radioactive waste accounting and control consists of the two main elements:

- State radioactive waste register, representing successive special-format records on radioactive waste generation, physical-chemical composition, amount, properties, and transportation, storage and disposal;
- State cadastre of radioactive waste storage facilities and temporary storage sites, representing systematic information on facilities designed for radioactive waste storage or disposal, which is incorporated into a unified system of data on location, quantitative and qualitative characteristics of radioactive waste storage facilities.

Provisions on the State Radwaste Register and State Cadastre are approved by the Resolution of the Cabinet of Ministers of Ukraine No. 480 dated 29 April 1996.

The Main Information and Analytical Centre of the State Radioactive Waste Accountancy System (MIAS) based at the UkrSA Radon maintains the register and cadastre. This Centre receives information from regional RADIOACTIVE WASTE accountancy centres (RRAC). RRAC work on the basis of the SISP and SSE "Complex" of the UkrSA Radon.

For effective updating of the State Radioactive Waste Register, joint Order of the Ministry for Environment and Natural Resources and Ministry for Emergencies No. 117/66 of 22 March 2001 approved the "Procedure for Interaction of the State Register of Ionising Radiation Sources and the State Register of Radioactive Waste".

The Main Registration Centre of the Ukrainian State Enterprise "Isotope" manages RS accounting through a network of associated regional centres (registration centres). If RS is to be transferred into radioactive waste category, the Main Registration Centre shall submit appropriate information to the State Radioactive Waste Register.

Accordingly to established procedure the following radioactive waste types are subject to inventory:

- Radioactive waste (solid and liquid) generated during operation with radioactive materials and RS, equipment, accessories and devices that contain RS, applied in industrial, scientific, medical and other types of activity;
- Radioactive waste located at storage or disposal sites and at decommissioned or laid up objects designed for radioactive waste management.

State inventory of radioactive waste takes place once per three years. Schedules for inventory are determined by the State authority in the field of radioactive waste management.

Results of inventory are submitted to the State regulatory bodies and governmental bodies as well as to local authorities on their request.

The first state inventory according to the Procedure (approved by Order of the Ministry for Environmental Protection and Nuclear Safety of Ukraine No. 38 dated 11 March 1998 and registered in the Ministry for Justice of Ukraine by reg. No. 199/2339 dated 26 March 1998) was taken by the Ministry for Emergencies in 1999-2000 on the whole territory of Ukraine. Pursuant to Order of the Ministry for Fuel and Energy No. 23 dated 3 March 1999, radioactive waste and RS inventory was conducted at all NPPs of Ukraine.

The inventory lists are given in Annex 4.

D.4.1. An inventory of radioactive waste that is stored at radioactive waste management and nuclear fuel cycle facilities

Annexes 4.1 – 4.3 provide inventories of radioactive waste being held in storage facilities at sites of NPPs, SSE "ChNPP", Nuclear Research Institute of Science Academy (NRI NANU).

D.4.2. An inventory of disposed radioactive waste

Annex 4.4 provides an inventory of radioactive waste that has been disposed in storage facilities of UkrSA Radon and SSE “Complex”. The storage facilities listed in the Annex have been preserved and subjected to licensee’s control.

D.4.3. Inventory of radioactive waste that has resulted from past practices

An inventory of radioactive waste that has resulted from past practices and that is being held in storage at UkrSA Radon specialized enterprises is provided in Annex 4.5.

Annual reports and letters of the licensees, newsletters of the Ministry for Fuel and Energy and UkrSA Radon represent relevant information for the Annexes.

D. 4.4. List of radioactive waste generated in uranium mining industry

The State Enterprise “Eastern Ore Mining and Processing Plant” (DP “SkhidGZK) deals with uranium ore mining and processing in Ukraine. Before 1991 the Industrial Association “Pridniprovsky Chemical Plant” was also involved in uranium ore processing but ceased its operations in 1991.

DP “SkhidGZK” includes two mines: Smolinsky (Smolino, Kirovograd Region) and Ingulsky (Kirovograd). The Hydrometallurgical Plant in Zhovti Vody of Dnyepropetrovks Region processes uranium ore to obtain concentrated uranium product (U_3O_8). Two tailing pits were created to store waste of uranium ore processing (tails): “Iron Ore Mine” (KBZ) and Scherbakivske (Sch). Information on DP “SkhidGZK” tailing pits is provided in the Annex.

The “KBZ” tailing pit is located at a 3-km distance to the south from Zhovti Vody outskirts in the sanitary protection zone of the DP “SkhidGZK” Hydrometallurgical Plant. The exhausted iron ore pit is used as the tailing pit. To 1987 the pit cavity was practically filled up and after partial reclamation is used as backup storage for Hydrometallurgical Plant emergency discharges. The tailing pit has been filled up with pulp of leached ore with uranium content of 0.007%.

The tailing pit “Sch” is located at a 1.5-km distance from Zhovti Vody in “Scherbakovska” gully adjacent to the Zhovti River valley. It is currently used as storage of pulp from the DP “SkhidGZK” Hydrometallurgical Plant.

In 1948 the IA “Pridniprovsky Chemical Plant” in Dnyeprodzerzhinsk started processing uranium ore and other uranium-containing raw material in order to obtain concentrated uranium product (U_3O_8). The enterprise started production of uranium salts from slag obtained in uranium-iron ore meltdown in Blast Furnace 6 of the Dzerzhinsky Metallurgic Plant.

IA “Pridniprovsky Chemical Plant” tailing pits are located on the territory of Dnyeprodzerzhinsk and Dnipropetrovsk Distict of Dnipropetrovsk Region. Nine tailing pits for uranium ore processing products were created from 1948 to 1991 on this territory. The tailing pits have accumulated approximately 42 million tons of tails with total activity more than $31.8 \cdot 10^{14}$ Bq.

List of waste from uranium mining industry is given in the Annex 4.6.

D.5. List of nuclear facilities in the process of decommissioning and the status of decommissioning activities at those facilities

Nuclear facilities of Chernobyl NPP – power units 1, 2, 3 with RBMK reactors - are in the process of decommissioning (Annex 3).

Power unit 1 was finally shut down on 30 November 1996, power unit 2 – 11 October 1991, power unit 3 – 15 December 2000.

Decommissioning activities are being carried out at Chernobyl NPP units 1, 2, 3 according to the appropriate Programmes for termination of power unit operation and “Comprehensive Program on Chernobyl NPP Decommissioning”.

Decommissioning facilities are being constructed at the Chernobyl NPP site for management of radioactive waste that has accumulated during ChNPP operation and that will be generated in decommissioning activities, Shelter stabilisation measures etc. They are as follows:

1. Liquid radioactive waste treatment plant (LRTP).
2. Industrial complex for solid radioactive waste management (ICSRM), which consists of:
 - facility for removal of solid waste from the existing solid waste storage facility – Lot 1,
 - facility for sorting solid radioactive waste of all categories and processing low- and intermediate-level solid waste – Lot 2,
 - specially equipped near-surface disposal facility for low- and intermediate-level short-lived solid waste – Lot 3 (it is situated on the “Vector” territory).

The design and construction of the facilities are funded in the framework of international assistance rendered to Ukraine for ChNPP decommissioning (LRTP is funded out of the EBRD Nuclear Safety Account, and ICSRМ is funded by the Commission of European Community within the TACIS Programme).

LRTP “turn key” construction is carried out by the International Consortium Belgatom (Belgium)/SGN(France)/Ansaldo(Italy). The Belgatom Company represents the General Contractor.

LRTP building has been practically completed at the moment. Equipment assembling is in progress.

At the beginning of 2003 ChNPP has completed the development of the construction project of ICSRМ. State expertise of the ICSRМ project is in the stage of completion now. In 2003 the construction is planned to begin. Construction of ICSRМ is fulfilled by German Company NUKEM on the “turn-key” basis.

Section E. LEGISLATIVE AND REGULATORY SYSTEM

E.1. Implementing measures (Article 18)

The Law of Ukraine "On Ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" and the Law of Ukraine "On Amendment of Some Laws" to bring these acts into compliance with the Joint Convention were approved on 20 April 2000. Therefore, after ratification of the Convention and appropriate amendment of national legislation, Ukraine takes the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations

under the Convention. More detailed information on these measures is provided in subsequent sections.

E.2. Legislative and regulatory framework (Article 19)

E.2.1. National safety requirements and regulations for radiation safety

Legislative and regulatory acts that govern the safety of spent fuel and radwaste management are listed in Annex 5.

The Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” is the most important act establishing safety requirements for spent fuel and radwaste management. This Law establishes priority of human and environmental safety, regulates activities related to nuclear installations, ionising radiation sources and radioactive waste. The Law of Ukraine “On Human Protection from Ionising Radiation” is intended to protect human life, health and property against adverse impact of ionising radiation resulted from practices and caused in the event of radiation accidents through taking preventive and rescue measures and compensating for damage. The Law of Ukraine “On Radioactive Waste Management” is aimed at protecting the human and environment against adverse impact of radioactive waste at present and in future.

Legislative requirements on safety assurance and licensing of activities related to spent fuel and radioactive waste have been implemented in standards and regulations on nuclear and radiation safety and in licensing conditions.

E.2.2. Licensing system of spent fuel and radioactive waste management

The Law of Ukraine “On Permissive Activities in the Field of Nuclear Energy Utilisation”, approved by the Verkhovna Rada (Ukrainian Parliament) on 11 January 2000, sets forth the legal and organisational principles of the licensing activity as a part of State regulation in nuclear energy utilisation and establishes the activities to be licensed:

- licensing of the operating organisation’s activity in a specific stage of the nuclear installation or radioactive waste repository lifetime, namely at the stages of design, construction, commissioning, operation and decommissioning of a nuclear facility or radioactive waste storage facility, as well as at the stage of closure of a radioactive waste repository;
- licensing of individual activities in nuclear energy utilisation, in particular activities pertaining to spent fuel and radioactive waste management:
 - a) design of a nuclear facility or radwaste storage and disposal facility;
 - b) transportation of radioactive material;
 - c) treatment, storage and disposal of radwaste.

Licensing procedures for individual activities (conditions for issuance, revision, termination, cancellation and extension of a licence) are regulated by Resolution of the Cabinet of Ministers of Ukraine No. 1782 of 6 December 2000 “On Approval of Licensing Procedure of Individual Activities in the Field of Nuclear Energy Utilisation”.

Safety requirements and conditions of individual activities in nuclear energy utilisation are established in regulations issued by the SNRCU.

E.2.3. System of prohibition of the operation of spent fuel or radioactive waste management facility without a licence

According to part three of Article 26 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety”: “Any activity associated with nuclear installations and RS is prohibited for legal or natural entities that have not obtained a licence under established order. A nuclear installation or RS (including radwaste repository) may be used only with the purpose and in the manner provided for by the terms of the issued licence”.

E.2.4. System of appropriate institutional and regulatory control, system of documentation and reporting

Institutional control of spent fuel and radwaste management is exercised by appropriate divisions of operating organisations (for example NNEGC Energoatom at the NPPs operational stage), Ministry for Fuel and Energy and Ministry for Emergencies depending on the subordination of the enterprises. Institutional control is intended for continuous (daily) check-up of technology, state of equipment and safety-related systems to be in compliance with requirements of operational documents, standards and rules of nuclear and radiation safety.

According to regulatory requirements, internal inspections of nuclear safety are conducted annually at each NPP, the inspection acts are submitted to the SNRCU. Other enterprises carry out their own inspections of radiation and environmental protection at least once per two years. Based on these inspections, measures are developed to eliminate revealed drawbacks if needed.

State supervision over nuclear and radiation safety, as a part of state regulation of nuclear and radiation safety, has been regarded as one of the main principles of national policy in nuclear energy utilisation and radiation protection according to Article 5 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety”.

The SNRCU, pursuant to its Statute (item 10, Annex 6), performs the following tasks:

- organise and exercise state supervision over observation of laws, standards, rules and regulations on nuclear and radiation safety, as well as terms of issued licenses (permits);
- check up preparedness of operating organisations to deal with safety-related systems according to the requirements of laws, standards, rules and regulations on nuclear and radiation safety;
- apply enforcement actions to legal and natural entities that have violated legislative acts, rules, standards and regulations on nuclear and radiation safety, as well as terms of issued licenses (permits).

The Law of Ukraine "On Nuclear Energy Utilisation and Radiation Safety" (Article 81) lists violations in nuclear energy utilisation and Article 25 of this Law determines the rights of inspectors carrying out their obligations and enforcement measures and means to be applied if legislative acts, standards and regulations on nuclear and radiation safety and terms of issued licences are violated.

Legislation requires that reports on licensing activity be submitted to the Regulatory Authority. Requirements on the periodicity and content of these reports are set forth in issued licenses and regulations developed by the SNRCU.

E.2.5. The enforcement of applicable regulations and of the terms of the licences

According to Ukrainian legislation, the following enforcement actions can be applied to the licensee in case of violation of laws, rules and standards on nuclear and radiation safety and terms of the licence and permits issued by the SNRCU:

- termination or cancellation of the licence authorising the activity or permit for specific operations;
- penalties imposed on the licensee’s officials;
- restrictions, suspension or termination of activities or operations, including construction (assembling), commissioning or operation of safety-related structures, systems or equipment;
- submission of formal requests to the licensee concerning inadequate work status of some individuals, submission of associated materials to the law-enforcement authorities if necessary.

The licence may be terminated at the stages of construction, commissioning and operation of safety-related structures, systems and equipment, the licence may be cancelled by the licensing authority, pursuant to Article 16 of the Law of Ukraine “On Permissive Activities in the Field of Nuclear Energy Utilisation” in the following cases:

- violation of the terms of the licence (permit);
- expiration or non-conformance with the requirements set forth in documents submitted along with materials for the licence (permit) that constituted the basis for concluding on the applicant’s ability to meet the established requirements;
- liquidation of a legal entity upon the court decision or for other reasons.

E.2.6. Allocation of responsibilities of the bodies involved in the different steps of spent fuel and radwaste management

Laws “On Nuclear Energy Utilisation and Radiation Safety” (Article 5) and “On Radioactive Waste Management” (Article 3) provide for allocation of responsibilities of the bodies involved in the different steps of spent fuel and radwaste management.

The Statute on the Ministry for Fuel and Energy of Ukraine, approved by Decree of the President of Ukraine No. 598 of 14 April 2000, stipulates that the Ministry for Fuel and Energy of Ukraine, according to its tasks, fulfils organisational and methodological provision and co-ordination of activities, related to the development and implementation of the programs on radwaste management, temporary radwaste storage, decommissioning of nuclear facilities and other objects of nuclear-industrial complex.

The Statute on the Ministry for Emergency Situations and Protection of the Population from the Consequences of the Chernobyl Accident of Ukraine, approved by Decree of the President of Ukraine No. 1005 of 28 October 1996, states that the Ministry is the main executive body in the field of radwaste management. Responsibilities of the Ministry include organisation and co-ordination of activities in radwaste management. Only responsibility of the Ministry is management of the activities regarding disposal of radwaste.

E. 3. Regulatory Authority (Article 20)

According to Decree of the President of Ukraine No. 1303 of 5 December 2000 “On State Nuclear and Radiation Safety Regulation” the SNRCU is entrusted with state regulation of nuclear and radiation safety.

Detailed information on the Regulatory Authority of Ukraine entrusted with state regulation of nuclear and radiation safety and other functions of the national regulatory authority on nuclear and radiation safety, determined in the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management is provided in Section 3.2 of the second Ukraine’s Report on Compliance with the Convention on Nuclear Safety Obligations.

According to Decree of the President of Ukraine “On Amendment of the Statute on the Ministry for Environment and Natural Resources of Ukraine and Statute on the State Nuclear Regulatory Committee of Ukraine” No. 378/2002 of 25 April 2002, the SNRCU is entrusted with regulation of activities pertaining to RS. In order to fulfil the Decree, the SNRCU regional offices are to be established to issue licences for individual activities in the sphere of nuclear energy utilisation and to supervise observation of nuclear law, radiation safety standards and rules and terms of licenses issued by the SNRCU, in particular, for radwaste treatment and disposal.

The Ministry of Health of Ukraine is involved in State regulation of radiation safety in developing and implementing ecological standards and radiation safety rules in the sphere of nuclear energy utilisation (item 19 of Annex 5).

Regulatory authorities on nuclear safety are independent of other central executive authorities responsible for nuclear energy utilisation. This provision is set forth in Article 23 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety”.

The organisational chart of the SNRCU is provided in Annex 9.

Section F. OTHER GENERAL SAFETY PROVISIONS

F.1. Responsibility of the Licensee (Article 21)

Requirements on responsibility of the licensee are established in the Law of Ukraine "On Nuclear Energy Utilisation and Radiation Safety".

The licensee bears full responsibility for the radiological protection and safety of nuclear installation, radwaste repositories and other radwaste management facilities irrespective of the activities and responsibilities of suppliers or state regulatory authorities on nuclear and radiation safety.

In particular, according to the legislation of Ukraine, the operating organisation (licensee) is responsible for:

- Assurance of nuclear and radiation safety;
- Development and implementation of measures on safety improvement of nuclear installations;
- Provision of radiological protection of personnel, population and environment;
- Provision of financial coverage of the liability for nuclear damage in the amount and on the conditions defined by the Ukrainian legislation. Financial coverage of the liability for nuclear damage to the ChNPP is provided by means of State guaranty;

- Specification of requirements for personnel’s qualification depending on their responsibility for safe operation of nuclear installation or radwaste repository.

The Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” prohibits any activity related to utilization of nuclear fuel or radwaste by legal or natural entities unless they have permission issued in the established order (see item E.2.3 of this Report). To date all entities undertaking activity related to spent fuel or radwaste management in Ukraine either have obtained or have applied for SNRCU licence.

F.2. Human and Financial Resources (Article 22)

F.2.1. Personnel training needed for safety-related activities during the operating lifetime of a spent fuel and a radwaste management facility

The national system for personnel training and developing the network of educational institutions for training specialists for enterprises and organisations of nuclear power and industry has been established and is functioning in Ukraine.

The training system functions in co-operation with the organisations, enterprises, State executive and regulatory authorities, and other systems in order to get advanced training, retraining, upgrading and maintaining of the staff qualification for the purpose of gaining and maintaining knowledge, capabilities and skills required for safe management of spent fuel and radwaste. The established system ensures fulfilment of the following tasks:

- planning, co-ordination and improvement of the training system;
- organisation of training and staffing with qualified personnel, provision with material, technical and financial resources, supplying with documentation;
- personnel training and qualification maintaining.

The training system at Ukrainian NPPs, including training of staff who deal with spent fuel and radwaste management, is reviewed in Section 4.2.2 of Ukraine’s Report “On Compliance with the Convention on Nuclear Safety Obligations”. This system has been improved for the time passed since 2001.

Organisations that operate research reactors and manage spent fuel and radwaste from these reactors also have adequate qualified staff.

Requirements on qualification and knowledge examination are established in licenses for operation of radwaste management facilities.

Staff qualification is checked up for compliance with established requirements for operation and maintenance of spent fuel and radwaste management facilities in accordance with relevant examination schedules or beyond them as the need arises or prior to special activities. Authorised representatives of the operating organisation or relevant state inspectorates may examine knowledge of employees who occupy administrative and technical positions.

Systematic interface with staff intended to maintain their safety culture, ensure needed qualification and preparedness to perform their duties is a vital component in ensuring nuclear and radiation safety at spent fuel and radwaste management facilities.

Staff qualification is maintained and improved in the Ukrainian Radiological Training Centre (URUC), Sevastopol Institute for Nuclear Energy and Industry of the Ministry for Education of Ukraine (SNINEI) and educational institutions of the State Construction Committee and State Committees on Industrial Safety.

F.2.2. Adequate financial resources to support the safety of facilities for spent fuel and radwaste management during their operating lifetime and for decommissioning

Financial resources to support the safe operation of spent fuel and radwaste management facilities of NNEGC Energoatom NPPs (ZNPP, RNPP, KhNPP, SUNPP) are included in the net cost of generated electricity. These resources ensure support to spent fuel reliable and safety management at nuclear power units and ZNPP spent fuel storage facility, on-site facilities for radwaste treatment and storage, as well as provide for measures to minimise radwaste and improve safety in compliance with radwaste management programmes at NPPs.

Ukraine's Report "On Compliance with the Convention on Nuclear Safety Obligations" (2001) addressed the status of the NNEGC Energoatom, in particular, the status of payments for supplied electricity. Noticeable progress has taken place in the energy production sector as compared to that period. This progress has allowed 82% payment for the NNEGC Energoatom in 2002. The status of payments has achieved 103.7% for the two months of 2003 owing to repayment of debts for the previous period. This situation with payments for supplied nuclear energy has resulted in improved funding of programmes, including those for spent fuel and radwaste management.

Funding of spent fuel and radwaste management systems is carried out of the State Budget of Ukraine.

ChNPP decommissioning is funded out of the State Budget of Ukraine based on the annual «Work Programmes for Chernobyl NPP Decommissioning».

Radioactive waste management at enterprises of UkrSA Radon (specialised enterprises, SSE "Complex", SSE "Tekhnocentre") is funded out of the State Budget of Ukraine and partially by enterprises that transfer radwaste for storage to UkrSA Radon specialised enterprises on a contractual basis. In addition, SSE "Tekhnocentre" receives some financial support from the international community within Chernobyl programmes, in particular, out of the EBRD Nuclear Safety Account.

Management of radwaste generated as a consequence of the Chernobyl accident is funded by the State.

