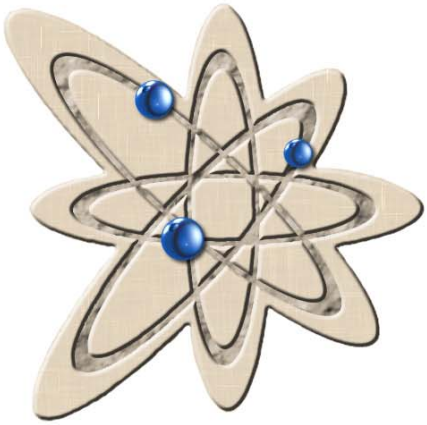


RUSSIAN FEDERATION

NATIONAL REPORT ON THE FULFILLMENT OF COMMITMENTS RESULTING FROM THE CONVENTION ON NUCLEAR SAFETY

Third Review Meeting under the Convention on Nuclear Safety

MOSCOW 2004

This is the third National Report of the Russian Federation on the fulfillment of commitments arising from the Convention on Nuclear Safety. The Report covers nuclear power plant operation period after 2001 and takes into account the recommendations of the second meeting of the Contracting Parties to review the national reports held 15-26 April 2002 in IAEA (Vienna, Austria).

The Report does not address some individual aspects of the fulfillment of the Convention's articles that were described in detail in the first and second National Reports of the Russian Federation and which have not sustained any changes for the period under review.

This Report places major emphasis on the additional information on the issues and problems that aroused interest in the course of review and discussions of reports at the second Review Meeting of the Contracting Parties including those mentioned in the IAEA Secretariat's Report to the third Review Meeting under the Convention on Nuclear Safety of 11 March 2004.

Contents

List of Abbreviations

BCR - Back-up Control Room
ERC - Emergency Response Center
ETC - Emergency Technical Center
IAEA - International Atomic Energy Agency
INES - International Nuclear Event Scale
IRS - Incident Reporting System
ISA - In-depth Safety Assessment
KOPUR - Component Lifetime Control, Assessment, Prediction and Management Program
LRW - Liquid Radioactive Waste
LWS - Liquid Waste Storage
MCC - Mining and Chemical Combine
MChS - Ministry for Civil Defense, Emergency Management and Liquidation of the Consequences of Natural Calamities
M & R - Maintenance and Repair
NPP - Nuclear Power Plant
OPAS - NPP Emergency Assistance Team
PAR - Passive Autocatalytic Recombiner
POKAS - NPP Quality Assurance Program
PRIS - Power Reactor Information System
PSA - Probabilistic Safety Assessment
R & D - Research and Development
RI - Reactor Installation
RPS - Reactor Protection System
RSChS - Unified System for Prevention and Liquidation of Emergencies
SB EOP - Symptom-based Emergency Operating Procedure
SCC - Situation and Crisis Center
SEC NRS - Scientific and Engineering Center for Nuclear and Radiation Safety
SFA - Spent Fuel Assembly
SNF - Spent Nuclear Fuel
SNFSF - Spent Nuclear Fuel Storage Facility
SSSF - Special Separate-standing Storage Facility
SRW - Solid Radioactive Waste
SWS - Solid Waste Storage
UCR - Unit Control Room