It should be noted that budget funding is sufficient for scheduled operations intended to maintain routine safety of radwaste management facilities, however financial difficulties always appear when it comes to equipment upgrading, reconstruction and construction of new storage facilities, complete implementation of planned safety improvement measures at existing installations.

F.2.3 Financial provision, which will enable the appropriate institutional controls and monitoring arrangements during the period necessary following the closure of a disposal facility

Institutional controls and monitoring arrangements after the closure of radwaste disposal facilities at UkrSA Radon (before radwaste retrieval and decommissioning according to the State Programme of Radioactive Waste Management) and after the closure of radwaste disposal facilities at SSE "Complex" and SSE "Tekhnocentre" are planned to be funded from the State Budget.

F.3. Quality Assurance (Article 23)

Pursuant to Article 11 of the Law of Ukraine “On Radioactive Waste Management”, licensees shall ensure safety at all stages of spent fuel and radwaste management. Development and implementation of the quality programme for sent fuel and radwaste management is a condition under which the regulatory authority shall issue a licence.

According to regulation NP 306.5.02/3.017-99 “Requirements for the Quality Assurance Programme at All Stages of the Nuclear Installation Lifetime”, the NNEGC Energoatom and its detached divisions NPPs have implemented and are improving their quality systems. The quality systems cover safety-related activities, including those pertaining to spent fuel and radwaste. Therefore, general provisions of the quality assurance programme for the NNEGC Energoatom, and in particular for its detached divisions ZNPP, RNPP, KhNPP and SUNPP, cover spent fuel and radwaste as well. Section 4.4 of Ukraine’s Report “On Compliance with the Convention on Nuclear Safety Obligations” (2001) sets forth detailed information on functioning of NNEGC Energoatom general quality system and associated improvement mechanisms.

As a result of commissioning (September 2001) the spent fuel storage facility start-up system in trial commercial operation at ZNPP (based on the SNRCU licence of 16 July 2001), special procedures and new regulations have been introduced in the ZNPP quality system to operate the first dry storage facility with ventilated storage casks for WWER-1000 spent fuel (VSC-WWER-1000) in Ukraine.

State Specialised Enterprise «Chornobyl NPP» (ChNPP) has also introduced a general quality system which, in particular, is aimed at development and implementation of a quality assurance programme for safe management of spent fuel and radwaste.

The «Quality Assurance Manual for Dry Spent Nuclear Fuel Storage Facility» at ZNPP and «Quality Manual. Interim Spent Nuclear Fuel Storage Facility 00Z K02-01.3» at ChNPP have been elaborated and implemented. These documents meet DSTU ISO 9000-2001 standards, IAEA recommendations related to establishment of quality assurance systems, as well as regulation NP 306.5.02/3.017-99 “Requirements for the Quality Assurance Programme at All Stages of the Nuclear Installation Lifetime”.

The quality system functions at all life stages of the NRI NASU research reactor, spent fuel storage facility and radwaste management. The quality system meets DSTU ISO 9000 standards. Findings of quality examinations and conclusions on their effectiveness are represented in the "Quality Guideline for Operation of WWR-M Nuclear Research Reactor".

Quality systems have been developed and are being implemented at UkrSA Radon enterprises. Independent evaluations (peer reviews) of quality manuals at UkrSA Radon enterprises have demonstrated that in general these documents comply with current regulatory and legislative acts of Ukraine and in particular with DSTU ISO 9000 standards, incorporate all processes that affect radiation safety, describe managerial authorities and responsibilities, represent basic methodologies and instructions, establish the main quality functions, and assure that the safety level required by regulations in force will be achieved through compliance with their requirements. Their further implementation shall allow assessment of validity and effectiveness of these documents.

Requirements of regulations cover all processes that affect or can affect individuals (including personnel of specialised enterprises), population and environment caused by potential hazards of RS and objects related to activity of specialised enterprises (radwaste,

spent RS, radioactive contaminated clothes and individual protection means) at present and in future.

According to the UkrSA Radon development plan, new improved quality manuals have been implemented since 2002 at SSE “Tekhnocentre”, SSE “Complex”, Dnipropetrovsk, Donetsk, L’viv and Kiev specialised enterprises of the UkrSA Radon. New quality manuals are to be implemented at other specialised enterprises of the UkrSA Radon in 2003.

F.4. Operational Radiation Protection (Article 24)

F.4.1. Radiation protection of personnel and population

Legislative framework of personnel and population radiation protection is outlined in Section 4.6 of Ukraine’s Report “On Compliance with the Convention on Nuclear Safety Obligations” (INF CIRC/449) for 2001 (hereinafter referred to as the “Report”). It should be noted that after issuance of the Report in 2001, the Law of Ukraine “On Human Protection from Ionising Radiation” was amended to bring its provisions into full compliance with recommendations of the International Commission on Radiological Protection. Taking into account that personnel of spent fuel storage facilities do not differ from NPP personnel in view of radiation protection, Annex 7 shows trends in collective doses of personnel of Ukrainian NPPs from 1996 to 2002 (Figure L.7.1) and trends in annual individual equivalent doses of NPP personnel for the same period (Figure L.7.2) to illustrate personnel radiation protection practices. From 1998 to 2002 annual individual equivalent doses of UkrSA Radon category “A” personnel did not exceed: 5 mSv UkrSA Radon specialised enterprises and 10 mSv at SSE “Complex”.

Radiation monitoring is conducted at nuclear facilities in order to make sure that dose limits, permissible and reference limits and investigation levels for investigation (see item F.4.1.1) of radiation hazardous factors are not exceeded. Radiation monitoring regulations are determined by monitoring types, scope, periodicity and objects; list, location and technical requirements on measurement instrumentation; order of development, registration and storage of monitoring results etc. Radiation monitoring regulations for facilities with releases and discharge shall obligatory include local environmental monitoring: atmosphere (air, precipitation); hydrosphere (surface water, underground water, potable water); soil, local farm foodstuff, organisms-indicators of radioactive contamination, bottom sediments, sand, and gamma-radiation.

From 1998 to 2000 each NPP in Ukraine developed programmes on radiation safety improvement. During the programme development a detailed analysis of radiation protection effectiveness was carried out. The issues relating to radiation safety were detected and formulated. A number of steps were also planned to solve these issues.

F.4.1.1. Application of the ALARA principle

The optimisation (ALARA) is one of the main radiation protection principles in Ukraine, i.e. radiation exposure to the workers and the public shall be kept as low as reasonably achievable, economic and social factors being taken into account. This principle is implemented through development and implementation of regulatory provisions, codes and standards, and through elaboration and implementation of appropriate operational procedures. A number of organisational and technical activities which are aimed at reduction of individual and collective doses of personnel, minimisation of releases and

discharges and improvement of radiation monitoring systems are related to the activities on ALARA principle implementation. Each NPP has resident ALARA team. In order to optimise exposure doses at nuclear facilities, personnel exposure is planned for radiation-hazardous operations carried out under special permits indicating admissible duration of work and protection means.

The main instruments for radiation protection optimisation in Ukraine are as follows:

- application of reference levels (RL) of personnel exposure and RL of releases and discharges. Reference levels are established by the administration of a nuclear facility and are obligatory approved by nuclear and radiation safety regulatory authorities. Reference levels indicate achieved radiation safety at facilities and are always lower than appropriate permissible levels (see item F.4.2 for dose limits and permissible levels). RL of personnel exposure are usually 10-30% lower than the dose limit and RL for releases and discharges are much lower than admissible releases and discharges of radioactivity into the environment;
- application of administrative process levels of releases and discharges (investigation levels) for additional monitoring of equipment process modes at each NPP. Investigation levels are established by NPP administration. These levels are lower than RL and incorporate equipment operational experience. If these levels are exceeded, the case is investigated by a commission involving the responsible division, institutional control service and division responsible for the equipment concerned. Based on investigation results corrective measures are taken if necessary.

F.4.1.2. Non-exceeding of the established dose limits

Non-exceeding of the established dose limits is one of the main principles of radiation safety and radiation protection in Ukraine. In particular, effective dose limits are established for category A personnel - 20 mSv/y (for NPPs since 2001) and for the population – 1 mSv/y and equivalent dose limits are determined for lens, skin, bones and feet in compliance with ICRP Publication 60.

Figure L.8.3 of Annex 7 shows distribution of individual doses of Ukrainian NPPs personnel. As noted in Section F.4.1, most personnel of UkrSA Radon have doses less than 5 mSv a year.

Constraints of the public exposure dose limit are established for public protection against releases and discharges: 80 μ Sv/y for nuclear facilities and 40 μ Sv/y for operating waste management sites. Doses of critical public groups are substantially lower in practice than the established constraints. Authorised releases and discharges, which are not to be exceeded in normal operation, are established for each facility based on the dose constraint for the public. Figures L.7.4, L.7.5 and L.7.6 of Annex 8 correspondingly show the trend in releases of radioactive noble gases, releases of long-lived radionuclides and releases of radioactive iodine from Ukrainian NPPs.

A uniform State control and accountancy system for personnel and population individual exposure doses should be created in Ukraine to strengthen supervision over non-exceeding dose limits. The main tasks of the system are to establish a uniform procedure for individual monitoring, ensure unified and efficient methodology to monitor the quality of dosimetric measurement, provide for registration, storage and access to dosimetric monitoring results.

F. 4.1.3. Prevention of unplanned and uncontrolled releases of radioactive materials into the environment

There are technical means and appropriate operational procedures at NPPs to prevent unplanned and uncontrolled releases of radioactive materials into the environment. Administrative process levels of releases and discharges, the so-called “investigation levels” are established by each NPP administration to monitor equipment process modes and prevent unplanned and uncontrolled releases and discharges of radioactive materials into the environment (see item F. 4.1.1). Investigation levels comprise certain percentage of permissible releases and discharges. The cases of exceeding these limits are investigated by a commission and based on the investigation results corrective measures are taken if necessary.

F.4.2. Limitation of releases and discharges

Permissible releases and discharges, which are not to be exceeded in normal operation, are established for each facility based on the dose limit quota for the public (see item F.4.1.2). In practice, releases and discharges comprise percentage of the established permissible releases and discharges (see item F. 4.1.1).

F.4.2.1. Application of the ALARA principle in limitation of releases and discharges

Establishing and keeping references levels and investigation levels are the main means for optimisation of releases and discharges in Ukraine. Radiation monitoring of releases and discharges is kept at nuclear facilities (see item F.4.1 for more detail).

F.4.2.2. Non-exceeding of established exposure dose limits

Non-exceeding established exposure dose limits for NPPs releases and discharges is ensured by non-exceeding permissible releases and discharges, which are in turn controlled by non-exceeding reference levels and investigation levels.

F.4.3. Corrective measures to control unplanned or uncontrolled release of radioactive materials into the environment and to mitigate its effects

Personnel and population protection in case of unplanned or uncontrolled release of radioactive materials is settled in Article 7 and 8 of the Law of Ukraine “On Human Protection from Ionising Radiation” and Norms of Radiation Safety of Ukraine (NRBU).

Justification, non-exceeding and optimisation principles are applied in planning and implementation of intervention in case of unplanned or uncontrolled release of radioactive material. Regulatory and legal acts establish quantitative criteria – intervention levels and action levels for countermeasures, determine justified and unconditionally justified intervention and intervention termination procedure.

In order to protect personnel and population in case of unplanned or uncontrolled radioactivity release into the environment, the operating organisation’s administration shall develop, implement and ensure availability of the plan of measures to protect personnel and the population. This plan shall be intended to bring NPPs into a safe state and mitigate

accident consequences. The plan shall determine appropriate measures, intervention levels, response procedure, implementation forces and means, organisation and monitoring of the accident progression¹.

Regional emergency response authorities shall develop, implement and ensure availability of the plan of measures to protect the population under the threat of radioactive exposure. This plan deals with organisation and procedure for actions of all forces and divisions of the region, forces and means for population protection and mitigation of accident consequences, as well as organisation of monitoring of accident progression and consequences.

In order to assure emergency preparedness in the event of accidents and other emergencies, plans of measures shall be revised and updated in a timely manner. Technical means for notification of personnel and population on the emergency occurred and needed protection means are periodically tested for their operability.

Emergency training is periodically conducted at all managerial levels to ensure preparedness for emergency actions.

Measures of environmental radiological monitoring are taken and threshold detectors in the event of exceeded releases and discharges are installed around each site within the 30-km radius.

F.5. Emergency Preparedness (Article 25)

F.5.1. On-site and off-site emergency plans. Emergency plans testing

Ukraine has established an emergency preparedness and response system in the event of nuclear and radiation accidents in Ukraine. This system is completely applicable to spent fuel and radwaste management facilities, as well as to utilization of ionising radiation sources and transportation of radioactive material.

The main legislative and other regulatory and legal documents related to emergency preparedness and response and information associated with on-site emergency planning are identified in Section 4.7 of Ukraine's Report "On Compliance with the Convention on Nuclear Safety Obligations" (2001).

Requirements on emergency plans at any facility undertaking practices related to radiation and nuclear technologies, including spent fuel and radwaste management, are established by the Norms of Radiation Safety of Ukraine (NRBU-97).

According to NRBU-97 the enterprise emergency plan shall allocate responsibilities for notification of regulatory authorities, state administrative authorities and public, obligations and responsibilities for initiation of intervention, typical accident scenarios, guidelines for personnel dosimetric monitoring, measures for creation of emergency stocks etc.

Availability of the enterprise emergency plan approved by state authorities is one of the obligatory conditions for licensing of radwaste processing, storage and disposal as regulated

¹ This plan shall set forth:

- organisation and procedure of notification on the events occurred;
- indications of an accident and criteria for making decision on plan implementation;
- schemes, organisation and procedure for notification of operating organisation officials, central and local governmental authorities and local administrations;
- a list of NPPs officials responsible for notification;
- organisation and procedure of measures for personnel and population protection, accident confinement and mitigation, list of forces and means intended for these purposes, including monitoring of accident progression and consequences;
- organisation and procedure for interaction with divisions delivered to assist NPP.

by Resolution of the Cabinet of Ministers of Ukraine No. 1782 of 6 December 2000 “On Approval of Licensing Procedure of Individual Activities in the Field of Nuclear Energy Utilization”. The emergency plan constitutes inseparable part of technical specifications and radiation safety certificate of facilities. Management staff of the operating organisation is responsible for the development of emergency plans.

According to regulatory document “Safety Conditions and Requirements (Licensing Conditions) on Activities associated with Radioactive Waste Processing, Storage and Disposal”, approved and introduced by Order of the SNRCU No. 110 of 22 October 2002 and registered in the Ministry of Justice of Ukraine by reg. No. 874/7162 of 6 November 2002, in the event of a radiation accident the licensee shall properly notify the regulatory authority, regional office of the Ministry for Health of Ukraine and other establishments and shall initiate appropriate actions envisaged by emergency plans.

The enterprise emergency plan shall be periodically tested in the operational process by regulatory authorities, revised, and updated as required by NRBU-97. In addition, emergency plans are tested for effectiveness during scheduled emergency training, which is also regulated by NRBU-97.

Planning of off-site emergency measures, as well as other emergency preparedness and response measures, is incorporated in the Unified State System for Prevention and Response to Man-Induced and Natural Emergencies (USSE). Requirements on the establishment of such a system are determined by the Law of Ukraine “On the Protection of Population and Territories against Man-Induced and Natural Emergencies”.

The USSE consists of four permanent-basis functional and territorial subsystems and is divided into four levels – national, regional, local and enterprise.

USSE functional subsystems are established by ministries and other central executive bodies to organise activities intended to prevent emergencies and protect population and territories against their consequences. In the event of emergencies, forces and means of regional, local, and enterprise-level functional subsystems are subordinated, to the extent not contradicting the law, to governmental bodies of USSE respective territorial subsystems. USSE territorial subsystems are established in the Autonomous Republic of Crimea, regions (oblasts), Kiev and Sevastopol to prevent and respond to emergencies within respective regions.

In order to assure preparedness of USSE functional and regional subsystems for effective and quick response to emergencies, governmental bodies responsible for subsystems of all levels develop individual plans for response to emergencies that are the most probable for a particular territory, branch or enterprise depending on predicted data and expert assessments. Development of individual plans is required by the National Plan for Response to Emergencies elaborated and approved by Resolution of the Cabinet of Ministers of Ukraine NO. 1567 of 16 November 2001.

F.5.2. Appropriate steps for preparation and testing of emergency plans in Ukraine insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory

Information on emergency measures in the event of a radiation accident in other State posing a threat of transboundary release is set forth in Section 4.7 of Ukraine’s Report “On Compliance with the Convention on Nuclear Safety Obligations” (2001). In addition to bilateral interstate treaties identified in the Report providing for mutual notification and subsequent information exchange in the event of a nuclear or radiation accident, Ukraine

has entered into two new treaties since issuance of the Report – with the Republics of Byelorussia and Latvia.

Developed national nuclear energy necessitates establishment and functioning of the emergency response system in Ukraine, the resources of which shall be used in the event of emergencies in other States posing a threat of radiation impact on the territory of Ukraine.

F.6. Decommissioning (Article 26)



Three RBMK power units of the ChNPP are being decommissioned in Ukraine prior to expiration of their designed life time. Power unit 4 of the ChNPP (“Shelter” object) destroyed by the beyond design-basis accident is being transformed into an ecologically safe system.

Thirteen WWER power units will be decommissioned according to the design after 2011 or 2021 if their life time will be extended.

Regulations in force provide for the development of conceptual and programmatic documents on decommissioning of nuclear facilities at

different stages of their lifetime.

In order to fulfil the above requirements, NNEGC Energoatom started developing in 2002 the Concept for WWER NPPs Decommissioning.

Resolution of the Cabinet of Ministers of Ukraine No. 1747 of 29 November 2000 approved the “Comprehensive Programme on Chornobyl NPP Decommissioning”. The main tasks of the Programme are as follows:

- identify the content and sequence of measures, including organisational ones, intended for ChNPP decommissioning,
- assess the scope of funds and financial sources for decommissioning activities,
- ensure adequate and timely funding of planned measures.

According to the Law of Ukraine “On Amendments to Some Laws of Ukraine in View of Closure of Chornobyl Nuclear Power Plant”, development of national programmes for decommissioning ChNPP units and Shelter transformation into an ecologically safe system



are urgent and important tasks.

The ChNPP developed the Concept for ChNPP Decommissioning, being in its completion stage, in compliance with the terms established in the Licence for ChNPP decommissioning (series EO No. 00040 of 22 March 2001).

F.6.1. Availability of qualified staff and adequate financial resources for decommissioning

The number of ChNPP staff currently constitutes more than 4000 persons. There is an urgent need to train staff involved in ChNPP decommissioning, taking into account changes associated with new objectives and tasks of the ChNPP. The training basis of the ChNPP training centre is being expanded and modified for this purpose. Implementation of the efficient management structure and measures for improvement of the structural management scheme at ChNPP are of great importance for improving the effectiveness of decommissioning activities and co-ordination of ChNPP projects.

Decommissioning of ChNPP units is funded out of the State Budget of Ukraine according to Resolution of the Cabinet of Ministers of Ukraine No. 399 dated 25 April 2001.

F.6.2. Radiation protection, minimization of discharges and unplanned and uncontrolled releases in the decommissioning stage

After termination of power unit 3 operation, ChNPP site has not recorded any event of exceeding personnel permissible annual dose of 20 mSv/y and reference level of personnel individual dose of 17 mSv/y.

Since ChNPP units are out of operation and are in the decommissioning stage, radioactive releases into the environment contain only long-lived radionuclides. Their average daily release constituted 663 kBq/d in 2002 and comprised approximately 4.5% of the reference level of long-lived radionuclide release established at ChNPP.

F.6.3. Emergency preparedness

In compliance with the Licence for decommissioning activities (series EO No. 00040 of 22 March 2001), ChNPP shall revise the "Personnel Protection Plan" in 2003 to take into account changes in the condition of power units. The "Shelter Emergency Plan" was developed as a part of the above "Plan" in 2002.

According to the requirements of the "General Provisions on Safety Assurance in Decommissioning", an off-site emergency centre of the ChNPP in Slavutich is to be established to ensure emergency preparedness.

F.6.4. Keeping records of information important to decommissioning

There is an archive of design and operational documentation important to decommissioning at ChNPP.

Information important to the decommissioning is recorded in a systematic manner. An insurance fund of enterprise documentation has been planned. Comprehensive engineering and radiation surveys, as well as specialised research of the condition of equipment (first of all reactor structures) and structural elements of power units, are conducted to collect missing information at ChNPP power units.

F.6.5. Conceptual approaches to decommissioning of the spent fuel storage facility at ZNPP

In compliance with Article 37 of the Law of Ukraine "On Nuclear Energy Utilisation and Radiation Safety", plan of measures for spent fuel storage facility decommissioning along

with estimation of associated radwaste and plan for management of this waste was a necessary condition for permission to construct the nuclear facility, ZNPP spent fuel storage facility. The required plan is conceptually outlined in the design document “ZNPP. Environmental Impact Assessment of the Spent Nuclear Fuel Storage Facility. XI “Energoprojekt”. 1995”, Volume 1 “General Provisions”, Section 4.10 “Decommissioning”. Basic measures of this plan are set forth below.

The designed lifetime of the spent fuel storage facility constitutes 50 years, hence the storage facility can be independently operated almost over 20 years after NPP decommissioning.

According to Ukrainian current standard PNAEG-1-011-89, detailed design for ZNPP spent fuel storage facility decommissioning shall be developed not later than 5 years before expiration of the period permitted for spent fuel storage in the first (main) batch of casks VSC-WWER-1000.

Irrespective of the strategy accepted for the final stage of the nuclear fuel cycle (spent fuel processing, disposal or long-term storage in regional storage facilities), decommissioning of the on-site ZNPP spent fuel storage facility provides for off-site removal of SFA from the facility.

Structures and equipment for reloading of SFA in transport containers for removal from ZNPP spent fuel storage facility shall be designed, installed and commissioned prior to decommissioning.

Section G. SAFETY OF SPENT FUEL MANAGEMENT

G.1. General Safety Requirements (Article 4)

General safety requirements at all stages of spent fuel management are established by the Laws of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” and “On Permissive Activities in the Field of Nuclear Power Utilisation”.

Design principles, requirements and rules for spent fuel management are established by the regulations related to the sphere of nuclear fuel management at nuclear power units and sites, research reactors and subcritical test benches. These documents are as follows:

NP 306.1.02/1.034-00 “General Provisions of Nuclear Power Plant Safety Assurance”,

“Regulations on Nuclear Safety of Reactor Installations of Nuclear Power Plants” (PBYa RU AS-89),

«Regulations on Nuclear Safety of Research Reactors» (PBYa-02-78),

«Regulations on Nuclear Safety of Critical Test Benches» (PBYa-02-78),

«Safety Regulations for Storage and Transportation of Nuclear Fuel at Nuclear Power Facilities» (PNAE G-14-029-91),

G.1.1. Subcriticality and removal of residual heat

According to the requirements of the above regulations, the effective neutron multiplication factor shall not exceed 0.95 in spent fuel management under normal operation and in design-basis accident by ensuring appropriate characteristics of facilities. The subcriticality in spent fuel storage is ensured through limitation of fuel assemblies pitch; use of heterogeneous or homogenous absorbers and control of their absorbing capacity; control over availability, condition and composition of cooling medium in dry-type storage facility; control of technological parameters of spent fuel management systems.

Spent fuel assemblies residual heat removal systems and appropriate chemical composition of cooling medium are envisaged in design of spent fuel management systems to avoid temperature increase above designed values and uncontrolled level of corrosion in normal operation and design-basis accidents. Equipment and systems for supply, purification and cooling of water, ventilation, monitoring of radioactivity, temperature, level and quality of water and, if necessary, hydrogen concentration are provided for decay pools.

G.1.2. Minimisation of radioactive waste generation

Generation of radioactive waste associated with spent fuel management is kept to the practicable minimum in accordance with the established policy of nuclear fuel using. In order to achieve this goal, steps are taken to:

- increase the nuclear fuel burnup;
- improve the quality of nuclear fuel;
- optimise spent fuel management technologies.

G.1.3. Interdependencies among the different steps in spent fuel management

Interdependencies among the different steps in spent fuel management are taken into account beginning from design of nuclear fuel. Technical requirements on spent fuel storage in decay pool, cladding temperature and terms of storage in dry storage facilities are established at the stage of technical specifications for supply of fresh nuclear fuel. Ukraine has not established the policy for the final stage of spent fuel management, therefore the following two strategies are being implemented:

“deferred decision” that is presented by designing and construction of dry storage facilities with terms of storage 50 or 100 years;

return of high-level waste to Ukraine after spent fuel processing for final disposal.

G.1.4. Radiation protection of personnel, population and the environment

Fulfilling of regulations assures effective protection of individuals, society and the environment. The above-mentioned requirements comply with criteria and standards endorsed by the IAEA and other international organizations in field of nuclear energy. Detailed description of the radiation protection systems in Ukraine is provided in Section F4 of this report.

G.1.5. Consideration of biological, chemical and other hazards

Biological, chemical and other hazards that may be associated with spent fuel management are taken into account in the safety analysis and assessment of spent fuel management facilities. Information on such hazards is provided according to “Safety of Spent Nuclear Fuel Storage. Requirements on Safety Analysis Report for Dry Spent Nuclear Fuel Storage Facility. KND 306.710-95. 1995”. Biological, chemical and other hazards are assessed within the comprehensive state expertise in accordance with the “Procedure for Approval of Investment Programmes and Construction Projects and Their Comprehensive State Expert Examination”, approved by the Resolution of the Cabinet of Ministers of Ukraine No. 438 dated 11 April 2002.

G.1.6. Avoiding actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation

Protection of future generations is addressed in the SARs of spent fuel facilities. Regulatory review requires strong evidence that in the future personnel and population will be protected at the level consistent with the beginning of operation. It is also required that degradation of fuel claddings, processes under the containment and spent fuel storage facility elements be examined during operation of spent fuel storage systems in order to take timely corrective measures if necessary. While licensing it is required the development of appropriate provisions for decommissioning of the facility and radwaste disposal.

G.1.7. Reduction of burdens on future generations

The policy intended to reduce imposing undue burdens on future generations is achieved in two directions:

- reducing the risk associated with nuclear energy through development and implementation of safety improvement measures at associated facilities in compliance with the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” and
- reducing the burdens of decommissioning through establishment and collection of the decommissioning and radwaste management funds.

G.2. Existing Facilities (Article 5)

Spent fuel management is provided in Ukraine in the facilities are listed in the Annex 1.

G.2.1. SNF management at NPP

The operating organisation reassessed the safety of operating NPPs, including spent nuclear fuel management systems. This safety reassessment was carried out within the SAR development and combined a periodic safety assessment and in-depth safety analysis applying up-to-date methods. Analysis of the operating experience has confirmed that all safety indicators (first of all availability indicators of safety systems, protective barrier condition indicators, indicators of NPP impact on staff, the public, the environment, etc.) are maintained at the proper level and have no tendency to improve. Safety improvement measures shall be taken to eliminate drawbacks and weak points in the NPP designs revealed in the safety assessment. Implementation of the «Comprehensive Programme on Upgrading and Safety Improvement of Nuclear Power Units and Improvement of Operational Practice», approved by Resolution of the Cabinet of Ministers No. 504-r dated 29 August 2002, allows successful solution to such issues. The safety reassessment has not revealed any principle drawbacks that would require upgrading of on-site spent nuclear fuel management systems.

G.2.2. Zaporizhzhya NPP dry spent fuel storage facility (ZNPP SNFSF)

Stage I of Zaporizhzhya NPP SNFSF commissioning was completed in 2002. Results presented by the operating organisation demonstrate that SNFSF complies with safety criteria set forth in SNFSF SAR and with the terms of the licence for Zaporizhzhya NPP SNFSF commissioning. Consistency of the SNFSF design with fundamental safety

principles, standards and rules on nuclear and radiation safety was confirmed in the storage facility commissioning process. SNFSF trial-commercial operation has demonstrated that all storage facility systems function properly. Results of SNFSF commissioning have shown that radiation conditions outside and inside SNFSF meet radiation safety standards. Based on the commissioning results, the SNFSF safety analysis report was revised (Revision 02) and then reviewed and approved by the SNRCU. Safety improvement measures and measures for improvement and upgrading of SNFSF have been proposed taking into account operational experience.

G.2.3. Chornobyl NPP SNF storage facility

The spent nuclear fuel storage facility located on the Chornobyl NPP has been in operation since 1986. The storage facility was designed in the early eighties of the last century in accordance with the standards of that time, however in the nineties it did not comply with the existing standards and rules on nuclear and radiation safety as, for example, confirmed in the Report “Analysis of Possible Storage of Spent Nuclear Fuel in Existing Chornobyl NPP SNFSF, VO VNIPIET, inv. No. 92-10507, 1992”. In particular, this SNFSF was not designed to withstand possible seismic events; SNFSF safety is not ensured in accidents caused by aircraft crash and other initiating events; SNFSF-1 ventilation, power supply and water supply systems, control and monitoring systems and process control systems do not meet the requirements of current standards and regulations on nuclear and radiation safety. The safety analysis report for SNFSF-1 has not been developed.

SNF is not transported to the storage facility at present. After Chornobyl SNFSF-2 completion and issuance of commissioning licence, SNF from SNFSF-1 will be transported to SNFSF-2. SNFSF-1 is operated according to the terms of the Chornobyl NPP decommissioning licence (see Section H.6).

G.2.4. Spent fuel management in the Nuclear Research Institute (NRI)

The safety of SNF management on the NRI site is justified in the technical safety substantiation (TSS) for the WWR-M research reactor. According to the expert examination on nuclear and radiation safety, TSS has been approved and the safety of WWR-M reactor and SNF management in particular has been considered acceptable.

G.2.5. SNF management in the Sevastopol Institute for Nuclear Energy and Industry

The safety of irradiated nuclear fuel management at the Sevastopol Institute for Nuclear Energy and Industry is justified in the TSS for IR-100 research reactor, IR-100 physical test bench and subcritical uranium-water assembly. The SNRCU review has shown that all nuclear facilities of the Institute comply with safety requirements established by current standards, rules and regulations. Spent nuclear fuel, in compliance with the definition of the Joint Convention, is absent on the site of the Sevastopol Institute.

G.3. Siting of Proposed Facilities (Article 6)

G.3.1. Evaluation of all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime

In compliance with the Law of Ukraine "On Nuclear Energy Utilisation and Radiation Safety", decision-making on siting of nuclear facilities (including spent nuclear fuel storage facilities) is in the competence of the Verkhovna Rada (Ukrainian Parliament) and Cabinet of Ministers of Ukraine. According to this Law, the applicant for nuclear facility siting shall submit properly prepared documentation containing substantiation for such a facility and at least three siting variants. The submitted documents shall obligatory include:

- characteristic of the environment on possible facility site;
- human and environmental impact assessment for planned construction, commissioning, operation, decommissioning and closure of the facility;
- design-basis measures for prevention and mitigation of the environmental impact.

Materials related to characteristics of possible nuclear facility sites are provided in the feasibility study for facility siting.

Decisions on construction of a nuclear facility are made by the Cabinet of Ministers of Ukraine taking into account the opinion of local authorities. The decisions are taken on the basis of the state expertise of safety of the facility and other relevant expert examinations in compliance with legislation.

Siting description and safety assessment of associated facilities, taking into account characteristic of the facility site, are set forth in the SAR for these facilities developed according to KND 306.710-95 "Safety of Spent Nuclear Fuel Storage. Requirements on Safety Analysis Report for Dry-Type Spent Nuclear Fuel Storage Facility".

According to KND 306.710-95, SAR shall provide information on site location, population distribution and industrial activities in the region that are likely to affect the safety of facility systems during operating lifetime and shall describe meteorological, geological, hydrogeological and seismic factors of the site. Based on the analysis of site conditions, facility design criteria shall be developed and provided in the SAR to incorporate quantitative indicators of the environment, in particular, ambient temperature variations, maximum solar irradiation, conditions of possible flooding, seismicity, impacts of wind, hurricane and tornado, rain and snow etc. Design criteria incorporating possible man-caused impact on the facility shall be presented.

In order to assess site-related factors of Chornobyl NPP SNFSF-2, being constructed in the 10-km exclusion area, feasibility study has been developed to substantiate SNFSF-2 siting. In addition, the "Preliminary Safety Analysis Report for SNFSF-2" and "Environmental Impact Assessment of the Chornobyl NPP Spent Nuclear Fuel Storage Facility (SNFSF-2)" have been prepared. These documents analyse natural and man-made conditions of SNFSF-2 site. The most acceptable site for SNFSF-2 (out of the 4 variants considered) has been selected on the basis of the feasibility study, associated additional materials and conclusions of state expert examinations on nuclear and radiation safety for these materials. This variant has been approved by the Resolution of the Cabinet of Ministers of Ukraine.

G.3.2. Evaluation of the likely safety impact of such a facility on individuals, society and the environment

Environmental impact assessment for a nuclear facility shall be set forth in EIA developed according to DBN A.2.2-1-95 "State Construction Standards of Ukraine "Structure and Content of Environmental Impact Assessment Materials (EIA) for Design and Construction of Enterprises, Buildings and Structures. Basic Design Provisions".

EIA is intended for ecological substantiation of designed activity and its implementation methods, determination of methods and means for ensuring normal environmental conditions and meeting environmental safety requirements. According to the Law of Ukraine "On Ecological Expert Examination", design documents of SNF management facilities are subject to state ecological expert examination.

The EIA shall also contain the Statement of Ecological Consequences of the Activity, representing a legal document that sets forth consequences and safeguards of ecological safety measures for the whole period of the designed activity. The Statement is prepared by the client and general designer and constitutes the EIA summary.

G.3.3. Making information on the safety of such a facility available to members of the public

Public hearings related to nuclear energy utilization and radiation safety are provided for by current legislation. The procedure of these hearings is established by Resolution of the Cabinet of Ministers of Ukraine "On Approval of the Procedure for Public Hearings on Nuclear Energy Utilisation and Radiation Safety" No. 1122 dated 18 July 1998. The main objective of public hearings on nuclear energy utilization and radiation safety is to respect rights of members of the public and their associations for participation in discussion of such issues as for example siting, design, construction, operation and decommissioning of nuclear facilities.

The process of public consultation was held in 1998 in the development of the Khmelnytsky-2 and Rivne-4 completion project. All basic aspects of the project received in-depth and independent analysis of the interested general public. NNEGC "Energoatom" identified future environmental protection measures incorporating comments of the general public. This gives a warranty that any potential environmental impact of these NPPs will be minimised in the completion, modernisation, startup and operation of the new power units.

G.3.4. Consultation of State in the vicinity of such a facility

According to DBN A.2.2-1-95 "State Building Standards of Ukraine. Structure and Content of Environmental Impact Assessment Materials (EIA) for Design and Construction of Enterprises, Buildings and Structures. Basic Design Provisions", transboundary EIA shall be issued in the event of any impacts of designed activity on the territory of nearby States in compliance with the Convention on Environmental Impact Assessment in a Transboundary Context.

The following reports were published in mass media during development of Khmelnytsky-2 and Rivne-4 completion projects:

- Environmental impact assessment of Kmelnytsky-2 completion project. Mouchel Consulting Ltd., 1998;

- Environmental impact assessment of Rivne-4 completion project. Mouchel Consulting Ltd., 1998;
- Environmental impact assessment of Kmelnitsky-2 and Rivne-4 completion project. Environmental impact assessment of alternative energy production other than nuclear. Mouchel Consulting Ltd., 1998;

In the framework of public consultation (see subsection G.3.3), national and foreign organisations, international news agencies, other world news organisations and representatives of nearby States were provided with general data on the power unit completion projects and environmental impact assessment in particular.

The SNRSU prepared information on facilities located in the Chernobyl NPP exclusion area and description of these facilities and provided this information to the Minister of Emergencies of the Byelorussian Republic upon request in 2002.

G.4. Design and Construction of Facilities (Article 7)

G.4.1. Limitation of possible radiological impacts of SNF management facilities

Legislation of Ukraine provides obligatory licensing of designing and construction activities of spent nuclear fuel management facilities. A licence for activities at a corresponding stage of the nuclear facility life cycle is issued on the basis of a comprehensive safety assessment of the facility and capability of the applicant to take all safety measures. The construction licence for a nuclear facility shall be issued only if the facility decommissioning plan is available.

The following measures are taken to limit possible radiological impacts on individuals, society and the environment: defence in depth principle based on the application of a system of physical barriers to the spread of radioactive materials and ionising radiation into working areas and the environment and application of a system of technical and organisational measures to ensure integrity and effectiveness of barriers. Safety principles and requirements to be incorporated in the design of nuclear facilities are set forth in documents referred to in Sections G1 and F4.

G.4.2. Conceptual plans and technical provisions for the decommissioning of SNF management facilities

Article 42 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” establishes requirements on incorporation of decommissioning in the design.

At the design stage of Zaporizhzhya SNFSF, a conceptual plan for SNFSF decommissioning was developed. SNFSF decommissioning procedures are described in the Programme for SNFSF unloading and decommissioning. The Programme describes SNFSF decommissioning measures and assesses the amount of generated radioactive waste, provides waste management plans, etc. The Programme provides for the development and proper implementation of the technical project on SNFSF decommissioning.

At the design stage of ChNPP SNFSF-2, a facility decommissioning concept was developed and described in the PSAR. Generated liquid and solid radioactive waste will be utilised to prevent its spread into the environment. Most of the equipment will be suitable for reuse. Structural elements are to be dismantled. In doing so, generated radioactive waste will be utilised and transferred for storage by means of decommissioning facilities located in the Chernobyl exclusion area.

G.4.3. Support of technologies incorporated in the design by experience, testing or analysis



Technologies used for SNF storage facilities are supported by experience, testing and analysis. Technologies incorporated in the design of ZNPP SNFSF represent adaptation of the technology for SNF storage in casks VSC-24 used in US NPPs. These technologies incorporate operational experience of appropriate storage facilities in the USA and are supported by the analysis provided in the SAR for the storage facility. Technologies incorporated in the design of ChNPP SNFSF-

2 represent adaptation of the NUHOMS SNF storage technology used worldwide for storage of SNF from different types of nuclear power reactors. SNFSF-2 safety analysis is provided in the PSAR and will be presented in greater detail in the next SAR version.

G.5. Assessment of Safety of Facilities (Article 8)

G.5.1. Safety assessment and environmental expert examination

The operating organisation (utility) shall submit documents confirming the safety of the nuclear facility to obtain licences for specific stages of the nuclear facility lifetime. A list of these documents is established by the state regulatory bodies for nuclear and radiation safety.

Safety analysis reports (SAR), which are subject to obligatory state expert examination on nuclear and radiation safety, and environmental impact assessments (EIA), which are subject to obligatory state ecological expert examination in compliance with the Law of Ukraine "On Ecological Expert Examination" represent these documents.

Requirements on the content of SAR for spent nuclear fuel storage facilities are set forth in the document "Safety of Spent Nuclear Fuel Storage. Requirements on Safety Analysis Report for Dry-Type Spent Nuclear Fuel Storage Facility» KND 306.710-95. Provisions of this document require that SAR submitted for SNFSF construction licence should contain information adequate for assessment of the SNFSF safety analysis. According to current legislation, the design of the facility is subject to other relevant expert examinations. They are summarised in the process of Comprehensive State Expert Examination established by Resolution of the Cabinet of Ministers of Ukraine "On Procedure for Approval of Investment Programmes and Construction Projects and Their Comprehensive State Expert Examination" No. 1308 dated 17 August 1998.

The safety of Chornobyl SNFSF-2, being in its construction stage, is substantiated in two basic design documents – PSAR and EIA. The Conclusion of the State Expert Examination on Nuclear and Radiation Safety for ChNPP SNFSF-2 construction project and safety substantiating documents has shown that the SNF storage technology is acceptable in terms of nuclear and radiation safety and complies with the approaches to SNF interim storage adopted in Ukraine. The nuclear and radiation safety principles incorporated in the design meet national regulatory legal acts and safety assurance approaches. ChNPP SNFSF-2 construction licence was issued on the basis of conclusions of the State Expert Examination on Nuclear and Radiation Safety and summarised comprehensive conclusion on the SNFSF-2 design incorporating findings of assessments carried out in compliance with current legislation.

G.5.2. SAR reassessment in construction and commissioning

Upon completion of the construction, the safety level of the completed SNFSF shall be proved consistent with the safety level incorporated in the design. This version of the SAR shall also substantiate the safety of changes, modifications and corrections made to the design in the SNFSF construction, pre-commissioning and testing. This SAR version shall be updated as required by expert conclusions and will be presented by the applicant along with the application for SNFSF-2 operation licence. A regular SAR assessment shall be carried out at this stage.

Therefore, SNFSF-2 licensing has demonstrated that the SNRCU pays constant attention to safety assessments of spent nuclear fuel management facilities .

G.6. Operation of Facilities (Article 9)

G.6.1. Licenses for operation of facilities

Submission of documents substantiating nuclear and radiation safety is an obligatory condition for issuing the licence to operate a nuclear facility. A list of these documents is established by the SNRCU (see Section 5). The licence in particular establishes operating conditions of the facility. These conditions are based on the review of the submitted documents. Documents submitted for the review in particular shall contain:

- SAR updated according to results of facility commissioning;
- operational and technical documentation establishing procedures for operation, maintenance, monitoring, inspection and testing of facility equipment, operational limits and conditions substantiated in SAR. The documentation establishes conditions, procedure and periodicity of its revision;
- report on facility commissioning results;
- decommissioning programme of the facility, which is to be periodically updated and detailed;
- inspection report on availability of the facility for operation.

G.6.2. Definition and revision of operational limits and conditions

In compliance with the “General Provisions of Nuclear Power Plant Safety Assurance”, the design of every nuclear installation incorporates limits of nuclear plant safe operation – designed process parameters whose deviations can cause an accident – and conditions of

safe operation – designed minimal conditions of the quantity, characteristics, operability and maintenance of safety-significant systems (components) intended to maintain limits of safe operation and/or safety criteria.

According to the terms of issued licences, the operating organisation shall reassess the safety of operating NPPs and submit associated reports to the SNRCU every 10 years. The reassessment constitutes the basis for defining and revising operational limits and conditions of the facility.

G.6.3. Operating procedures

In compliance with the Law of Ukraine "On Permissive Activities in the Field of Nuclear Power Utilisation", the operation licence issued to operating organisations in particular defines conditions of this activity, which are substantially based on provisions of operational and technical documentation submitted by the applicant. The documentation establishes procedures for operation, maintenance, monitoring, inspection and testing of facility equipment and operational limits and conditions.

G.6.4. Engineering and technical support in operation

In compliance with the “General Provisions of Nuclear Power Plant Safety Assurance”, the operating organisation is responsible for establishment of the organisational structure required for safe operation of the nuclear facility as a whole and for its engineering and technical support in particular. In order to fulfil this provision, the operating organisation develops and implements appropriate programmes and carry out needed activities. For example, with the purpose of investigating conditions of dry storage of WWER-1000 spent nuclear fuel, NNEGC “Energoatom” has developed and is being implementing the long-term “Programme of Activities to Investigate Spent Nuclear Fuel Storage Conditions”.