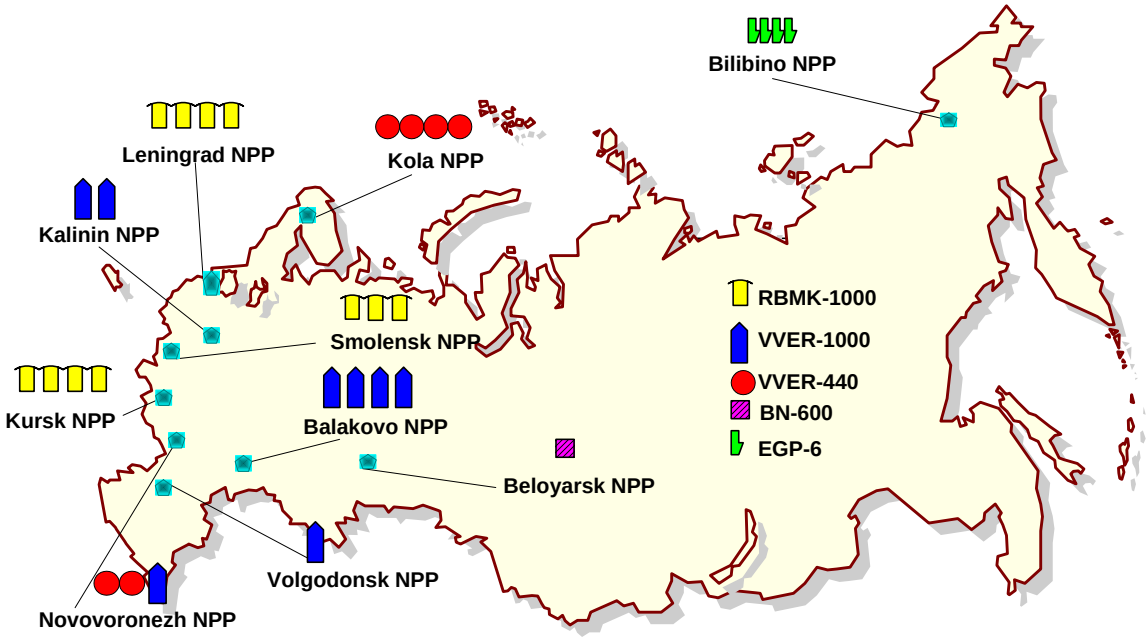
Introduction

The main objectives of nuclear power expansion, as defined in the Russia's energy strategy for the period up to 2020 approved by the Russian Federation Government's Ordinance No 1234-r of 28 August 2003, are to improve nuclear power efficiency and introduce new capacities while assuring the safety level in line with existing standards and regulations.

As of 01.01.2004, 30 nuclear units were in operation in the Russian Federation with a total installed capacity of 22.242 GWe (gross). The total electricity generation by nuclear power plants (NPPs) in 2003 amounted to 148.6 bln kWh or 16.5% of the overall electricity generated by all Russian power stations.

The location of operating NPPs is shown below.

Location of Russian NPPs



Almost all NPPs are situated in the European part of Russia and operate within four united power systems of North-West, Center, Mid Volga and Urals.

The list of Russian NPPs as of 01.01.2004 is given in Appendix 1, which shows nuclear units in operation, those being prepared for decommissioning as well as units planned to be commissioned up to 2010.

Russian Federation's national policy in the area of nuclear power safety assurance is based on the federal acts on the "Use of Atomic Energy", "Radiation Safety of the Public", "Environmental Protection" and others.

These acts are aimed at protecting human life and health, preserving environment, protecting property while using atomic energy and are intended to promote nuclear science and technology, contribute to the strengthening of international regime of safe atomic energy uses.

In connection with the improvement of the structure of federal bodies of executive power and abolition of the Russian Federation Ministry for Atomic Energy by the Russian Federation Government Ordinance No 164 of 6 April 2004, the functions to ensure the development and safe operation of nuclear power in Russia were delegated to the newly established Federal Atomic Energy Agency on the basis of the former ministry. In accordance with the Russian Federation Government Ordinance No 316 of 28 June 2004, the Federal Atomic Energy Agency is a body of state management of atomic energy use and is entrusted with the functions of pursuing state policy and normative-legal regulation in the field of atomic energy use. The Federal Atomic Energy Agency is directly subordinate to the Russian Federation Government.

The Act on the "Use of Atomic Energy" specifies that the overall responsibility for the safety of nuclear installations as well as for safe management of nuclear materials and radioactive substances rests with the operating organization.

Today there is only one operating organization in Russia - Federal State Unitary Enterprise "Russian State Concern for the Production of Electrical and Thermal Energy at Nuclear Plants" ("Rosenergoatom" Concern), which incorporates all 10 Russian nuclear power plants.