G.6.5. Reporting on incidents significant to safety to the SNRCU

Information on all operational events, emergencies and accidents occurred at NPP is investigated in compliance with the “Provision on Investigation and Accounting of Events Occurred in Ukraine’s NPP Operation” and reported to the SNRCU and other relevant organisations.

The following information is to be reported on each operational event at the facility:

- early notification on the event (within an hour);
- preliminary notification on the event (within 24 hours);
- classification of the event;
- report on investigation of the event (within 15 days since occurrence).

Representatives of the SNRCU and their experts participate in the investigation of the operational events at the facility if necessary.

G.6.6. Analysis of relevant operating experience

In compliance with the “General Provisions of Nuclear Power Plant Safety Assurance”, the operating organisation is responsible for the completeness and quality of investigation, development and implementation of measures to prevent further operational events and accidents, submission of truthful and timely investigation reports to the state regulatory bodies,.

The operating organisation exercises constant monitoring of all activities significant to safety of nuclear facilities. The operating organisation submits findings of safety inspections of the facility and periodical reports on current safety level to the SNRCU. In compliance with the “General Provisions of Nuclear Power Plant Safety Assurance”, information on violations of limits and conditions of safe operation shall be included in periodic reports on current safety level. Requirements on annual safety reports are established in the document “Requirements on Annual Safety Reports for WWER NPPs”.

Operation of facilities is also supported by the informational database on incidents at facilities. This database constitutes a part of the unified information system of the operational organisation (NNEGC "Energoatom") - "Informational system on operational events at Ukrainian NPPs". The system provides for storage and analytical processing of information and information exchange with the similar system of the SNRCU.

G.6.7. Decommissioning plans for facilities

In compliance with the Law of Ukraine "On Nuclear Energy Utilisation and Radiation Safety", a plan of decommissioning measures shall be developed before the construction of a nuclear facility. This plan is updated in due course and detailed using the relevant experience. Conditions for revision of the plan are established in the operation licence for the facility.

G.7. Disposal of Spent Fuel (Article 10)

The “Programme on Management of NPP Spent Nuclear Fuel” does not identify measures on treatment of spent nuclear fuel for disposal up to 2010.

Therefore Ukraine, like many other States, is implementing the so-called “deferred decision”, meaning that the decision on spent fuel disposal or processing is deferred to future when it can be made with greater confidence taking into account relevant worldwide experience and progress of science and industry of the State.

Section H. SAFETY OF RADIOAKTIVE WASTE MANAGEMENT (Article 11)

H.1. General Safety Requirements (Article 11)

General safety requirements for all stages of radioactive waste management are established by standards and rules on nuclear and radiation safety and regulations:

“Safety Conditions and Requirements (Licensing Conditions) on Activities Associated with Radioactive Waste Processing, Storage and Disposal” NP 306.5.04/2.060-2002;

“Requirements to the Structure and Contents of the Safety Analysis Reports on Radioactive Waste Treatment Facilities” NP 306.3.02/3.043-2001;

“Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposal Facilities of Radioactive Waste” NP 306.3.02/3.038-2000;

“Procedure for Exemption of Radioactive Waste and By-product Radioactive Materials from Regulatory Control” NP 306.3.04/2.002-97;

“Radioactive Waste Management. Annual Safety Analysis Report on Radioactive Waste Management. Requirements on the Structure, Content and Format” ND 306. 307-96;

“Radioactive Waste Management. Annual Safety Analysis Report on Radioactive Waste Management in the Exclusion Area. Requirements on the Form and Content” ND 306. 309-95;

“Radioactive Waste Management. Disposal of Radioactive Waste in Near-Surface Facilities. General Radiation Safety Requirements” ND 306.604.95;

“Radioactive Waste Management. Requirements on Radioactive Waste Management before Disposal. General Provisions” ND 306.607.95;

“Radioactive Waste Management. Casks for Disposal of Solid Radioactive Waste. Radiation Safety Requirements” ND 306.608.95.

H.1.1. Subcriticality and removal of residual heat

Requirements concerning obligatory account and assurance of subcriticality and removal of residual heat in radioactive waste management are established in the “Main Sanitary Rules for Radiation Protection of Ukraine”, regulation “Requirements on Radioactive Waste Management before Disposal” ND 306.607.95 (Section 4.2) and other lower-level regulatory documents.

Requirements for assurance of subcriticality are incorporated in technical specifications for the development of radioactive waste management equipment likely to contain fissile materials.

Requirements for removal of residual heat are also incorporated in technical specifications for the development of radioactive waste management equipment (mainly for the development of casks to contain radioactive waste).

H.1.2. Minimisation of radioactive waste generation

One of the main principles of the state policy in radioactive waste management is to ensure that the generation of radioactive waste is kept to the minimum practicable (Article 3 of the Law of Ukraine “On Radioactive Waste Management”, Article 5 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety”).

In order to implement this principle in practices associated with nuclear energy utilisation, Article 21 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” establishes that one of the functions assigned to the body for nuclear energy utilisation is to “plan measures intended to ensure that the generation of radioactive waste in nuclear energy utilisation is kept to the minimum practicable”.

This is achieved through developing and implementing radioactive waste minimisation programmes in the framework of radioactive waste management practices. Regulation “Requirements to the Structure and Content of Radioactive Waste Treatment Facilities” (NP 306.3.02/3.043-2001) requires providing information on activity intended to minimise generation of radioactive waste.

The Programmes on Radioactive Waste Management are updated and specified every three years. The goal of the Programmes is to provide technical and organisational support to the implementation of the state policy in radioactive waste management at NPPs and UkrDO Radon SISP in compliance with the main areas of the Comprehensive Programme of Radioactive Waste Management.

The main tasks of the Programmes:

- identify sources of radioactive waste generation;
- develop radioactive waste minimisation measures;
- improve existing radioactive waste management systems.

H.1.3. Interdependencies among the different stages in radwaste management

Interdependencies among the different steps in radioactive waste management are governed by the Laws of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” and “On Radioactive Waste Management”, regulatory documents “Main Sanitary Rules for Radiation Protection of Ukraine (OSPU)” and “Sanitary Rules for Radioactive Waste Management (SPORO-85)”.

These documents require that properties of the final treatment product at the preliminary stage comply with acceptance criteria at the next state of radioactive waste treatment, storage or disposal.

H.1.4. Effective protection of individuals, society and the environment

The system on radiation protection of staff, the public and the environment, measures for radiation protection in Ukraine in radioactive waste management and the status of affairs in this area are described in Section F4 of the Report.

H.1.5. Biological, chemical and other hazards

Requirements for obligatory account of biological, chemical and other hazards that may be associated with radioactive waste management are established in the regulations OSPU, “Requirements on Radioactive Waste Management before Disposal” ND 306.607.95 (Section 4.2) and other lower-level regulations.

These documents establish acceptance criteria for transfer of radioactive waste from research laboratories, institutes and industry to repository. They are as follows:

- pretreatment of biological substances and specimens to a stable condition;
- pretreatment of radioactive waste to a fire and explosive safe condition;
- prohibition of joint storage of radioactive and toxic waste.

H.1.6. Avoiding actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation

This is the main legislative principle of the state policy on nuclear energy utilisation (Article 5 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety”). Implementation of this principle is set forth in Section G1.6.

H.1.7. Reduction of burdens on future generations

Legislative framework and implementation of this principle are set forth in Section G1.7.

H.2. Existing Facilities and Past Practices (Article 12)

A list of radioactive waste management facilities is provided in Annex 2.

H.2.1. Safety of existing facilities

UkrSA Radon

According to the first inventory of radioactive waste, there are 2694 plants, organisations and enterprises that use radioactive materials in Ukraine. Specialised management of radioactive waste resulted from utilisation of ionising radiation sources in national economy is undertaken by the Industrial Association UkrDO "Radon", which is subordinated to the Ministry of Emergencies and consists of 6 State Interregional Special Plants (SISP): Dnipropetrovsk, Donetsk, Kyiv, L'viv, Odesa and Kharkiv. SISP were commissioned in 1961-1962. State Special Enterprise (SSE) "Complex" and SSE "Tekhnocentre" entered into the Association in 1998.

A service area consisting of several regions of Ukraine is assigned to each SISP:

Kyiv SISP – Kyiv, Vinnitsa, Zhitomir, Khmelnytsky, Cherkasy, Chernigiv Regions and Kyiv;

Dnipropetrovsk SISP – Dnipropetrovsk, Donetsk, Zaporizhzhya, Kirovograd, Luhansk Regions;

L'viv SISP – L'viv, Volyn, Zakarpatye, Ivano-Frankovsk, Rivne, Ternopil, Chernivtsy Regions;

Kharkiv SISP – Kharkiv, Poltava, Sumy Regions;

Odesa SISP – Odesa, Mykolaiv, Kherson Regions and the Autonomy Republic of Crimea;

Donetsk SISP – Donetsk Region.

SISP storage facilities have been constructed according to typical designs.

Each SISP (excluding Donetsk) is equipped with: trench storage facilities for solid radwaste (SRW), vault-type storage facilities for used radiation sources (IRS), storage tanks for liquid radwaste (LRW), specialised transport vehicles and process facilities.

The SRW storage constitute engineering structures with dimensions of 14,5×9,5×3,0 m and capacity of 400 m³.

The LRW interim storage facilities constitute two-channel cylindrical underground tanks ($\varnothing = 9$ m, $h = 3,15$ m) made of stainless steel and coated with reinforced concrete.

The storage facility for biological radioactive waste constitutes a four-section tank of 60 m³.

Storage facilities for high-level spent ionising radiation sources are made of stainless steel and are concreted at a 6-m depth. Receiving wavy tube of $\varnothing=104$ mm and receiving cone are made of stainless steel. The receiving device is provided with a plug and metal cover.

SISP readjustment for radioactive waste collection and temporary storage in containers requires appropriate changes to radioactive waste management technology, re-equipment of SISP, changes of procedures. These aspects are set forth in Radioactive Waste Management Programmes and Quality Assurance Programmes for Radioactive Waste Management at each SISP.

Safety assessments of radioactive waste management facilities are carried out in the SARs submitted to the SNRCU along with the application for operation licence and in licensees' annual safety analysis reports on radioactive waste management. The submitted reports have proved that SISP facilities are capable of performing the main function – confinement of radioactive materials.

In order to eliminate drawbacks peculiar to outdated designs of radioactive waste management facilities, the licences require implementation of appropriate safety improvement measures. During the recent years at the SNRCU request:

- water-drain covering has been constructed over solid radioactive waste near-surface facilities to prevent ingress of precipitation;
- some sections of radioactive waste disposal process have been mechanized – remote control equipment has been implemented for IRS unloading from transport casks to IRS disposal vaults.

SSE “Complex” operates facilities for disposal of short-lived radioactive waste of groups I and II, having the total area of 140,0 thousand m² and locating about 650 thousand m³ of radioactive waste altogether. SSE “Complex” also deals with decontamination of various equipment in the exclusion zone.

Since radwaste disposal plants (RWDP) “Buryakivka”, “Pidlisny” and “construction site of units 5 and 6 of ChNPP” operated by SSE “Complex” were constructed under extreme post-accident conditions. The safety assessment of these RWDPs was carried out as a part of the closure concept approved by the SNRCU.

NPP

NPP designs provides for radioactive waste management systems: LRW and SRW storage facilities; SRW sorting and compacting facilities; SRW and LRW incineration facilities; LRW evaporation facilities and facilities for radioactive oil regeneration.

Radioactive waste treatment facilities currently available on site are listed in Table H.2.1.

Table H.2.1. Existing radioactive waste treatment equipment at Ukrainian NPPs

Radioactive waste treatment facility	ZNPP	RNPP	KhNPP	SUNPP
Solid radioactive waste sorting facility	+	-	-	-
Solid radioactive waste compacting facility	+	-	-	+
Solid and liquid radioactive waste incineration facility	+	-	-	-
Radioactive oil incineration facility	-	-	+	-
Evaporation facility	+	+	+	+
Radioactive oil purification facility	+	-	+	-
Bituminisation facility	-	*	-	-
Deep-evaporation facility	+	-	+	-

* - the facility was preserved in the 4th quarter of 2002

The existing practice of LRW management consists in collection of floor drains and their evaporation to the state of high level salt concentration. Zaporizhzhya and Khmelnytsky NPPs implemented 2-nd stage of LRW processing to the state of salt fusion cake, which is stored in 200-L steel drums with protective coating of sputtered aluminium. Rivne and South Ukraine NPPs store bottoms in stainless steel tanks in on-site LRW storage facilities. Used sorbents are stored in stainless steel tanks in LRW storage facilities on site.

SRW is collected in place of its production, sorted into groups (by gamma dose rate) and transferred to SRW storage facilities. Only some NPPs deal with SRW sorting depending on further processing, SRW pre-compaction (at ZNPP and SUNPP) and incineration of low-level radioactive waste (at ZNPP).

According to Programmes on Radioactive Waste Management, each NPP takes technical and organisational measures in order to improve radioactive waste management technologies, improve safety in this field and minimise radioactive waste.

Safety assessment of on-site radioactive waste management is carried out in the content of NPP designs and reports on implementation of Programmes on Radioactive Waste

Management submitted by the operating organisation in the framework of the licence (SUNPP) and permits for operation of other NPPs and annual reports on NPP current safety state.

Research reactors

There are temporary storage facilities for radioactive waste of 2 and 3 groups at NRI NASU research reactor. Solid radioactive waste storage facilities are intended for high-level waste resulted from research efforts in the NRI NASU metallography laboratory. Waste is stored in tanks having different capacity, wall and covering thickness. Depending on specific gamma-activity SRW is located in appropriate compartments of the storage facility.

Sevastopol National Institute for Nuclear Energy and Industry stores all radioactive waste on the territory of IR-100 research reactor at liquid and solid radioactive waste temporary storage sites in compliance with design. SRW is stored in specially designed containers. LRW in small amount is solidified and stored on SRW temporary storage point prior to its transportation to the Odesa SISP. LRW in large amount is stored in sump tanks.

Radioactive waste management safety at sites of research reactors is justified in the Technical Safety Substantiation for WWR-M and IR-100 reactors. Based upon review of technical safety substantiation by the SNRCU, it has been proved that both nuclear facilities comply with safety requirements established by standards, rules and regulations in force.

H.2.2. Past practices

H.2.2.1. Management of radioactive waste resulted from the Chernobyl disaster

Soil, radioactive contaminated forest (including fire sites, dead-wood), structures, machines, mechanisms, etc., which have high radioactive contamination and are located on the surface of the exclusion zone, in radioactive waste temporary storage points (that amount to more than 800 in the exclusion zone) and in “Pidlisny”, “ChNPP Stage III” and “Buryakivka” RWDP constitute radioactive waste sources in the exclusion zone (excepting the “Shelter”). The total amount of low- and intermediate-level radioactive waste accumulated in the exclusion zone (excepting the “Shelter”) constitutes approximately 11 mln. m³, including 1,2 mln. m³ of radioactive contaminated forest.

Radioactive waste management in the exclusion zone is regulated by the Law of Ukraine “On Legal Regime on the Radioactive Contaminated Territory as a Consequence of Chernobyl Disaster”. The concept on Chernobyl exclusion zone determines this activity as the main one and provides for creation of an industrial complex for radioactive waste treatment and storage.

The land of the Chernobyl exclusion zone has been withdrawn from national economy use and its reclamation is not envisaged. In order to enhance capabilities of the zone to prevent migration of radionuclides, the most optimal variant is to plant forests for environmental protection, stabilization and enhancement.

According to the concept on the Chernobyl exclusion zone, the measures ensuring reliable long-term storage of radioactive waste in RWTSP without its subsequent retrieval is considered to be the first priority in Ukraine. The need for retrieval of intermediate-level radioactive waste from RWTSP for subsequent disposal can be determined only after appropriate research of hazards associated with this waste.

SSE “Complex” implements radioactive waste management activities in the exclusion zone based on associated licences issued by the SNRCU. These activities include radioactive waste collection in places with the most intensive contamination in the exclusion zone, radioactive waste transportation, monitoring and operation of in-service “Buryakivka”

RWDP, monitoring of out-of-service “Pidlisny” and “ChNPP Stage III” RWDP and RWTSP, decontamination of metal roll, cable items, metal scrap, machines and mechanisms.

The safety of radioactive waste management is substantiated in the safety analysis report submitted along with the application for a licence and in the safety analysis report on radioactive waste management annually submitted by the licensee in compliance with regulatory requirements established in document ND 306.307-96.

H.2.2.2. Management of “Shelter” radioactive waste

The “Shelter” is hazardous in that it contains nuclear dangerous fissile materials and radioactive waste.

The “Shelter” still contains more than 95% of fuel from the reactor and therefore represents nuclear risk.

Supplement to NRBU-97 "Radiation Protection from Potential Ionising Radiation Sources" (NRBU-97/D-2000) states the following: "...the “Shelter” in its current state shall be classified as a place for surface storage of unorganised radioactive waste (temporary storage facility for unorganised radioactive waste under stabilization and reconstruction)". At that all materials of the facility, including nuclear materials, are considered as radioactive waste and can not be used for any purposes other than disposal.

Experts assessed that the amount of solid radioactive waste resulted from the accident and mitigation of its consequences in the “Shelter” and its site comprises from 530400 m³ to 1737400 m³ with the total activity of $7,4 \times 10^{17}$ Bq. The average amount of “after-accident” liquid radioactive waste is assessed at 4000 m³ with the total annual activity of 1.2×10^{13} Bq. There are no records on “Shelter” radioactive waste in the Register of radioactive waste because of the very uncertain assessment of its amount.

“Shelter” radioactive waste resulted from operation is managed according to the Chornobyl NPP SSE “Integral Programme on Radioactive Waste Management” within the ChNPP technical complex.

H.2.2.3. Management of radioactive waste resulted from military programmes

In compliance with the Agreement between the Ukrainian Ministry of Defence and US Department of Defence on cooperation for liquidation of mass destruction weapons infrastructure of 27 June 1995, UkrDO Radon is to liquidate radioactive waste military storage facilities.

Radioactive waste storage facility “Makariv” was liquidated under projects approved by the SNRCU. 6.6 m³ of waste with the activity of $2,61E+9$ Bq (Annex 4.7) was placed in Kyiv SISF for temporary storage.

H.3. Siting of Proposed Facilities (Article 13)

Decisions on siting of proposed facilities are adopted by the Verkhovna Rada or the Cabinet of Ministers of Ukraine. The decision-making procedure for siting of radioactive waste management facilities is established by Article 22 of the Law of Ukraine “On Radioactive Waste Management” and is similar to the procedure for siting of a nuclear facility as described in Section G.3.1.

H.3.1. Evaluation of relevant site-related factors likely to affect the safety of a facility during its operating lifetime and after closure

A decision on siting of a radioactive waste storage or management facility shall be made according to review of documents which in particular shall contain the following:

- substantiation of necessity to construct a radioactive waste management facility;
- at least three siting variants;
- analysis of data obtained in design exploration activities pertaining to site safety;
- environmental characteristics in the area where radioactive waste management and storage facilities are to be located;
- conclusion on the impact of these management and storage facilities on the human and environment;
- SNRCU conclusion on nuclear and radiation safety;
- proposals and comments of appropriate local authorities.

Taking into account that complex "Vector" was siting before establishing Ukrainian legislation the comprehensive examination was carried out by an international Cassiopee" Consortium (representatives of ONDRAF/NIRAS (Belgium), EPTISA-ENRESA (Spain), BNFL-NIREX (Great Britain) and DBE (Germany) in 1996 in the framework of TACIS



Project U4.02/99. Conclusions of the expert examination were positive.

While correcting the "Vector" I-stage construction project in 1998, the operating organisation (Scientific and Technical Centre for Decontamination and Complex Management of Radioactive Waste Materials and Ionising Radiation Sources (STC CMRW) updated the section "Environmental Impact Assessment" to comply with the Law of Ukraine "On

Radioactive Waste Management" and ND 306.604-95 "Radioactive Waste Management. Disposal of Radioactive Waste in Near-Surface Facilities". This work demonstrates acceptability and ecological safety of designed technical features pertaining to disposal of radioactive waste resulted from the ChNPP accident, including those after closure of "Vector" storage facilities.

Radioactive waste management facilities included in the NPPs technical complex are located on sites and therefore on-site factors are assessed in the NPP design.

H.3.2. Evaluation of likely safety impact of a facility on individuals, society and the environment



Human and environmental protection against radioactive waste impact and minimum restrictions to be imposed on future generations shall be the key factor in making decisions on siting of proposed radioactive waste management facilities (ND 306.607.95

“Requirements on Radioactive Waste Management before Disposal”).

Environmental impact assessment is set forth in the EIA Report according to the requirements established by DBN A.2.2-1-95 as determined in Section G.3.2 of this Report. For example, evaluations of “Vector” probable impact on staff, the population and the environment resulted in the following conclusion: “stage I of the “Vector” complex will not cause negative impacts exceeding regulated standards on the population and the environment in normal operation and accidents resulted from failure of process systems or caused by natural and man-made factors».

H.3.3. Informing members of the public on the safety of facilities

In compliance with Article 11 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” and Resolution of the Cabinet of Ministers of Ukraine No. 1122 dated 18 June 1998 "On Public Hearings on Nuclear Energy Utilisation and Radiation Safety", experts of plants included in the UkrDO Radon – SSE "Complex", SSE "Tekhnocentre", STC CMRW and SISP – make great efforts to popularise knowledge on radioactive waste management, treatment, storage and disposal and construction projects of new facilities. Conferences and workshops are conducted for this purpose, articles are published both in specialised periodicals – "Problems of Chernobyl Exclusion Zone", "Bulletin of Ecological Conditions at Exclusion Zone and Unconditional (Obligatory) Evacuation Zone", "Tekhnopolis" etc. – and in central press – "Uryadovy Kurier", "Visnyk Chernobilyu" etc.

- SSE Chernobyl NPP published statements on ecological consequences of construction and operation of on-site radioactive waste management facilities in city newspaper “Teleden’ Slavutych” while siting facilities for radioactive waste treatment.

H.3.4. Consultation of neighbouring States

Item 1.3 of “Requirements on Radioactive Waste Management before Disposal. General Provisions” ND 306.607.95 states that one of the main principles of radioactive waste management is to ensure protection outside the national borders, namely: ensure protection of human health outside the national borders at the level not lower than that considered acceptable in a given State.

Therefore Ukrainian executive bodies closely cooperate with the Ministry of Foreign Affairs and Ministry for Environmental Protection of Byelorussia as regards siting of radioactive waste treatment facilities under construction in the exclusion zone (see Section G.3.4 of this Report).

H.4. Design and Construction of Facilities (Article 14)

H.4.1. Limitation of possible impacts of a radioactive waste management facility at the design stage

According to the Law of Ukraine “On Permissive Activity”, design of a radioactive waste management facility is subject to licensing and is determined as a specific phase of the disposal facility lifetime. The SNRCU issues the licence based on the comprehensive safety assessment of the disposal facility and assessment of the applicant’s capability to take all safety measures.

The main safety principles incorporated in the design of radioactive waste management facilities are as follows:

- radioactive waste reliable isolation from the environment is ensured by a system of natural and man-made barriers during operation and after decommissioning or closure of radioactive waste management facilities;

- radiation safety in normal conditions is ensured through compliance with NRS standards, rules and regulations;

- radiation safety in extreme natural events or emergencies is ensured by scientifically proven design decisions on possible scenarios of events intended to confirm that limits established by NRS standards, rules and regulations are not exceeded;

- the design of a disposal facility shall contain two safety assessments – for operation and for the period after closure;

- a physical protection system is an obligatory element of the design.

For example the “Vector” design provides for the following:

- radiation process monitoring (radioactive waste incoming monitoring, monitoring of volume activity of drain water and water in radioactive drain collector tanks, monitoring, contamination monitoring of transportation vehicles and surface of casks etc);

- radiation dosimetry monitoring (monitoring of absorbed dose rate in the “contaminated” part in different process areas, volume airborne activity, surface contamination of walls, floor, roads, etc., and similar measurement in the “non-contaminated” part);

- individual radiation monitoring;

- environmental radiation monitoring to be carried out during storage facility construction and operation and after-operational period both on the site and in the kilometre zone around it. Observation boreholes are to be constructed for groundwater monitoring.

For example, two variants of possible siting were considered for the “Vector” radioactive waste storage facility. As a result of comparison and evaluation of natural conditions based on engineering and geological survey, the site was selected with the most appropriate geological characteristics for creation of a natural barrier to the migration of radionuclides. For the storage facility design to provide for reliable radioactive waste isolation from the environment, such man-made barriers shall be used as: reinforced concrete casks, reinforced concrete walls and 500-mm thick coverings of modules, 800-mm module bottom parts, upper and lower absorption layers provided with a reinforced concrete plate from below and with soil layer from above.

The design of a near-surface facility for radioactive waste disposal shall obligatory incorporate the requirements of the “Norms of Radiation Safety of Ukraine (NRBU-97) Radiation Protection from Potential Ionising Radiation Sources” NRBU-97/D-2000, which determine reference scenarios of public potential exposure after exemption of the near-surface facility from administrative control in 300 years after its preservation.

H.4.2. Conceptual plans and technical provisions for the decommissioning of radioactive waste management facilities

Article 39 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” states that the procedure for decommissioning of a radioactive waste management facility and closure of a repository shall be envisaged in the design according to standards, rules and regulations pertaining to nuclear energy.

Article 42 of this Law states that the construction permit for a radioactive waste management facility may be issued only after presentation of the plan of associated

decommissioning measures, evaluation of radioactive waste amount that will be generated and plan for management of this radioactive waste.

Item 4.9 of ND 306.304-96 “Requirements on the Safety Analysis Report on Radioactive Waste Treatment Facilities” establishes that the Safety Analysis Report, as a part of the design, shall:

- demonstrate that after operation termination the facility will be dismantled and the site will be brought into the condition allowing its unlimited economic use;

- identify methods for facility dismantling;

- evaluate radioactive waste amounts and characteristics for decommissioning period and provide a further plan of radioactive waste management;

- describe methods for reclamation of the site and adjacent territories.

These requirements are completely incorporated in the LRTP design.

H.4.3. Preparation of technical provisions for the closure of a radioactive waste disposal facility

Article 21 of the Law of Ukraine “On Radioactive Waste Management” states that radioactive waste storage facilities shall be closed pursuant to the closure project as decided by the state governmental body for radioactive waste management and agreed by the SNRCU. The possibility of unauthorised access to the closed storage facility shall be minimised and unauthorised population of the territory and activities that can cause destruction of protective barriers shall be prevented. This requirement is met through establishing caution signs, enclosures and indication of restriction signs on maps kept by appropriate state governmental bodies and administrations dealing with radioactive waste management.

For example, an individual section of the “Vector” design provides for preservation of the complex after active operation. Protective structures of the territory, structures for collection and removal of rainwater, observation boreholes, etc., shall be kept. Post-operational service of the storage facility has been determined as 300 years. Environmental monitoring will be conducted over that period.

H.4.4. Incorporation of proven technologies for radioactive waste management in the design

The requirement that the design shall meet current standards, rules and regulations and incorporate technologies supported by experience, testing or analysis is one of the main safety principles incorporated in the design of radioactive waste management facilities.

Ukraine is implementing several projects related to the creation of NPP radioactive waste management systems with involvement of well-known foreign companies.

For example, a liquid radioactive waste treatment plant (LRTP) including a radioactive waste grouting facility and industrial complex for solid radioactive waste management (ICSRM) are being constructed at the ChNPP. This complex incorporates a facility for solid radioactive waste retrieval from the existing storage facility, solid waste treatment plant (including SRW sorting, compacting, incineration and grouting facility) and short-lived low- and intermediate-level waste storage facility. A similar storage facility has been constructed in Spain (El Cabril).

H.5. Assessment of Safety of Facilities (Article 15)

According to Article 24 of the Law of Ukraine “On Radioactive Waste Management”, a systematic safety assessment of the future facility operation shall be carried out prior to its

construction. A safety assessment for the period after closure shall be additionally carried out for radioactive waste disposal facilities. A list of standards and rules on nuclear and radiation and regulations that require such an assessment is provided in Section H.1.

H.5.1. Safety assessment and environmental assessment of a radioactive waste management facility covering its operating lifetime

In compliance with the regulatory framework in force in Ukraine, the Safety Analysis Report (SAR) is one of the main documents for design of a radioactive waste management facility. Requirements on the structure and content of this report are set forth in NP 306.3.02/3.043-2001 «Requirements to the Structure and Contents of the Safety Analysis Reports on Radioactive Waste Treatment Facilities» and NP 306.3.02/3.038-2000 “Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposal Facilities of Radioactive Waste”.

The design for a radioactive waste management facility incorporates the operating safety assessment including analysis of possible emergency scenarios, their consequences and comparison of results with safety criteria. The construction licence may be issued only provided that there is a positive conclusion of state expert examination of the design, including that on nuclear and radiation safety.

The safety assessment has been carried out for such significant designs as Liquid Radwaste Treatment Plant of ChNPP (LRTP), Industrial Complex of Solid Radwaste Management of ChNPP (ICSRM) and “Vector” complex. Regulatory review of LRTP and ICSRM designs was carried out by the international consortium led by the “Riskaudit” and Ukrainian TSO State Scientific and Technical Centre on Nuclear and Radiation Safety (SSTC) within the TACIS Programme.

H.5.2. Safety assessment and environmental assessment of a radioactive waste disposal facility for the period following closure

Regulations establish additional requirements on the design of radioactive waste disposal facilities as regards safety assessment after their closure. This safety assessment is submitted to the SNRCU along with documents and application for the construction licence. According to the regulation “Disposal of Radioactive Waste in Near-Surface Facilities. General Radiation Safety Requirements” ND 306.604.95, the disposal facility design shall obligatory incorporate the preliminary plan of future preservation with description of sequence and content of the appropriate measures:

decontamination and dismantling of equipment and structures required for further operations;

storage of archives;

establishment of a post-operational and administrative control system, etc.

For existing facilities and those under design such an assessment is carried out in the Safety Analysis Report developed in compliance with regulation 306.3.02/3.038-2000 "Standards and Rules on Nuclear and Radiation Safety. Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposal Facilities of Radioactive Waste" and subjected to obligatory state expert examination on nuclear and radiation safety and environmental assessment.

STC CMRW developed the “Preliminary Safety Analysis Report” in 2001 in the framework of the “Project for Minimisation of the Radiation Accident Impact at Radioactive Waste Storage Facilities 5, 6, 7 of Kyiv SISP RWDP”. This report analysed radiation conditions

pertaining to the disposal of on-site short-lived radioactive waste and long-term storage of long-lived waste to be retrieved from RWDS of Kyiv SISF. Dose calculations for members of the public for the period when the storage facility is exempt from administrative control (according to the scenarios regulated by NRB-97/D-2000) has shown that the average annual total effective potential dose can achieve 0.85 mSv/y (non-exceeding 1 mSv per year is the condition for storage facility decommissioning). The total risk will constitute $6,21 \cdot 10^{-5}$ pik^{-1} .

Long-term safety assessment for the period after closure has been carried out in designs for the “Vector” complex and storage facility included in ICSRM.

H.5.3. Updated and detailed versions of the safety assessment

Ukraine has accepted and implemented a system of two- and three-stage safety assessment of designs for radioactive waste management facilities. The preliminary safety analysis report (PSAR) is developed at the stage of feasibility study or conceptual design. More detailed safety assessment is carried out at the stage of design development (detailed design) and is summarised in the interim SAR. This assessment is updated based upon results of start-up testing and is presented as the final SAR to be submitted to the SNRCU along with the application for a permit to operate the radioactive waste management facility or a licence to operate the radioactive waste disposal facility.

For example, the safety assessment of the LRTP design is regularly updated.

H.6. Operation of Facilities (Article 16)

H.6.1. Licence to operate a radioactive waste management facility

Ukrainian regulations in force related to the licensing procedure require submission of the safety analysis report along with the application for operation of a radioactive waste management facility to reflect safety assessments covering operation of the facility and following the period after closure for a radioactive waste disposal facility and to assess whether the facility, as constructed, is consistent with design and safety requirements (according to regulations "Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposal Facilities of Radioactive Waste" NP 306.3.02/3.038-2000, "Requirements to the Structure and Contents of the Safety Analysis Reports on Radioactive Waste Treatment Facilities" NP 306.3.02/3.043-2001).

Section 4.3 of ND 306.607.95 “Requirements on Radioactive Waste Management before Disposal. General Provisions” requires that testing of a radioactive waste treatment facility should ensure sufficient demonstration of facility reliability and safety during operation and compliance with technical requirements. Documentation on facility construction and commissioning is included in the safety report submitted for obtaining the operation licence.

H.6.2. Revision of operational limits and conditions based upon results of the safety assessment and start-up testing

Item 4.7.2 of ND 306.304-96 “Requirements to the Structure and Contents of the Safety Analysis Reports on Radioactive Waste Treatment Facilities” requires inclusion in the safety analysis report of administrative procedures intended for preparation and implementation of start-up inspection and testing, review and approval of their results and changes to the design based upon testing results.

H.6.3. Compliance with established procedures for operation, maintenance, inspection and testing of a radioactive waste management facility

Section 4.4 of ND 306.607.95 “Requirements on Radioactive Waste Management before Disposal. General Provisions” requires preparation of operating regulations and procedures, programmes for maintenance, periodical testing, monitoring and inspection of safety-related systems and components of a radioactive waste management facility prior to operation. The licensee shall ensure compliance with all operating regulations and procedures during operation, maintenance, inspection and testing of a radioactive waste management facility.

H.6.4. Engineering and technical support throughout the operating lifetime of a radioactive waste management facility

According to Article 10 of the Law of Ukraine “On Radioactive Waste Management”, research and development pertaining to radioactive waste management is coordinated by the state governmental body for radioactive waste management, i.e. the Ministry for Emergencies.

Engineering and technical support of Ukrainian NPPs in radioactive waste management is provided by the NPP Operational Support Institute and State Research Centre for Monitoring and Control Systems.

Scientific and technical support of UkrDO Radon specialised plants in radioactive waste management is provided by the Scientific and Technical Centre for Decontamination and Comprehensive Management of Radioactive Waste, Materials and Ionising Radiation Sources (STC CMRW) and SSE “Tekhnocentre”.

STC CMRW also deals with collection and analysis of information on radioactive waste management activities of the specialised plants and develops new advanced technologies, methods and technical means for safety improvement in radioactive waste management based upon this information.

H.6.5. Procedures for characterization and segregation of radioactive waste

Radioactive waste characterization is required to minimise radioactive waste and ensure further separate treatment, storage or disposal. Radioactive waste characterization is also required for the state system for radioactive waste accounting and control. Section 3.2 of ND 306.307-96 “Annual Safety Report on Radioactive Waste Management. Requirements on the Structure, Content and Format” emphasizes the need for a clear system of radioactive waste characterization as a part of radioactive waste management process.

Section 3.4 of NP 306.3.02/3.038-2000 “Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposal Facilities of Radioactive Waste” indicates that radioactive waste characteristics shall be checked against acceptance criteria, availability of equipment and methods for determining radioactive waste radionuclide composition, radionuclide activity in packages etc.

At present NPPs have no procedures, methods or equipment for determining SRW radionuclide composition. Implementation of such equipment, procedures and methods at each NPP of Ukraine has been provided for by the State Comprehensive Programme on Radioactive Waste Management.

SRW is segregated to minimise radioactive waste and ensure further separate treatment, storage or disposal. There are no facilities for SRW segregation at NPPs (excepting Zaporizhzhya NPP). Introduction of such facilities at each NPP of Ukraine has been provided for by the State Comprehensive Programme on Radioactive Waste Management.

Three methods for radioactive waste characterization certified by the State Standardization Committee have been implemented at the UkrDO Radon (spectral analysis by beta- and gamma-nuclides and determination of specific volume alpha- and beta-activity).

SSE “Complex” implemented at RWDP “Buryakivka” a system for automatic measurement, registration and documentation of radioactive waste characteristics at RWDP. The system ensures automatic measurement of radioactive waste weight and documentation of appropriate data. These data are registered in the system and are transferred to the regional centre for radioactive waste account and cadastre of storage facilities.

H.6.6. Reporting to the SNRCU on violation of radiation safety standards and rules

Article 33 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” obliges the operating organisation of a radioactive waste disposal facility to provide timely and complete information on incidents.

According to item 3.15 of NP 306.5.04/2.060-2002 “Safety Conditions and Requirements (Licensing Conditions) on Activities Associated with Radioactive Waste Processing, Storage and Disposal”, in the event of a situation or conditions resulted in violation of radiation safety standards and rules or a radiation accident during operation of the radioactive waste management facility, the licensee shall properly notify the SNRCU within an hour, initiate actions to eliminate the violation or initiate the emergency plan, investigate causes and conditions that caused incident or accident and submit a report on investigation to the SNRCU.

H.6.7. Incorporation of operating experience

According to Article 33 of the Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety”, Article 11 of the Law of Ukraine “On Radioactive Waste Management” and item 3.9 of NP 306.5.04/2.060-2002 “Safety Conditions and Requirements (Licensing Conditions) on Activities Associated with Radioactive Waste Processing, Storage and Disposal”, the licensee shall carry out a periodical safety reassessment of radioactive waste management facilities when there are changes in safety-related technologies and when operating experience indicates drawbacks in the previous assessment. Operating limits and conditions shall be also revised when new standards, rules and regulations are adopted (item 3.2 of the same NP). The reassessment report is submitted to the SNRCU.

In compliance with item 4.4.4 of ND “Requirements on Radioactive Waste Management before Disposal. General Provisions”, the licensee is required to periodically revise operating regulations and procedures for radioactive waste management facilities with the purpose of their improvement. At that safety-related changes may be made only after concurrence with the SNRCU.

H.6.8. Update of decommissioning plans for a radioactive waste storage facility

According to the “Requirements to the Structure and Contents of the Safety Analysis Reports on Radioactive Waste Treatment Facilities” NP 306.3.02/3.043-2001, licensees shall submit information on design decisions on decommissioning a radioactive waste treatment facility and review planned activities associated with decommissioning the facility.

Section 3.5 of ND 306.307-96 “Annual Safety Report on Radioactive Waste Management. Requirements on the Structure, Content and Format” determines the need for annual technical inspection of radioactive waste management facilities, storage of information on their technical condition and deviation of performance indicators from approved regulations

along with the analysis of their causes. Taking into account this information decommissioning plans for such facilities are updated.

H.6.9. Update of plans for the closure of a radioactive waste storage facility

According to the “Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposal Facilities of Radioactive Waste” NP 306.3.02/3.038-2000, licensees shall submit information on design decisions on the closure of radioactive waste disposal facilities and revision of planned activity associated with closure and decommissioning of radioactive waste storage facilities. Item 1.4 of this regulatory document requires regular update of information and results of the safety analysis report during the operating lifetime of a storage facility. The report is revised in terms of safety substantiation for post-operational period to incorporate relevant operating experience and data of environmental monitoring and to provide additional substantiation of long-term safety of the storage facility after closure.

Section 7 of ND 306.604.95 “Disposal of Radioactive Waste in Near-Surface Facilities. General Radiation Safety Requirements” also requires that the storage facility closure and preservation plan developed at the design stage be updated at the stage of storage facility closure taking into account construction and operation experience.

The SNRCU has agreed closure concepts for such disposal points located in the exclusion zone as “Pidlisny”, “ChNPP Stage III” and SSE “Complex” “Buryakivka”.

H.7. Institutional Measures after Closure (Article 17)

H.7.1. Preservation of records on a radioactive waste storage facility after closure

According to Article 21 of the Law of Ukraine “On Radioactive Waste Management”, possibility of unauthorised access to the storage facility after its closure shall be minimised. In order to prevent unauthorised population of territories and activities that can cause destruction of protective barriers, associated information and restrictions are indicated on maps stored at appropriate governmental authorities and administrations for radioactive waste management.

Section 8 of ND 306.604.95 “Disposal of Radioactive Waste in Near-Surface Facilities. General Radiation Safety Requirements” requires that records of the facility location and restrictions of land use for individual activities are preserved.

H.7.2. Institutional control of a radioactive waste storage facility after closure

OSPU and NP 306.3.02./3.038-2000 establish that post-operational monitoring shall be incorporated in the storage facility closure project developed by the operating organisation. According to Section 8 of ND 306.604.95 “Disposal of Radioactive Waste in Near-Surface Facilities. General Radiation Safety Requirements”, active administrative control includes such activities as periodic inspection of the drain system, repair of enclosures and radiation hazard signs, replacement of monitoring equipment and removal of vegetation that can affect the storage facility safety. Steps can also be taken to prevent erosion resulted from abrupt changes in weather conditions. The period of active control shall not exceed 300 years.

There are no radioactive waste disposal facilities in Ukraine which would have completely undergone the “closure” stage as required by current legislation. All decommissioned and preserved radioactive waste storage facilities of UkrDO Radon specialised plants are located

in the strict access zone at RWDP. RWDP staff carry out active institutional control of storage facilities and radiation monitoring on a permanent basis in compliance with GOST 12.1.048-85 "Radiation Monitoring of Radioactive Waste Disposal". Types and scope of activities are set forth in Radiation Monitoring Regulations of UkrDO Radon specialised plants and are approved by bodies of the State Sanitary and Epidemiological Service.

H.7.3. Implementation of intervention measures during active institutional control

The procedure for implementation of intervention measures in emergencies in the period of active institutional control is regulated by Emergency Plans to be developed by the organisation exercising active institutional control as required by NRBU-97. These plans shall provide for necessary intervention measures (organisational and technical).

Section I. TRANSBOUNDARY MOVEMENT (Article 27)

Laws of Ukraine, International Agreements and Conventions constitute the regulatory and legal framework for transboundary movement of radioactive materials, in particular:

- Law of Ukraine - "On Nuclear Energy Utilization and Radiation Safety", "On Transportation of Hazardous Cargoes", "On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation", "On Insurance";
- Convention on the Physical Protection of Nuclear Material of 1980;
- Convention on Early Notification of a Nuclear Accident of 26 September 1986;
- Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency of 26 September 1986;
- Vienna Convention on Civil Liability for Nuclear Damage of 21 May 1963;
- Resolution of the Cabinet of Ministers of Ukraine No. 1997 of 29 November 1997 "On Basic Provisions for Radioactive Material Movement through the Territory of Ukraine";
- Rules of Nuclear and Radiation Safety for Transportation of Radioactive Material;
- Provisions on emergency actions in transportation of radioactive materials, approved by Decree of the SNRCU No. 18 of 23 May 2001, which was registered in the Ministry for Justice of Ukraine by reg. No. 591/5782 and No. 592/5783;
- Procedure for Issuance of Certificates for Safety during Radioactive Materials Transportation NP 306.5.06/2.008-98, approved by Decree of the Ministry for Environmental Protection and Nuclear Safety of Ukraine No. 46 of 4 July 1998 and registered in the Ministry for Justice of Ukraine by reg. No. 269/2709 on 28 April 1998;
- Ukraine is a party of multilateral international agreements related to cooperation in movement of nuclear materials, which are referred to in Annex 6. These agreements set forth the main principles of cooperation in radioactive material transportation and state provisions regarding escort of special cargoes, their physical protection and security, liability for loss, civil liability for nuclear damage that can be caused to the environment in transportation, procedure for mitigation of accident consequences, notification on transportation, etc. These agreements also identify international documents whose provisions shall be fulfilled in radioactive material transportation.