To execute the above mentioned federal acts and implement the safety principles stated in the federal codes and standards the operating organization has adopted the basic activity principles formulated in the "Policy Statement".

These are:

- priority to safety, i.e. assuring NPPs safety at all stages of their life cycle is the top priority;
- maintaining NPP cost-effective and reliable operation and assuring their safety is the major task of the operating organization;
- adherence of individuals and organizations, involved in NPP life cycle at all its stages, to safety culture principles (75-INSAG-4);
- strict compliance with the Russian Federation legislation, with the requirements of existing national safety codes and standards in

nuclear power and consideration of NPP safety recommendations given by the International Atomic Energy Agency (IAEA).

In accordance with the Convention on Nuclear Safety and taking into account the recommendations formulated at the second Meeting of Contracting Parties to review national reports this Report will further describe the article-by-article fulfillment of the Russian Federation's commitments arising from the Convention on Nuclear Safety.

Article 6. Existing Nuclear Installations

Detailed description of all 30 nuclear units in operation was given in the first and second National Reports of the Russian Federation.

This Report highlights the most important results and changes that occurred in the period after the second Review Meeting of Contracting Parties.

Major performance indicators of the Russian operating nuclear units for 2001-2003 are given in Appendix 2.

Safety improvement of the operating NPP units represents a continuing process, which includes:

- meeting the program (schedules) of step-by-step safety improvement by means of unit modification.
- nuclear units safety improvement in the course of their modification while preparing for lifetime extension beyond the design-specified life;

As mentioned in the second National Report of the Russian Federation, safety assessment of NPP units and implementation of measures aimed at further improvement of their safety proceed on a continuous basis, namely:

- in the course of issuing operation licenses and amending the terms of the licenses;
- when changing the regulatory safety requirements in the area of atomic energy use;
- in the frame of the annual NPP unit operational safety assessments performed by the operating organization.

6.1. NPP Unit Lifetime Extension

Lifetime extension of operating NPPs on expiration of their design life is one of essential trends in the modern stage of nuclear power development in Russia and one of the most cost-effective investments in NPP safety assurance and preservation of generating capacities.

The efforts to extend operating NPP lifetime were launched in response to the "Program of Nuclear Power Development for the Period of 1998-2005 and up to the Year of 2010" approved by the Russian Federation Government Ordinance No 815 of 21.07.98.

NPP unit lifetime extension measures focus on further upgrading of NPP equipment and systems and aging management.

Implementation of a set of measures to extend the lifetime of the first generation plants allowed to improve their safety and also contributed to the improvement of the physical condition of these plants and reduction of risk associated with their operation.

NPP unit lifetime extension activities are performed in accordance with the requirements of the existing Russian legislation and federal codes and standards in the area of atomic energy use as well as in compliance with the guiding and methodological documents developed by the Operating Organization - "Rosenergoatom" Concern (See Appendix 3).

According to the regulatory documents adopted in Russia, NPP unit lifetime extension activities include:

- comprehensive examination of a NPP unit;
- assessment of technical feasibility of extending NPP unit component lifetime;
- unit safety assessment;
- cost-benefit analysis of extending unit lifetime.

The result of the work performed is the decision on the expediency of extending the concerned unit lifetime.

Further work consists in the development of a program of unit preparation for lifetime extension, which incorporates:

- justification of extending the lifetime of non-replaceable components;
- implementation of a comprehensive program of unit upgrading;
- conduct of unit components and systems testing;
- substantiation of unit safety (Safety Analysis Report);
- preparation of a new in-depth safety assessment report.

The results of this work are submitted by the operating organization to the Russian Regulatory Body for independent review and to obtain NPP unit operation license for the additional period.

When performing NPP unit lifetime extension activities it is assumed that the identification of the required unit upgrading work scopes is conducted on the basis of:

- deterministic analysis of NPP design conformance to the existing safety codes and standards including identification of deviations from the requirements of codes and standards, classification of deviations in terms of their impact on defense in depth and development of compensatory measures to eliminate major safety problems;
- probabilistic safety assessment which includes determination of the cumulative core damage frequency and its value on completion of the upgrading work.