SNF transboundary movement is undertaken when:

- SNF of Ukraine's NPPs is transported to Russian reprocessing plants,
- SNF of Eastern European States is subject to transit movement through the territory of Ukraine to Russian Federation.

In order to comply with the provisions of Article 27 of the Joint Convention, the SNRCU shall issue authorization for every movement of SNF. One of the conditions to be satisfied by the Russian operator is possession of a license issued by the Russian state nuclear SNRCU for nuclear material management and a license for spent nuclear fuel import.

Section J. DISUSED SEALED SOURCES (Article 28)

Ukraine has established a regulatory system for the management of disused sealed sources in order to ensure their possession, storage and disposal in a safe manner. Ukraine does not undertake processing of sealed sources.

According to the national law, having made a decision to disuse RS, the licensee shall ensure the safety and security of disused RS through one of the following ways:

- return RS to the manufacturer;
- transfer RS to a specialized enterprise for radioactive waste processing;
- ensure RS temporary storage on site within 2 months (6 months, as an exception) and provide for their obligatory transfer to a specialized enterprise for radioactive waste processing.

The licensee annually submits writing reports to the SNRCU to be kept informed on storage and transfer of disused RS.

Financial problems take place in the implementation of these provisions: some enterprises (licensee) are not able to fund RS transfer to specialized enterprises; other enterprises possessing high-level disused RS of category 1 cannot transfer their RS to specialized enterprises since they do not have any facilities and technologies for management of high-level RS. For the time being, Ukraine stores on-site more than 1000 disused sealed high-level sources that were supplied by Russian manufacturers at the time of the USSR. Ukraine makes great efforts since 1998 to enter into an agreement with the Russian Federation in order to return those sources to the Russian manufacturer for processing. However, no noticeable results have been obtained so far.

Requirements on security of disused RS intended to prevent their theft, loss, unauthorized utilization or withdrawal, to protect from such actions and ensure their early detection are established by the Law of Ukraine «On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation» and Rules for Storage of Nuclear Material, Radioactive Waste, Other Ionising Radiation Sources.

In order to minimize the probability of losing control over disused RS, national law provides for other steps in addition to physical protection, in particular – RS account and control at enterprises (through accounting, monitoring RS location, obligatory annual inventory taking and reporting to the licensing authority), state inspections for RS security and storage conditions at licensees, creation of a state system for RS accountancy, control, and registration – the State register of ionising radiation sources.

Ukrainian law has no limitations concerning reentry into the territory of Ukraine of disused sealed sources to be returned to the Ukrainian licensed manufacturer if such sources are not declared as radioactive waste. At the same time, Ukraine is not a manufacturer or supplier of ionising radiation sources, therefore this provision of the Convention is not applied in Ukraine.

Section K. PLANNED ACTIVITIES TO IMPROVE SAFETY

This Report covers all aspects of Ukraine's activities on spent fuel management and radioactive waste management. This section sets forth the most important issues and provides information on planned activities. The importance of international cooperation intended to solve problems of spent fuel and radiation waste management has been emphasised as well.

K.1. Safety improvement of spent fuel and radioactive waste management at Chornobyl NPP

This activity covers the large and comprehensive Chornobyl programme including construction and commissioning of spent fuel and radioactive waste management facilities required for ChNPP decommissioning, Shelter transformation into an ecologically safe system and monitoring of numerous radioactive waste storage facilities in the Chornobyl 30-km zone. The Chornobyl programme is intended for tens or hundreds of years. Long-term programmes have been developed and are being implemented under assistance of the international community.

Construction of a new spent fuel storage facility in the 30-km zone is the key element of the ChNPP decommissioning project. Spent fuel is to be removed from the ChNPP units and existing pool storage facility after commissioning this facility. This goal however cannot be achieved without solving the problem of removal and storage of about 100 damaged fuel assemblies being kept at ChNPP units. Technical assistance to solve this problem will be greatly appreciated in the context of international cooperation.

According to the Comprehensive Programme on Radioactive Waste Management, "Vector" complex is under construction in the exclusion zone to solve the issue of safe radioactive waste management and to lay the basis for constructing a radioactive waste treatment and disposal centre. The first stage of the "Vector" complex is to be completed in 2004.

Taking into account the pre-term shutdown of Chornobyl NPP and therefore the absence of a special decommissioning fund, the burden related to decommissioning and waste management is imposed on the State and in this context on future generations too.

K.2. Safety improvement of Chornobyl NPP "Shelter"

In compliance with the Comprehensive Programme on Radioactive Waste Management and the SIP, that is funded by Chornobyl Shelter Fund established by the "G-7" countries and European Commission, Shelter stabilisation measures, more reliable systems for monitoring of neutron-physical, radiation and other parameters, water management system and new safe confinement are being planned and prepared. According to the Strategy for "Shelter" transformation into an ecologically safety system, the new confinement is to constitute an engineering structure that shall allow removal of fuel-containing materials, high-level and long-lived radioactive waste from the "Shelter" for their storage and final disposal in a geological repository as required by the Joint Convention and Ukrainian legislation.

The SIP does not stipulate international assistance for removal and final disposal of "Shelter" spent fuel and radioactive waste in compliance with IAEA Principles of Radioactive Waste Management (2) Annex 7). Ukraine is looking forward to further international cooperation for solving of this issue.

K.3. Safety improvement of spent fuel and radioactive waste management at NPPs under operation

In order to avoid such funding problems as occurred with Chernobyl NPP decommissioning the Government of Ukraine has decided to establish a decommissioning and radwaste management fund for nuclear power plants under operation. A project pertaining to the development of legislative and institutional basis for the decommissioning fund was started in March 2003 under support of the European Commission. Appropriate documents are to be submitted to the Government for approval in October 2003.

Safety improvement activities at Ukrainian power units under operation are implemented in compliance with the "Comprehensive Programme on Upgrading and Safety Improvement of Nuclear Power Plants" approved by the Cabinet of Ministers of Ukraine on 28 August 2002. Measures to improve the safety of spent fuel management are taken in the framework of safety reassessment for nuclear power units under operation. This work shall result in the development of safety analysis reports for NPP units under operation. The list of first-priority measures for safety improvement, including spent fuel and radioactive waste management, is included in the content of these reports.

The spent fuel management strategy of Ukraine, as in most countries with developed nuclear energy, is characterized as "deferred decision". In this regard, construction and operation of spent fuel storage facilities at NPP sites are under way in Ukraine. The operating organisation will select design and supplier of the new storage facilities on the basis of the results and experience of licensing and commissioning the first spent fuel interim storage facility in Ukraine at Zaporizhzhya NPP .

K.4. Safety improvement of UkrSA Radon

Safety improvement measures for radioactive waste management facilities are summarised in Sections II-IV of the Comprehensive Programme on Radioactive Waste Management.

In order to mitigate consequences of the radiation accident occurred at storage facilities 5, 6, 7 of UkrSA Radon Kyiv SISP RWDP and to prevent or minimise individual potential emergency doses for the population living on the territories adjacent to RWDP, a project has been developed for minimisation of the environmental impact caused by the radiation accident. The project provides for retrieval of solid waste from the storage facilities and further transportation to the central disposal site of the exclusion zone. To improve radiation safety in future, RWDP shall be completely liquidated and located outside the city of Kyiv.

K.5. Improvement of radiation protection of personal and the population

In order to improve radiation monitoring at Ukrainian NPPs, the operating organisation NNEGC Energoatom is implementing the "Program for Upgrading Radiation Monitoring Systems at Ukrainian NPPs for 2002-2010" and developing Typical Regulations for WWER Radiation Monitoring to be completed in 2004.

In order to enhance control over non-exceeding dose limits in Ukraine, the uniform state system for control and accountancy of individual doses of staff and the population is under development.

K.6. Improvement of emergency response

The SNRCU is being developing a Plan for response to state-level radiation accidents (Plan) for implementation of Resolution of the Cabinet of Ministers of Ukraine “On Comprehensive Measures for Effective Implementation of the State Policy in Protection of Population and Territories against Man-Caused and Natural Emergencies, Their Prevention and Effective Response till 2005” No. 122 dated 7 February 2001. The plan is aimed at coordinated and effective response of authorities, forces and means of functional and territorial subsystems of the Uniform State System for Prevention and Response to Man-Induced and Natural Emergencies (USSE) in the event of threat or occurrence of a state-level radiation accident. The Plan is developed in compliance with IAEA recommendations and on the basis of the Plan for Response to State-Level Emergencies approved by Resolution of the Cabinet of Ministers of Ukraine No. 1567 dated 16 November 2001 as regards radioactive accidents. The Plan is being developed to provide the USSE with upper-level regulation to govern emergency planning and response to radiation accidents and to harmonise Ukrainian regulatory and legislative framework on emergency response with the regulatory and legislative framework of the European Union States through incorporating IAEA accepted recommendations.

K.7. Enhancement of the SNRCU

According to Decree of the President of Ukraine “On Amendment of the Statute on the Ministry for Environment and Natural Resources of Ukraine and Statute on the State Nuclear Regulatory Committee of Ukraine” No. 378/2002 dated 25 April 2002, the SNRCU is entrusted with regulation of activities pertaining to ionising radiation sources. In order to fulfil the Decree, SNRCU territorial inspectorates are to be established.

Seven regional divisions are to be established and staffed during 2003 based on the current availability of 38 staff positions and further increase of employees to allow complete fulfilment of SNRCU additional authorities.

SNRCU territorial divisions being established are to be entrusted with the following tasks of state radiation safety regulation:

- implementation of the state policy in nuclear energy;
- implementation of radiation safety requirements;
- licensing of utilisation of ionising radiation sources;
- state supervision over radiation safety on the assigned territories of production facilities dealing with ionising radiation sources, radioactive waste management, radioactive material transportation;
- state expert examinations on nuclear and radiation safety for projects pertaining to ionising radiation sources;
- prevention of illicit utilisation of ionising radiation sources and nuclear terrorism;
- state registration, accountancy and control of ionising radiation sources;
- emergency response.

K.8. International cooperation on safety improvement of spent fuel and radioactive waste management

Basic provisions of international cooperation in the field of radioactive waste management are set forth in Section IX “International Cooperation” of the Comprehensive Programme on Radioactive Waste Management.

Exchange of operating experience and introduction of new technologies to improve safety of radioactive waste treatment facilities take place in the framework of IAEA national and regional projects, EC TACIS Programme as well as in the framework of the bilateral cooperation programmes between operating organisations of Ukraine and other countries.

Ukraine is going to further implement the main principles of the State policy pertaining to the safety of spent fuel management and radioactive waste management. Priority to protection of health and safety of personnel, the population and the environment against ionising radiation at all stages of spent fuel and radioactive waste management is the main principle of the state policy of Ukraine.

Section L. ANNEXES

Annex 1.

List of Spent Fuel Management Facilities

List of Spent Nuclear Fuel Management Facilities (as of 1 January 2003)

Name of facility	Location	Main purpose	Comment
Unit 1 Zaporizhzhya NPP	Zaporizhzhya NPP	Generation of electricity	Under operation
Unit 2 Zaporizhzhya NPP	Zaporizhzhya NPP	Generation of electricity	Under operation
Unit 3 Zaporizhzhya NPP	Zaporizhzhya NPP	Generation of electricity	Under operation
Unit 4 Zaporizhzhya NPP	Zaporizhzhya NPP	Generation of electricity	Under operation
Unit 5 Zaporizhzhya NPP	Zaporizhzhya NPP	Generation of electricity	Under operation
Unit 6 Zaporizhzhya NPP	Zaporizhzhya NPP	Generation of electricity	Under operation
СВЯП Zaporizhzhya NPP	Zaporizhzhya NPP	Interim storage spent fuel	Under commissioning
Unit 1 Khmelnitsky NPP	Khmelnitsky NPP	Generation of electricity	Under operation
Unit 2 Khmelnitsky NPP	Khmelnitsky NPP	Generation of electricity	Under construction
Unit 1 Rivne NPP	Rivne NPP	Generation of electricity	Under operation
Unit 2 Rivne NPP	Rivne NPP	Generation of electricity	Under operation
Unit 3 Rivne NPP	Rivne NPP	Generation of electricity	Under operation
Unit 4 Rivne NPP	Rivne NPP	Generation of electricity	Under construction
Unit 1 South Ukraine NPP	South Ukraine NPP	Generation of electricity	Under operation
Unit 2 South Ukraine NPP	South Ukraine NPP	Generation of electricity	Under operation
Unit 3 South Ukraine NPP	South Ukraine NPP	Generation of electricity	Under operation
Unit 1 Chornobyl NPP	Chornobyl NPP	Cooling	Under decommissioning
Unit 2 Chornobyl NPP	Chornobyl NPP	Cooling	Under decommissioning
Unit 3 Chornobyl NPP	Chornobyl NPP	Cooling	Under decommissioning
“Shelter”	Chornobyl NPP	Interim storage spent fuel	Under decommissioning
Spent Fuel long-term	Chornobyl NPP	Interim storage spent	Under

storage Facility SFSF-1 Chornobyl NPP		fuel	decommissioning
Spent Fuel long-term storage Facility SFSF-2 Chornobyl NPP	Exclusion Zone Chornobyl	Interim storage spent fuel	Under construction
WWR-M research reactor INR NASU	Kyiv	Research	Under operation
Research reactor IR- 100 SRINE	Sevastopol	Research and training	Under operation
Physical test bench IR-100 SRINE	Sevastopol	Research and training	Under operation
Subcritical uranium- water assembly SRINE	Sevastopol	Research and training	Under operation

List of Radioactive Waste Management Facilities

2.1. List of Radioactive Waste Management Facilities under Operation at the NPPs

Facility	Location	Main purpose	Design power	Implementation date
UGV-1-500 (2 facilities)	SE ZNPP	Bottom deep evaporation	500 dm ³ /year	1 facility – 1987 2 facility - 2000
UGV-1-500	SE KhNPP	Bottom deep evaporation	500 dm ³ /year	28 December 1990
Incineration facility for radioactively contaminated oil	SE KhNPP	Incineration of radioactively contaminated oil	5 - 10 kg/year	16 September 1994
Bituminisation facility	SE ZNPP	Liquid radwaste bituminisation	150 dm ³ /year	07 June 1995
Incineration facility	SE ZNPP	Low-level radwaste incineration	40 kg/year – liquid radwaste 12 kg/ - liquid radwaste	15 February 1992
Compacting facility VNR-500	SE ZNPP	Reduction of low-level radwaste	P=500 κH Reduction by 5 times	31 January 1993
Compacting facility S-26	SE SUNPP	Reduction of low-level radwaste	P=200 κH Reduction by 5 times	1997

In 2001 filling of radwaste storage facilities at Ukrainian NPPs was 56 % for solid radwaste and 69.9 % for liquid radwaste of the design storage capacity, at that annual solid radwaste generation at NPPs was 2.5 – 4.5 % of the design storage capacity.

2.2. List of Radioactive Waste Management Facilities at ChNPP SSE

No.	Facility	Location	Main purpose	Implementation date
1.	Solid radioactive waste storage facility	ChNPP site	Radioactive waste interim storage during operation and decommissioning of units	13 March 1978
2.	Liquid and solid radioactive waste storage facility	ChNPP site	Radioactive waste interim storage during operation and decommissioning of NPP units	Compartments for solid radioactive waste storage have not been operated
3.	Liquid radioactive waste treatment plan including: <ul style="list-style-type: none"> – liquid waste retrieval system; – liquid waste evaporation system; – grouting facility; – on-site transportation system. 	ChNPP site	Management of radioactive waste accumulated in ChNPP operation; radioactive waste that will be generated in ChNPP decommissioning and SIP-related activities	Under construction
4.	Industrial complex for solid radioactive waste management: <ol style="list-style-type: none"> 1. Solid radioactive waste treatment plant including: <ul style="list-style-type: none"> – solid waste buffer storage facility; – solid waste sorting and fragmentation facility; – incineration facility; – compacting facility; – grouting facility; – system for management of high-level solid waste and low-, intermediate-level long-lived solid waste; – on-site transportation system; – off-site transportation 	ChNPP site	Management of radioactive waste accumulated in ChNPP operation; radioactive waste that will be generated in ChNPP decommissioning and SIP-related activities	Under design

	system; 2. Solid radioactive waste retrieval facility 3. Engineered near-surface “VALT” disposal facility for low- and intermediate-level short-lived solid radioactive waste	“Vector” site		
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2.3.List of Radioactive Waste Management Facilities of UkrSA Radon

Institution	Location	Main purpose	Design capacity	Implementation date
Kyiv SISP	Kyiv, Komunalna street, 1	Radwaste treatment, storage and disposal	Solid radwaste - 3075 m ³ Liquid radwaste - 1000 m ³ Spent RS – 4.44E6 GBq	1962
Central operation service of Kyiv SISP	Kyiv, Komunalna street, 1	Storage of decontamination waste	Solid radwaste -36090* m ³	The storage facilities were built during mitigation of ChNPP accident consequences in 1987-1995. *- provided only for Chernigov region, absent for other storage facilities
Dnipropetrovsk SISP	23 th km highway “Dnipropetrovsk-Zaporizhzhya”	Radwaste storage and disposal	Solid radwaste - 450 m ³ Liquid radwaste - 200 m ³ Spent RS – 1.85E+06 GBq	1961
Odesa SISP	75 th km highway “Odesa – Kyiv”	Radwaste treatment and disposal	Solid radwaste - 583 m ³ Liquid radwaste - 400 m ³ Spent RS – 1.85E+06 GBq	1961
L’viv SISP	Village Buda, Yavorivky district, Lviv region	Radwaste treatment and storage	Solid radwaste - 1140 m ³ Liquid radwaste - 200 m ³ Spent RS – 2.96E+06 GBq	1962
Kharkiv SISP	Dergachiv district Kharkiv region	Radwaste treatment, storage and disposal	Solid radwaste - 2384,6* m ³ Liquid radwaste - 1000 m ³ spent IPC– 2.22E+06 GBq	1962 * - without considering design capacity of tubing storage casing which weights 650 ton according to the project
SSE “Complex”	Chornobyl NPP Exclusion zone	operation of radwaste management facilities	Radwaste disposal point (RWDP) “Buryakivka” – 690000 m ³ R “Pidlisny” RWDP “ChNPP Stage III” radwaste interim storage points (RWTSP)*	1986 *- there is no design documentation (for all RWTSP)

List of nuclear facilities in the process of being decommissioned

Facility	Power unit	Location	Type of reactor facility	Shutdown date
Nuclear facility	No.1	ChNPP	RMBK-1000 (by modification RBM-K2)	30 November 1996
Nuclear facility	No. 2	ChNPP	RMBK-1000 (by modification RBM-K2)	11 October 1991
Nuclear facility	No. 3	ChNPP	RMBK-1000 (by modification RBM-K7)	15 December 2000
Dry spent fuel storage facility	SFSF-1	ChNPP		
“Shelter”	No.4	ChNPP	Destroyed RMBK- 1000 (by modification RBM-K7)	26 April 1986

Inventory of radioactive waste

4.1. NPP Radioactive Waste Inventory of NNEGC Energoatom

Material	Location	Volume, m ³	Mass, * kg	Activity, Bq	Main radionuclides
Filter materials*	SE KhNPP	135,2		5,06E+11	
Bottom*	SE KhNPP	395,1		9,58E+12	
Salt fusion cake	SE KhNPP	551,2	876400	4,5E+13	
Solid radwaste of I group **	SE KhNPP	2489,4			
Solid radwaste of II group **	SE KhNPP	95,3			
Solid radwaste of III group **	SE KhNPP	6,5			
Filter materials*	SE KhNPP	340		4,07E+10	
Bottom*	SE ZNPP	2662		9,94E+12	
Salt fusion cake	SE ZNPP	2113		5,47E+13	
Solid radwaste of I group ***	SE ZNPP	4373		8,58E+09	
Solid radwaste of II group ***	SE ZNPP	3259		5,44E+12	
Solid radwaste of III group ***	SE ZNPP	43,4		7,80E+12	
Filter materials	SE SUNPP	177,4			
Bottom*	SE SUNPP	2756		1,20E+14	
Solid radwaste of I group **	SE SUNPP	13910			
Solid radwaste of II group **	SE SUNPP	344			
Solid radwaste of III group **	SE SUNPP	10,8			
Filter materials	SE RNPP	730		8,72E+12	
Bottom*	SE RNPP	5303		1,66E+14	
Solid radwaste of I group **	SE RNPP	2501,9			
Solid radwaste of II group **	SE RNPP	21,1			
Solid radwaste of III group **	SE RNPP	31,5			

* - there is no methodology for determining mass of filter materials and bottoms at SE NPP

** - Solid radwaste activity and mass are not determined due to the absence of methodologies and equipment

*** - approximate data obtained by calculation

Radionuclide content of solid radwaste is not determined due to the absence of methodologies and equipment.

4.2. Radioactive Waste Inventory of ChNPP SSE

Liquid Radioactive Waste Inventory as of 30 June 2002

Material	Location (capacity)	Volume, m ³	Mass	Activity*, TBq	Main radionuclides
Stage I (LRSF)					
Bottoms	A-201/2	4852,00	-	83,250	Radionuclide mixture ¹³⁷ Cs, ¹³⁴ Cs, ⁶⁰ Co
Bottoms	A-201/3	4716,00	-	156,440	
Ion-exchange resins	A-202	2597,40	-	0,861	
Pulp	A-203/1	838,00	-	0,400	
Pulp	A-203/2	755,80	-	0,500	
Total:		13759,20	-	241,451	

Stage II (LSRSF)					
Bottoms	X01/1	1000,00	-	26,640	Radionuclide mixture ¹³⁷ Cs, ¹³⁴ Cs, ⁶⁰ Co
Bottoms	X01/2	905,00	-	30,470	
Bottoms	X01/3	1000,00	-	24,800	
Bottoms	X01/4	100,00	-	2,340	
Bottoms	X01/5	905,00	-	25,300	
Ion-exchange resins	X05/1	687,10	-	0,380	
Ion-exchange resins	X05/2	417,05	-	0,072	
Pulp	X06/1	349,70	-	0,143	
Pulp	X06/2	274,75	-	0,069	
Total		5638,60	-	110,214	
Total (LRSF+LSRSF)		19397,80	-	351,665	

4.3. Radioactive Waste Inventory at Research Reactor WWR-M Site of NRI NASU

Material	Location	Total weight, kg	Activity, GBq	Main radionuclides
III	Storage facility No. 8	110	22	¹³⁷ Cs, ⁶⁰ Co, ⁵⁹ Fe, ⁵⁴ Mn
III	Storage facility No. 9	320	64	¹³⁷ Cs, ⁶⁰ Co, ⁵⁹ Fe, ⁵⁴ Mn
II, III	Storage facility No. 10	1472,9	54	¹³⁷ Cs, ⁶⁰ Co, ⁵⁹ Fe, ⁵⁴ Mn
II	Storage facility No. 11	250	10	¹³⁷ Cs, ⁶⁰ Co, ⁵⁹ Fe
I	Storage facility No. 12	4900	1	¹³⁷ Cs, ⁶⁰ Co, ⁴⁵ Ca, ¹²⁴ Sb

I – used individual protection means, polyethylene film, radioactively contaminated tools which are out of order, some components of reactor equipment.

II and III – control system equipment which is out of order and reactor equipment components changed in repair, irradiated materials and experimental devices.

4.4. List of Radioactive Waste Stored at Specialised Enterprises of UkrSA Radon and SSE “Complex”

Material	Location	Volume, m ³	Mass, kg	Activity, Bq	Main radionuclides
Solid low- and intermediate-level radwaste	Kyiv SISP solid radwaste (SRW) No. 1/10	200	-	3,01E+13	
	SRW No. 2/9	200	-	2,35E+13	
	SRW No. 3/8	200	-	3,01E+14	
	SRW No. 4/7	400	-	4,73E+15	
	SRW No. 5/6	400	-	8,98E+14	
	SRW No. 6/5	400	-	1,21E+15	
	Dnipropetrovsk SISP SRW No. 1	200	-	2,43E+15	
	L'viv SISP SRW No. 1	200	-	2,35E+13	
	Kharkiv SISP SRW No. 18	60	-	5,16E+10	
	SRW No. 19	400	-	1,88E+13	
	SRW No. 20	400	-	1,96E+14	
Solid low- and intermediate-level radwaste	RWDP “Buryakivka” (exclusion zone)	600 000	-	2,5E+15	
Solid radwaste – graphite, parts of reactor core	RWDP “Pidlisny” (exclusion zone)	3960	-	≈ 1,0E+15 ²	
Solid radwaste–ground, ChNPP unit 4 construction waste	RWDP “ChNPP III Stage” (exclusion zone)	26200	4,19E+7	2,7E+14	Sr-90, Cs-137, Pu-239

4.5. List of UkrSA Radon Radioactive Waste Resulted from Past Practices as of 1 January 2003

Material	Location	Volume, m ³	Mass, kg	Activity, Bq	Main radionuclides
Solid low- and intermediate-level radwaste	Kyiv SISP	1896,5 including 6,6 ³	256162,7 19400	7,86E+15 2,61E+9	Co-60, Sr-90, Cs-137, Ra-226
	Dnipropetrovsk SISP	428,4	1001143,0	7,04E+15	
	Odesa SISP	497,0	279491,0	1,51E+15	
	L'viv SISP	492,0	1469733,0	1,133E+14	
	Kharkiv SISP	1320,9* * - without considering volume of tubing strings	2269291* *- taking into account mass of tubing strings	3,51E+14	
Liquid low- and intermediate-level radwaste	Kyiv SISP	413,0		2,163E+12	
	Dnipropetrovsk SISP	60,0		5,70E+10	
	Odesa SISP	137,5		4,50E+11	
	Kharkiv SISP	28,0		4,37E+10	
Spent RS	Kyiv SISP			1,33E+15	
	Dnipropetrovsk SISP			1,27E+14	
	Odesa SISP			8,41E+15	
	L'viv SISP			4,73E+14	
	Kharkiv SISP			4,57E+13	
Solid low- and intermediate-level radwaste	ChNPP exclusion zone				
	Radwaste disposal sites	690E+03- evaluation data, except RWDP "Buryakivka"		5,5044 E+15- evaluation data, except RWDP "Buryakivka"	
	Radwaste interim confinement point	1289,7E+03 - evaluation data	Additional survey is required to obtain data	1,9382E+15 - evaluation data	
Radioactively contaminated decontamination waste	Zone of intensive radioecological monitoring (Chernigov region)	10580,0	16928000,0	no data	

1 Radwaste accepted for interim storage of RWDP "Makariv" within liquidation of radwaste storage facilities of military units.

4.6. Waste of uranium ore mining

Operational period	Tailing pit	Area, hectare	Tail volume, mln. ton/ mln. m ³	Total activity, *10 ¹² Bq	Uranium content, mg/kg
DP "SkhidGZK" Tailing Pits					
1964 - 1991	"KBZ"	55,6	19,3 / 12,4	990	700
1959 - 1979	Scherbakivske Section 1	86,0	43,2 / 27	2200	
1979 – to present	Scherbakivske Section 2	139,0			
IA "Pridniprovsky Chemical Plant"					
1949 - 1954	Eastern	4,0	0,77 / 0,35	180	700
1951 - 1954	Central gorge	2,4	0,22 / 0,10	104	630
1956 - 1980	South-eastern	3,6	0,33 / 0,15	67	22
1968 - 1983	C, section 1	90,0	19,0 / 8,60	710	80
1983 – to present	C, section 2	70,0	9,60 / 5,50	270	80
1960 - 1990	Base C	25,0	0,15 / 0,10	440	100-1000
1954 - 1968	Dniprovske	73,0	12,0 / 5,84	1400	230
1982	Blast Furnace 6	0,2	0,04 / 0,02	11	-
1965 - 1988	Lanthanum fraction	0,06	0,007 / 0,003	0,86	-

References to national laws, regulations, requirements, guides

1. Law of Ukraine “On Nuclear Energy Utilisation and Radiation Safety” No. 39 of 8 February 1995.
2. Law of Ukraine “On Radioactive Waste Management” No. 255 of 30 June 1995.
3. Law of Ukraine “On Human Protection from Ionising Radiation” No. 15 14 January 1998.
4. Law of Ukraine “On Ecological Expert Review” No. 45 of 9 February 1995.
5. Law of Ukraine “On General Provisions of Subsequent Operation and Decommissioning of Chernobyl NPP and Transformation of its Destroyed Unit 4 to an Ecologically Safe System” No. 309 of 11 December 1998.
6. Law of Ukraine “On Permissive Activities in the Field of Nuclear Power Utilization” No. 1370 of 11 January 2000.
7. Law of Ukraine “On Physical Protection of Nuclear Installations, Nuclear Materials, Radioactive Waste, Other Sources of Ionising Radiation” No. 2064 of 19 October 2000.
8. Law of Ukraine “On Local Government in Ukraine” No. 280 of 21 May 1997.
9. Law of Ukraine “On Civil Defence in Ukraine” No.2974-XII of 3 February 1993.
10. Law of Ukraine “On Ratification of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management” No. 1688-III of 20 April 2000.
11. Law of Ukraine “On Amendment of Some Legislative Acts of Ukrainian as regards Nuclear Energy Utilisation and Radiation Safety” No. 1673-III of 20 April 2000.
12. Law of Ukraine “On Protection of Public and Territories from Man-caused and Natural Emergencies” No. 1809-III of 8 June 2000.
13. Law of Ukraine “On Civil Liability for Nuclear Damage and Its Financial Assurance” No. 2893-III of 12 December 2001.
14. Decree of the President of Ukraine “On State Regulation of Nuclear and Radiation Safety” No. 1303/2000 of 5 December 2000.
15. Decree of the President of Ukraine “On Provisions on the State Nuclear Regulatory Committee of Ukraine” No. 155/2001 of 6 March 2001.
16. Decree of the President of Ukraine “On Amendment of Provisions on the Ministry for Environment and Natural Resources of Ukraine and the State Nuclear Regulatory Committee of Ukraine” No. 598 of 25 April 2002.
17. Decree of the President of Ukraine “On Approval of Provisions on the Ministry for Fuel and Energy of Ukraine” No. 598 dated of 14 April 2000.
18. Decree of the President “On Approval of Provisions on the Ministry for Emergency Situations and Public Protection against Chornobyl Accident Consequences of Ukraine” No. 1005 of 28 October 1996.
19. Decree of the President “On Approval of Provisions on the Ministry for Health Protection of Ukraine” No. 918/2002 of 24 July 2000.
20. Resolution of the Cabinet of Ministers of Ukraine “On State Programme on Radioactive Waste Management” No. 480 of 29 April 1996.
21. “Comprehensive Programme on Radioactive Waste Management” approved by Resolution of the Cabinet of Ministers of Ukraine No. 2015 of 25 December 2002.

22. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Licensing Procedure of Individual Activities in the Field of Nuclear Energy Utilisation" No. 1782 of 6 December 2000.

23. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Procedure for Payment and Amount of Payment for Authorising Procedures in Nuclear Energy Utilisation" No. 440 of 6 May 2001.

24. Resolution of the Cabinet of Ministers of Ukraine "On Public Hearings on Nuclear Energy Utilisation and Radiation Safety" No. 1122 of 18 July 1998.

25. Resolution of the Cabinet of Ministers of Ukraine "On Procedure for Approval of Investment Programmes and Construction Projects and Their Comprehensive State Expert Examination" No. 483 of 11 April 2002.

26. Resolution of the Cabinet of Ministers of Ukraine "On Procedure for Submission Documentation for State Ecological Expert Examination" No. 870 of 31 October 1995.

27. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Provisions on State Radioactive Waste Register and State Cadastre" No. 480 of 29 April 1996.

28. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Provisions on State Control and Accountancy System of Nuclear Materials" No. 1525 of 18 December 1996.

29. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Provisions on Classification of Emergencies" No. 1099 of 15 July 1998.

30. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Plan for Response to State-Level Emergencies" No. 1567 of 16 November 2001.

31. Resolution of the Cabinet of Ministers of Ukraine "On Basic Provisions for Radioactive Material Transportation through the Territory of Ukraine" No. 1332 of 29 November 1997.

32. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Comprehensive Programme on Upgrading and Safety Improvement of Nuclear Power Plants" No. 504-r of 29 August 2002.

33. Resolution of the Cabinet of Ministers of Ukraine "On Approval of Programme for Nuclear Energy Development" No. 503-r of 29 August 2002. Agreement between the Government of Ukraine, the Government of Hungarian Republic and the Government of Russian Federation on cooperation in the field of nuclear fuel transportation between Hungarian Republic and Russian Federation through the territory of Ukraine dated 29 December 1992. Agreement between the Cabinet of Ministers of Ukraine, the Government of Russian Federation, the Government of Slovak Republic and the Government of Czech Republic on cooperation in the field of nuclear material transportation between Russian Federation and Czech Republic through the territory of Ukraine and Slovak Republic dated 14 March 1998. Agreement between the Cabinet of Ministers of Ukraine, the Government of Bulgarian Republic, the Government of Moldova Republic and the Government of Russian Federation on cooperation in the field of nuclear material transportation between Bulgarian Republic and Russian Federation through the territory of Ukraine and Moldova Republic dated 28 November 1997.

34. Agreement between the Government of Ukraine and Government of Russian Federation on cooperation in the field of nuclear material transportation dated 12 April 1996.

35. Agreement between the Government of Ukraine, the Government of Russian Federation and the Government of Slovak Republic on cooperation in the field of nuclear material transportation between Slovak Republic and Russian Federation through the territory of Ukraine dated 18 October 1993.

SNRCU Regulations on Nuclear and Radiation Safety in the Field of Spent Fuel and Radioactive Waste Management

1. Rules for Nuclear Safety of Research Reactors (PBYa-03-75), approved by USSR GKAE, 1975.
2. Rules for Nuclear Safety of Critical Test Bench (PBYa-02-78), approved by USSR GKAE, 1978.
3. Rules for Nuclear Safety in Storage and Transportation of Nuclear-Hazardous Fissile Materials (PBYa-06-09-80), approved by USSR GKAE, 1980.
4. General Provisions for Safety Assurance of Research Reactors in Design, Construction and Operation (OPB IR) 1988.
5. Rules for Nuclear Safety of Reactor Facilities of Nuclear Power Plants (PBYa RU AS-89), PNAE G-1-024-90, approved by USSR GPAN, 1990.
6. Safety Rules for Storage and Transportation of Nuclear Fuel at Nuclear Energy Facilities. PNAE G-14-029-91, approved by USSR GPAN, 1991.
7. General Provisions for Safety Assurance in Decommissioning Nuclear Power Plants and Research Reactors (NP 306.2.02/1.004-98), approved by Order of the Ministry for Environmental Protection and Nuclear Safety No. 2 of 9 January 1998 and registered by the Ministry for Justice of Ukraine No. 47/2487 of 23 January 1998.
8. Statement on Regulatory Policy in Nuclear and Radiation Safety of SE “ChNPP” Shelter (NP 306.10.2/1.007-98), approved by Order of the Ministry for Environmental Protection and Nuclear Safety No. 49 of 8 April 1998.
9. General Provisions of Nuclear Power Plant Safety Assurance (NP 306.1.02/1.034-2000), approved by Order of the State Nuclear Regulatory Administration of Ukraine No. 63 of 9 December 1999 and registered by the Ministry for Justice of Ukraine No. 132/4353 of 6 March 2000.
10. Requirements to Structure and Contents of Safety Analysis Reports on Decommissioning Stages of Nuclear Power Plant and Research Reactor (NP 306.3.02/3.040-2000), approved by Order of the Ministry for Environment and Natural Resources of Ukraine No. 177 of 31 October 2000 and registered in by the Ministry for Justice of Ukraine No. 842/5063 of 21 November 2000.
11. Radioactive Waste Management. Requirements on Radioactive Waste Management before Disposal. General Provisions (ND 306.607.95), approved by Order of the Ministry for Environmental Protection and Nuclear Safety No. 87 of 1 July 1995.
12. Radioactive Waste Management. Disposal of Radioactive Waste in Near-Surface Facilities. General Radiation Safety Requirements (ND 306.604.95), approved by Order of the Ministry for Environmental Protection and Nuclear Safety No. 89 of 1 July 1995.
13. Radioactive Waste Management. Casks for Disposal of Solid Radioactive Waste. Radiation Safety Requirements (ND 306.608-95), approved by Order of the Ministry for Environmental Protection and Nuclear Safety No. 115 of 24 September 1996.
14. Procedure for State Inventory of Radioactive Waste (NP 306.2.04/3.005-98), approved by Order of the Ministry for Environmental Protection and Nuclear Safety No. 38 of 11 March 1998 and registered by the Ministry for Justice of Ukraine No. 199/2639 of 26 March 1998.
15. Provisions on the List and Requirements on the Format and Content of Documents Submitted by the Operating Organisation to Obtain Licences for Activities at Specific Stages of Radioactive Waste Disposal Facility Lifetime (NP-306.2.02/3.037-2000), approved by Order of the Ministry for Environment and Natural Resources of Ukraine No.

109 of 15 August 2000 and registered by the Ministry for Justice of Ukraine No. 601/4833 of 12 September 2000.

16. Provisions on Procedure for Investigation and Account of Incidents at Nuclear Power Plants, approved by the Order of the Ministry for Environment and Natural Resources of Ukraine of 3 July 1996 and registered by the Ministry for Justice No. 384/1409 of 26 July 1996.

17. Requirements to the Structure and Contents of the Safety Analysis Reports of the Near Surface Disposal Facilities of Radioactive Waste (NP-306.3.02/3.038-2000), approved by Order of the Ministry for Environment and Natural Resources of Ukraine No. 154 of 2 October 2000 and registered in by the Ministry for Justice of Ukraine No. 758/4979 of 30 October 2000.

18. Requirements to Structure and Contents of the Safety Analysis Reports on Radioactive Waste Treatment Facilities (NP 306.3.02/3.043-2001), approved by Order of the Ministry for Environment and Natural Resources of Ukraine No. 11 of 26 January 2001 and registered by the Ministry for Justice of Ukraine No. 137/5328 of 14 February 2001.

19. Requirements on the Structure and Content of the Safety Analysis Report for Shelter Designs (NP 306.5.04/3.054-2001), approved by Order of the SNRCU No. 106 of 3 December 2001 and registered by the Ministry for Justice of Ukraine No. 1049/6240 of 19 December 2001.

20. Safety Conditions and Requirements (Licensing Conditions) on Activities Associated with Radioactive Waste Processing, Storage and Disposal NP 306.5.04/2.060-2002, registered in the Ministry for Justice of Ukraine No. 874/7162 of 6 November 2002.

21. Procedure for State Inventory of Radioactive Waste (NP 306.5.04/2.059-2002), registered by the Ministry for Justice of Ukraine No. 160/7481 of 25 February 2003.

22. Recommendations on the Structure and Content of the Safety Analysis Report for Spent Fuel Storage Facilities. RD 308.8.02/2.067-2003, approved by Order of the SNRCU No. 33 of 20 February 2003.

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Sanitary Rules and Standards for Radioactive Waste Management

1. "Sanitary Rules for Radioactive Waste Management" (SPORO-85) approved by the Ministry for Health Protection of USSR of 1 January 1985.

2. "Sanitary Rules for Design and Operation of Nuclear Power Plants" approved by the Ministry for Health Protection of USSR (SP AS-88).
3. "Norms of Radiation Safety of Ukraine" (NRBU-97) approved by the Ordinance of the Ministry for Health Protection of Ukraine No. 208 of 14 July 1997.
4. "Norms of Radiation Safety of Ukraine/ Supplement: Radiation Protection from Potential Ionising Radiation Sources " (NRBU-97/D-2000) approved by Decree of the State Medical Doctor No. 116 of 12 July 2000.
5. DSP 6.074.120 - 01 "Main Sanitary Rules for Radiation Protection of Ukraine" approved by the Ordinance of the State Medical Doctor No. 433 of 29 November 2002.

Annex 6.

References to official national and international reports related to safety

1. Report of Ukraine "On Compliance with the Convention on Nuclear Safety Obligations", Kyiv, 2001.
2. Report OSAT-E N 86 "Utilisation of ChNPP Facilities for Lot-2».
3. Report OSAT-E N88 "Comparative Analysis of Siting Variants for ICSRM Facilities».
4. Report on TACIS Project (Contract 96-5450.00). «Final Conclusions on Review of ChNPP Seismic Data», May 1997.
5. Report of AEA Technology on TACIS Project "Plan for Decommissioning ChNPP Units 1, 2, 3", 1996.
6. Report of AEA Technology, SGN, EWN on TACIS Project "Plan of Measures Required for Decommissioning ChNPP Units 1, 2, 3", 1996.
7. Report "Chernobyl Unit 4 – short and long term measures – Design Criteria Unit 4», TACIS, EC, Brussels, 1996.
8. Report "Chernobyl Unit 4 – short and long term measures – Final Report», TACIS, EC, Brussels, 1996.
9. Report "Chernobyl Unit 4 – short and long term measures – Evaluation, Control and Mitigation of Criticality Risk », TACIS, EC, Brussels, 1996.