The main objectives of unit comprehensive examination are as follows:

- obtain and assess information on the actual status of unit components;
- estimate residual lifetime of unit components;

- identify unit components that need to be replaced due to expiration of their service life.

As a result of unit comprehensive examination the following actions are undertaken:

- replacement of components with expired service life;
- modification or repair of components, whose service life restoration is foreseen in the codes and standards;
- justification of residual life of unit non-replaceable components operating under the most harsh conditions and subjected to the maximum effects of operational factors.

For the reported period a package of activities was completed to prepare the following first generation units for lifetime extension: Novovoronezh NPP Units 3 and 4, Kola NPP Unit 1, Leningrad NPP Unit 1 and Bilibino NPP Unit 1.

For each operating NPP unit safety improvement measures have been developed including the schedules for their implementation. Implementation of these measures within the specified time scales is under permanent control of the management of the operating organization and regulatory body.

For example, major safety improvement actions implemented at Kola NPP Unit 1 and Leningrad NPP Unit 1 are given in Appendix 4.

The work performed has demonstrated the possibility of unit safe operation beyond the specified 30-year lifetime. The Russian regulatory body's licenses for operation of Kola NPP Unit 1 and Novovoronezh NPP Units 3 and 4 have been granted in the established order, which is reflected in Appendix 1.

Preparatory actions for lifetime extension are also being undertaken at Kola NPP Unit 2, Leningrad NPP Unit 2, Kursk NPP Units 1 and 2, Bilibino NPP Unit 2 and at a number of other plants.

6.2. NPP Unit Upgrading

The engineering-technical strategy of Russian NPP unit upgrading is based on the results of assessment of unit conformance to the requirements of the modern safety codes and standards, probabilistic safety assessments and feedback of NPP operating experience.

For the reported period (2001-2003) significant upgrading works have been completed at RBMK-1000 units of second generation, namely:

- Kursk NPP Unit 3;
- Smolensk NPP Units 2 and 3;
- Leningrad NPP Units 3 and 4.

The upgrading actions completed at Smolensk NPP Units 2 and 3 are given in Appendix 4.

In conclusion it should be noted that the provisions of Article 6 of the Convention on Nuclear Safety are fulfilled for all the operating NPP units.

The technical and organizational measures that are being implemented allow to maintain the acceptable safety level of the existing Russian nuclear units.

Article 7. Legislative and Regulatory Framework

The regulation of relations in the area of atomic energy use is performed on the basis of the Russian Federation Constitution as the Basic Law, which has the supreme legal effect and direct action, on the basis of federal laws of the Russian Federation, legal regulatory documents of the President of the Russian Federation and of the Government of the Russian Federation, federal standards and regulations in the area of atomic energy use, regulatory documents of the state safety authorities and regulatory documents of the bodies that manage the use of atomic energy, of the standards, construction norms and rules.

7.1. Federal Acts

The basic principles of legal regulation in the area of atomic energy use and principles of ensuring radiation safety are defined by the federal acts on the "Use of Atomic Energy" and "Radiation Safety of the Public", the basic provisions of which were described in detail in the second National Report.

Since the time of presentation to the IAEA of the previous National Report a number of federal acts intended to contribute to more effective state regulation of safety in the use of atomic energy have been passed.

On 10 July 2001 the federal law on the "Addenda to the Federal Act on the Use of Atomic Energy" was passed. This law supplements the earlier established objects of law application with two additional objects named "fuel assemblies of a nuclear reactor" and "irradiated fuel assemblies of a nuclear reactor". Also a legal norm was introduced in the federal act on the "Use of Atomic Energy", according to which the export from the Russian Federation and import to the Russian Federation of nuclear reactor fuel assemblies is to be effected based on the terms of civil-legal agreements, and the order of fuel assembly export and import is defined by the Government of the Russian Federation.

On 10 January 2002 the federal act on "Environmental Protection" was passed. This act states that during nuclear installations and NPPs siting, design, construction, commissioning and operation environmental protection has to be ensured to preclude radiation effects of these facilities, the established sequence and parameters of the technological process are to be followed, and state regulation of safety while using atomic energy shall also be performed. The act also specifies that NPP siting is undertaken once the positive conclusions of the state ecological review and other federal reviews of the design and other related materials are available that are foreseen by the Russian Federation legislation and confirm ecological and radiation safety of nuclear installations. The projects of NPP siting must incorporate solutions that will provide for their safe decommissioning. It

should be noted that as regards the use of atomic energy, the above act contains the requirements to all the stages of the management of radioactive substances, nuclear materials and radioactive waste.

On 28 March 2002 the federal law was passed entitled "Addendum to the Federal Act on the Use of Atomic Energy". This addendum specifies that the import to the Russian Federation of nuclear reactor irradiated fuel assemblies fabricated in the territory of a foreign country (foreign-made spent fuel assemblies) is to be performed on the basis of a positive conclusion of a special commission established by the President of the Russian Federation. This commission acts in accordance with the Manual to be approved by the President of the Russian Federation, and together with performing its intended task the commission has to submit to the President the annual reports on the state of the art with the imports of foreign-made spent fuel assemblies to the Russian Federation.

On 27 December 2002 the federal act on "Technical Regulation" was passed. This act specifies that the mandatory requirements to products, to the processes of production, operation, storage and transportation can only be established by the technical specifications. These technical specifications are adopted by a federal act, Russian Federation President's decree or by the Russian Federation Government ordinance.

The technical specifications have to be adopted within 7 years from the date of putting into force the federal act on "Technical Regulation".

The mandatory requirements to the products, to the processes of production, operation, storage and transportation, in relation to which the technical specifications will not be adopted within the above timing, terminate their validity.

In view of that technical specifications on nuclear and radiation safety are currently being developed that will incorporate obligatory requirements arising from the federal codes and standards.

On 11 November 2003 the federal law on "Amendments and Addenda to Article 5 of the Federal Act on the Use of Atomic Energy" was passed. This law specifies that the radioactive sources and substances not designed for defense purposes and the radioactive wastes that do not contain nuclear materials can be owned not only by the State, entities of the Russian Federation and municipal authorities, but also by legal entities. These legal entities make transactions related to the above mentioned objects provided they have relevant permits (licenses) to perform activities in the area of atomic energy use, while the right of ownership of these objects is acquired and cancelled according to the civil legislation of the Russian Federation.

It is also important to note that on 30 December 2001 the Russian Federation Code of Administrative Violations was enforced which in particular incorporates the basic provisions of the currently cancelled (in

view of enforcement of the above Code) Federal Act on "Administrative Responsibility of Organizations for Violating the Legislation in the Area of Atomic Energy Use".

7.2. Regulatory Legal Acts of the President of the Russian Federation and of the Government of the Russian Federation

The federal act on the "Use of Atomic Energy" in some of its provisions, is not a law of direct action, but contains references to other federal acts and regulatory legal deeds of the President of the Russian Federation.

For the purpose of implementing the provisions of the federal act on the "Use of Atomic Energy" a number of regulatory legal documents were prepared and issued, namely:

- Decree of the President of the Russian Federation of 21 January 1997 No 6 on the "Federal Bodies of Executive Power Authorized to Perform State Regulation of Safety in the Use of Atomic Energy";
- Russian Federation Government Ordinance of 14 July 1997 No 865, which defines that licensing of activities in the area of atomic energy use is performed by the Regulatory Body of Russia. The Ordinance also sets forth the order of licensing;
- Regulations for the Development and Approval of the Federal Codes and Standards in the Area of Atomic Energy Use, approved by the Russian Federation Government Ordinance No 1511 of 1 December 1997;
- Russian Federation Government Ordinance No 746 of 10 July 1998 on the approval of the Rules for the Organization of State System of Accounting and Control of Nuclear Materials;
- Russian Federation Government Ordinance No 1117 of 15 September 1998, which defines the federal body of executive power (Minatom of Russia, and since 6 April 2004 - Federal Atomic Energy Agency) authorized to conclude agreements for the transfer of nuclear materials that are in federal ownership.