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IAEA Documents Associated with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

1. SS-115 International Basic Safety Standards for Protection against Ionising Radiation and for the Safety of Radiation Sources, 1996
2. 111-F The Principles of Radioactive Waste Management, 1995
3. 120 Radiation Protection and Safety of Radiation Sources' A Safety Fundamental, 1996
4. 111-G-1.1 Classification of Radioactive Waste, 1994
5. 111-G-4.1 Siting of Geological Disposal Facilities, 1994
6. WS-R-2 Predisposal Management of Radioactive Waste, including Decommissioning, 2000
7. WS-G-2.3 Regulatory Control of Radioactive Discharges to the Environment, 2000
8. WS-G-2.6 Predisposal Management of High Level Radioactive Waste, 2003
9. 111-G-3.1 Siting of Near Surface Disposal Facilities, 1994
10. NS-G-2.7 Radiation Protection and Radioactive Waste Management In the Operation of Nuclear Power Plants, 2002
11. WS-R-1 Near Surface Disposal of Radioactive Waste, 1999
12. WS-G-1.1 Safety Assessment for Near Surface Disposal, 1999
13. WS-G-1.2 Management of Radioactive Waste from the Mining and Milling of Ores, 2002
14. WS-G-2.3 Regulatory Control of Radioactive Discharges to the Environment, 2000
15. WS-G-2.5 Predisposal Management of Low and Intermediate Level Radioactive Waste, 2003
16. WS-G-2.6 Predisposal Management of High Level Radioactive Waste, 2003
17. GS-R-1 Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety, 2000
18. GS-R-2 Preparedness and Response for a Nuclear or Radiological Emergency, 2002
19. GS-G-1.1 Organization and Staffing of the Regulatory Body for Nuclear Facilities, 2002
20. GS-G-1.2 Review and Assessment of Nuclear Facilities by the Regulatory Body, 2002
21. GS-G-1.3 Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body, 2002
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23. WS-G-2.1 Decommissioning of Nuclear Power Plants and Research Reactors, 1999
24. WS-G-2.2 Decommissioning of Medical, Industrial and Research Facilities, 1999
25. WS-G-2.4 Decommissioning of Nuclear Fuel Cycle Facilities, 2001
26. RS-G-1.1 Occupational Radiation Protection, 1999
27. RS-G-1.2 Assessment of Occupational Exposure due to Intakes of Radionuclides, 1999

28. RS-G-1.3 Assessment of Occupational Exposure due to External Sources of Radiation, 1999
29. RS-G-1.4 Building Competence in Radiation Protection and the Safe Use of Radiation Sources, 2001
30. RS-G-1.5 Radiological Protection for Medical Exposure to Ionising Radiation, 2002
31. TS-R-1 Regulations for the Safe Transport of Radioactive Material, 2000
32. TS-G-1.1 Advisory Material for the Regulations for the Safe Transport of Radioactive Material, 2002
33. TS-G-1.2 Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material, 2002
34. RS-G-1.3 Assessment of Occupational Exposure due to External Sources of Radiation, 1999
35. RS-G-1.3 Assessment of Occupational Exposure due to Intakes of Radionuclides, 1999
36. RS-G-1.4 Building Competence in Radiation Protection and the Safe Use of Radiation Sources, 2001

Radiation protection of personnel and public

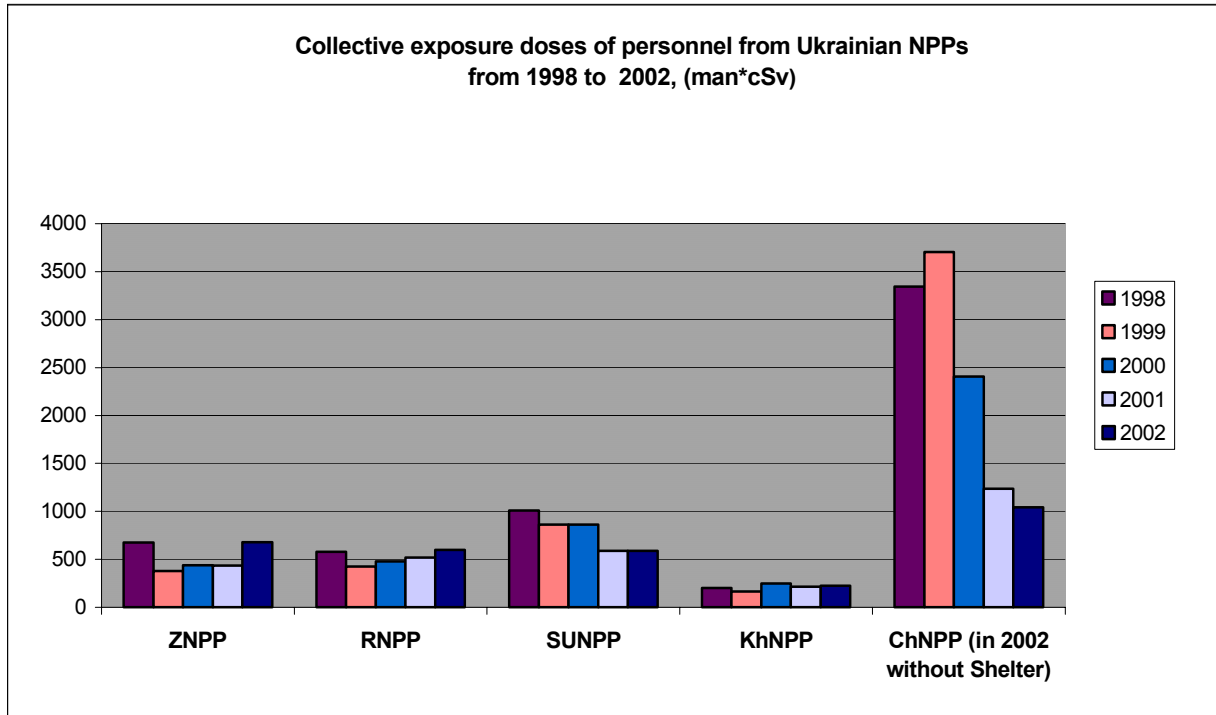


Figure L.8.1. Trend in collective doses of personnel from Ukrainian NPPs

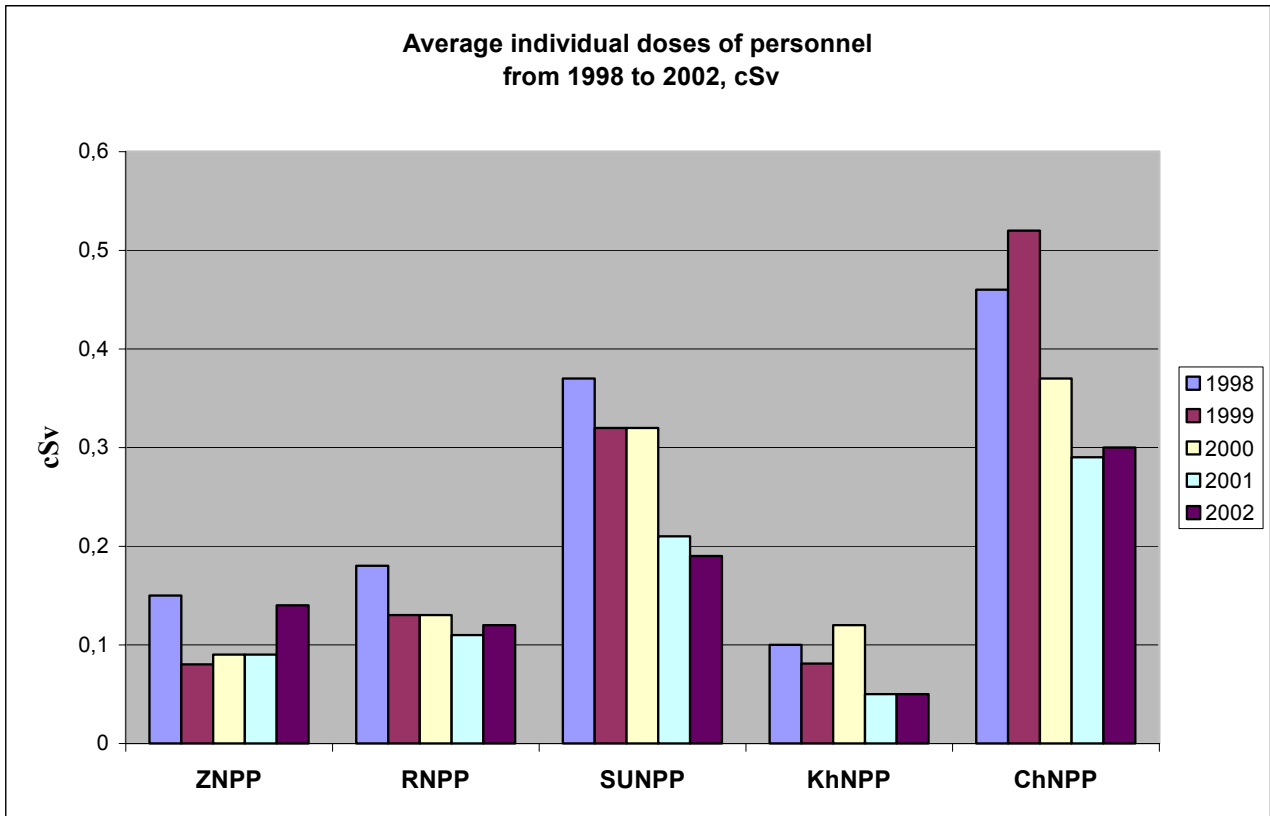


Figure L.8.2. Trend in average annual individual doses of personnel from Ukrainian NPPs

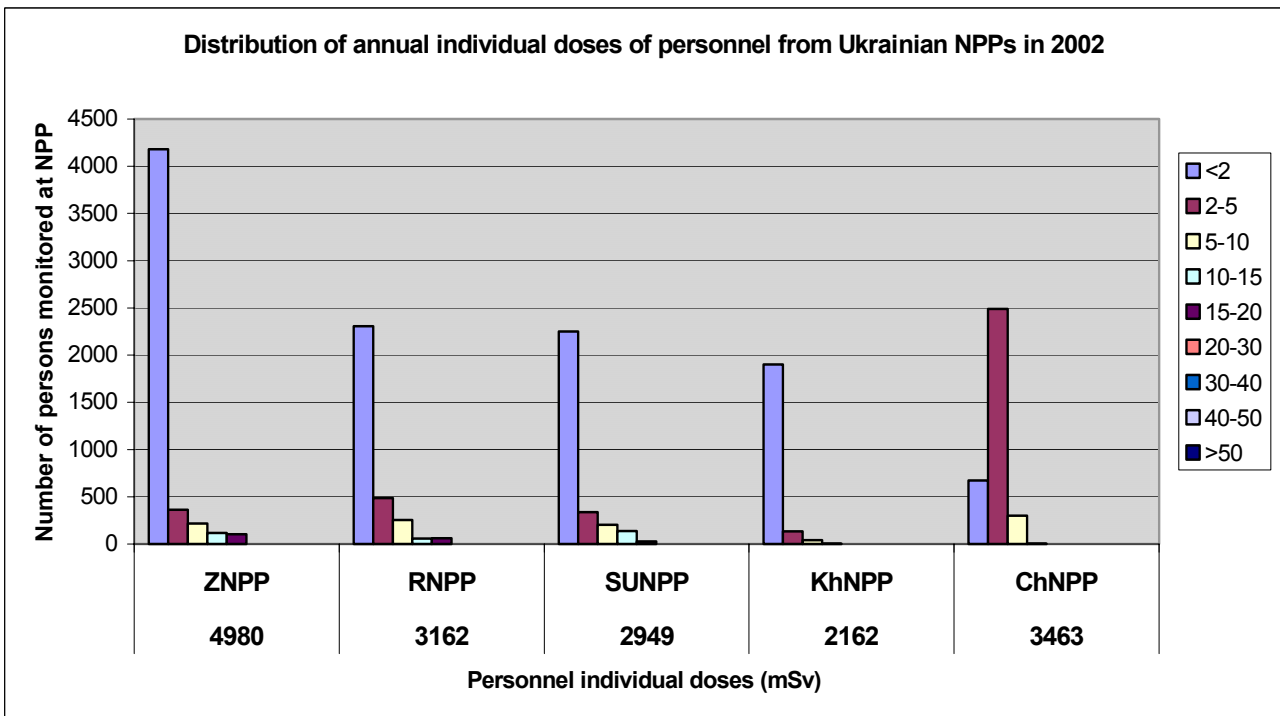


Figure L.8. 3. Distribution of individual doses of personnel from Ukrainian NPPs

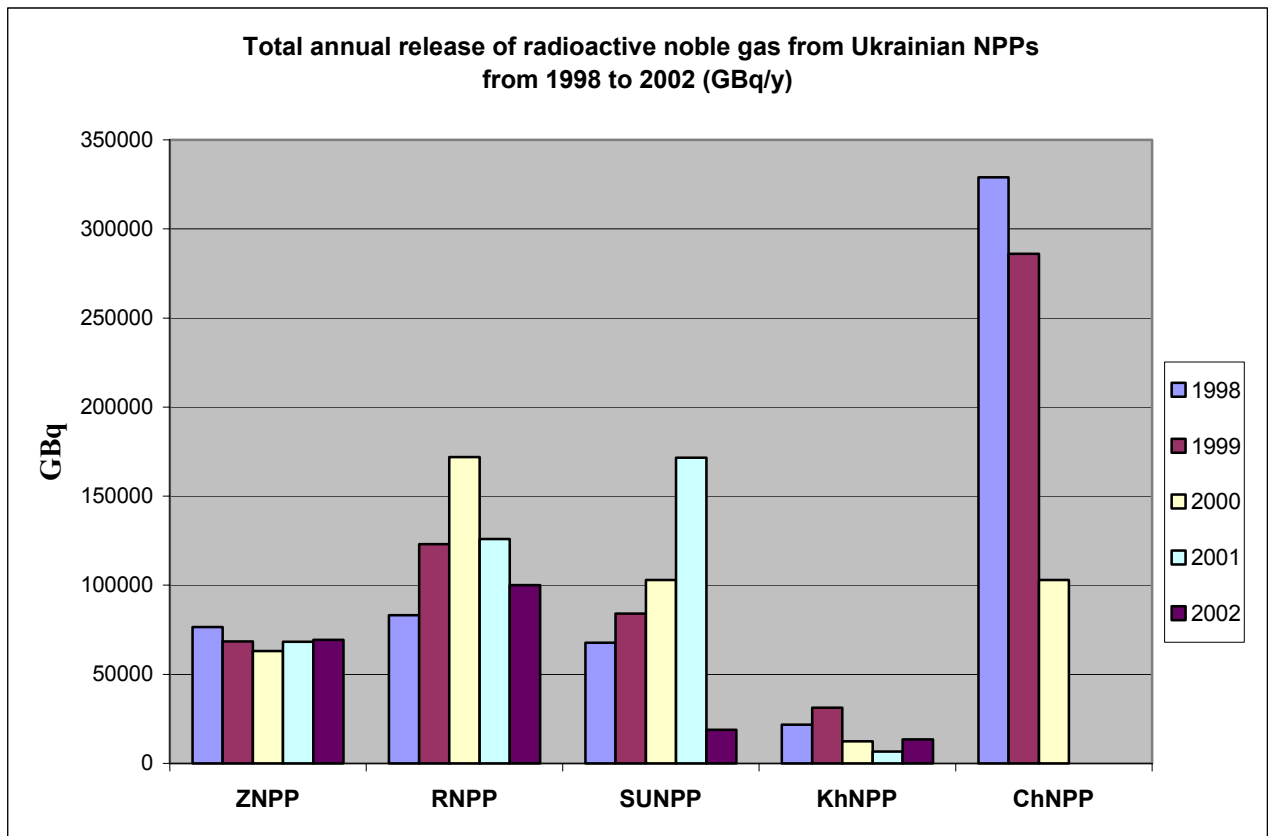


Figure L.8.4. Trends of radioactive noble gas releases from Ukrainian NPPs

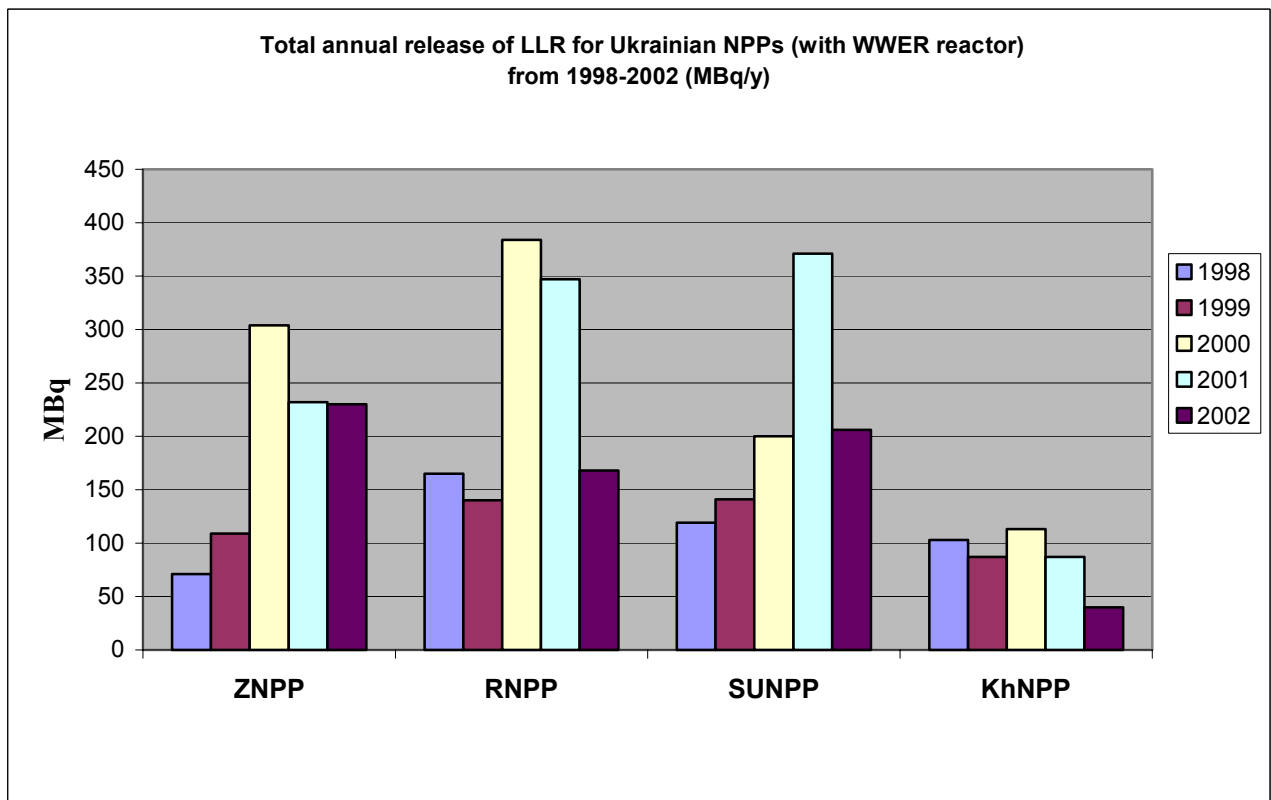


Figure L.8.5. Trend of long-lived radionuclide releases from Ukrainian NPPs

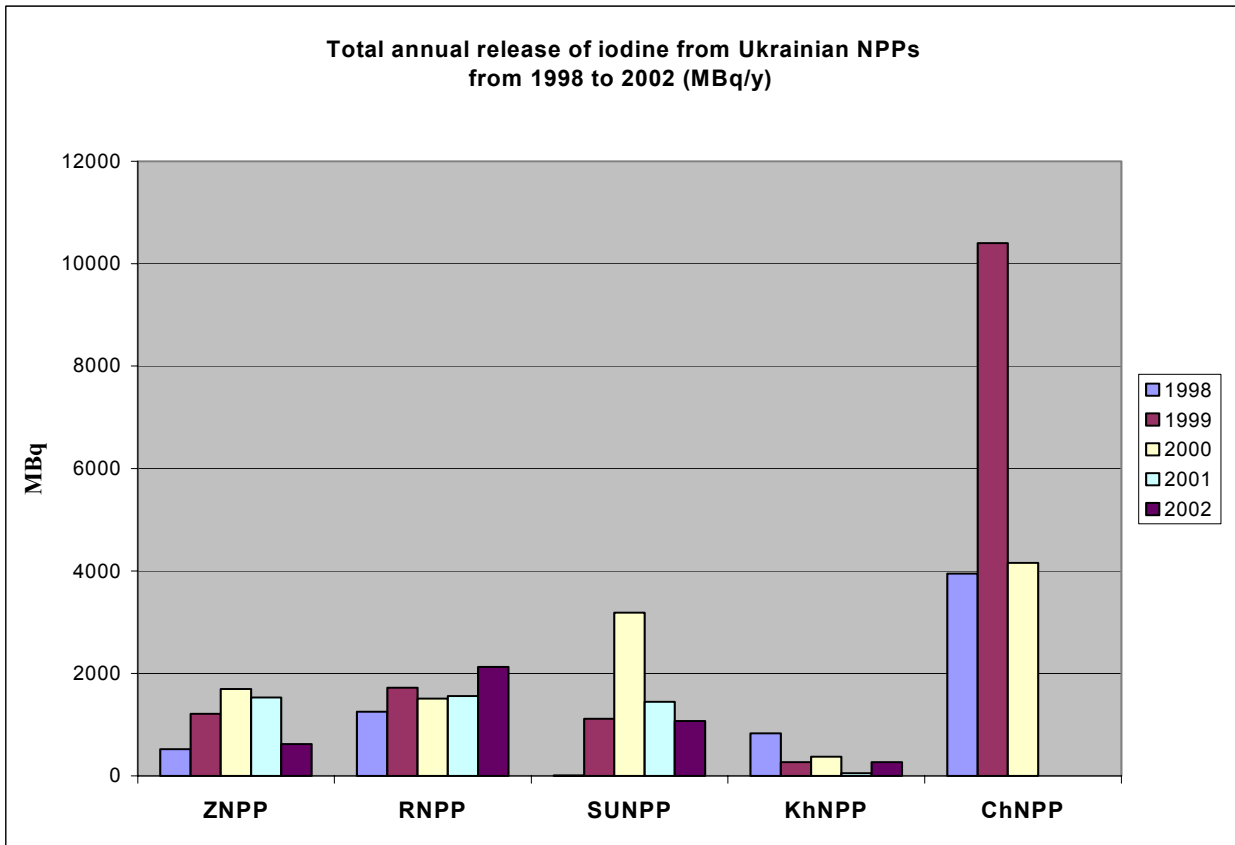


Figure L.8.6. Trend of radioactive iodine releases from Ukrainian NPPs