An important role in assuring safety while performing activities in the area of atomic energy use is played by the Russian Federation Government Ordinance No 240 of 3 March 1997 on the "Approval of a List of Positions of Atomic Energy Facility Employees who are to Obtain Licenses of the Russian Federal Nuclear Regulatory Body for the Conduct of Works in the Area of Atomic Energy Use". According to this Ordinance, a regulatory legal document was issued entitled "Regulations for Issuing Permits of the Russian Federal Nuclear Regulatory Body for the Conduct

of Works in the Area of Atomic Energy Use to be Granted to Nuclear Plant Employees". This document is valid since 1 January 2001.

Other decrees of the President of the Russian Federation and ordinances of the Russian Federation Government have also entered into force that are aimed at the implementation of the federal act on the "Use of Atomic Energy" and regulate various aspects of activities in the area of atomic energy use.

In accordance with the Decree of the President of the Russian Federation No 444 of 17 April 2003, the Russian Federation Ministry for Civil Defense, Emergency Management and Liquidation of the Consequences of Natural Calamities has been defined as one of the bodies of state regulation of safety in the use of atomic energy (instead of the Russian Federation Ministry of the Interior).

According to the Decrees of the President of the Russian Federation No 314 of 9 March 2004 on the "System and Structure of the Federal Bodies of Executive Power" and No 649 of 20 May 2004 on the "Issues of the Structure of the Federal Bodies of Executive Power" the following entities have been established in the Russian Federation:

- Federal Atomic Energy Agency, which is a federal body of executive power that performs the functions of rendering state services, managing state property and also the law enforcement functions in the area of atomic energy use, development and safe functioning of the nuclear defense sector, nuclear fuel cycle, atomic science and engineering, nuclear and radiation safety, non-proliferation of nuclear materials and technologies, as well as international cooperation in this field;
- Federal Ecological, Technological and Nuclear Authority, which is a federal body of executive power that performs the functions of monitoring and regulation of safety in the use of atomic energy in the territory of the Russian Federation (except activities associated with the development, manufacture, testing, operation and utilization of nuclear weapons and military nuclear power installations) including licensing as well as special functions in the area of state security in this field.

The management of the activities of the Federal Atomic Energy Agency and of the Federal Ecological, Technological and Nuclear Authority is performed by the Government of the Russian Federation, thus assuring independence of the Russian Regulatory Body from the organizations responsible for ensuring safety in the use of atomic energy.

7.3. Federal Standards and Regulations in the Area of Atomic Energy Use Approved by the Regulatory Body of Russia

In accordance with the federal act on the "Use of Atomic Energy" and Russian Federation Government Ordinance No 1511 of 1 December 1997 the Russian Regulatory Body organizes the development, develops, approves and puts into force the federal standards and regulations that define the requirements in the area of assuring nuclear, radiation safety (except sanitary-hygienic rules) as well as requirements to the systems of unified state accounting and control of nuclear materials, radioactive substances and radioactive waste. Besides, the federal standards and rules regulate the procedures of investigating and reporting unusual events in the operation of atomic energy facilities and, which is of special importance, set the order of early notification of legislative authorities of different levels, management bodies and other concerned agencies on the occurred anomalies (accidents, events) in the operation of the above facilities. This provides a possibility of immediate involvement of means and resources foreseen by the Unified State System for Preventing and Eliminating Emergencies in the Territory of the Russian Federation, if necessary.

In the period from 2000 to March 2004 the Russian Regulatory Body, both independently and with involvement of other federal authorities and competent organizations, took significant efforts to develop new and revise the existing federal standards and regulations to assure conformance of the established regulatory requirements to the achieved level of science and engineering with due account of foreign experience with atomic energy use.

In the above mentioned period federal standards and regulations on nuclear plant safety assurance shown in Appendix 5 were approved and put into effect.

7.4. Guidance Documents and Safety Guides to be Approved by the Regulatory Body of Russia

To realize its safety regulation authorities the Regulatory Body of Russia develops, approves and puts into effect the guidance documents. These documents, according to the Russian Federation Government Ordinance No 865 of 14 July1997, in particular define the structure of the documents needed to justify the assurance of nuclear and radiation safety of the nuclear installations and requirements to their content, the order of verifications to check the validity of data contained in the documents submitted to obtain the license as well as the sequence of review.

For example, the Regulatory Body of Russia has approved and put into effect the guiding documents entitled "Requirements to the Structure and Content of the Documents that Justify the Assurance of Nuclear and

Radiation Safety of a Nuclear Installation, Storage Facility, Radiation Source and/or Declared Activity (for nuclear plants)" RD-04-27-2000 and "Requirements to the Structure and Content of the Documents that Justify Safety in the Period of Extended Operation of a Nuclear Plant Unit" RD-04-31-2001.

The set of guiding documents also includes those, which regulate the order of performing state supervision over nuclear and radiation safety.

The basic of these documents is the "Regulations for the Organization of State Supervision of Safety in the Use of Atomic Energy" approved in December 1998.

In view of high importance of the task of assuring safekeeping of nuclear materials and preventing the potential for their theft, the Regulatory Body of Russia has developed and put into force the following documents for its regional office inspectors:

- Provisional Guidelines for the Use of Nuclear Materials Monitoring and Measuring Tools at Nuclear Installations and Storage Facilities (RD-08-23-2000);
- Procedure for Carrying out a Target Inspection for Nuclear Materials Inventory Check at Nuclear Power Plants with VVER-440 and VVER-1000 reactors (RD-08-18-99);
- Standard Program for Carrying out an Inspection of Security of Nuclear Materials, Nuclear Installations and Nuclear Materials Storage Facilities (RD-08-20-2000).

In the period from early 2000 to March 2004 the Russian Regulatory Body has significantly updated the organizational-practical framework for performing regulatory activity. In particular, the following guidance documents were approved and put into force:

- Guide for Surveillance over the System of State Accounting and Control of Nuclear Materials (RD-08-01-2003);
- Procedure for the Conduct of Target Inspection of the Status of Accounting, Control and Security of Nuclear Materials in Connection with their Loss, Theft, Unauthorized Use, Lack and Excess (RD-08-11-2003);
- Procedure for Performing Supervision of Construction and Assembly Activities in Atomic Energy Utilization Facilities (RD-03-33-2003);
- Methodological Guidance for Performing Supervision of Design and Engineering of Nuclear Plant Control Systems and Electric Power Systems (RD-04-32-2003);
- Methodological Guidance for Performing Supervision of the Assembly of Nuclear Plant Control Systems, Electric Power Systems and their Components (RD-03-61-2003).

In the period from early 2000 to March 2004 four safety guides were developed and put into effect which define methods and ways of complying with the requirements of the federal codes and standards by organizations involved in the use of atomic energy (as applied to nuclear installations).

In conclusion of this Article it should be noted that in the Russian Federation they are continuously improving the legislative and regulatory framework for taking decisions aimed at assuring nuclear installations safety and further expansion of nuclear power taking account of international experience and harmonization of safety standards.

Article 8. Regulatory Body

8.1. Authorities and Duties of the Regulatory Body

According to tasks entrusted to it the Regulatory Body of Russia exercises the following functions:

- Develops drafts of legal and regulatory documents on safety assurance in the use of atomic energy and submits them for consideration according to the established order;
- Analyzes practical application of the legislation of the Russian Federation in the field of atomic energy use and develops proposals for its improvement;
- In accordance with the order established by the Government of the Russian Federation develops, approves and puts into effect federal standards and rules in the field of atomic energy use that set forth requirements in the area of nuclear, radiation (except sanitary-hygienic standards, regulations and requirements in the field of radiation safety), technical and fire safety (with regard to setting requirements to components and systems for ensuring nuclear and radiation safety), physical protection of nuclear installations and radiation sources (sources of ionizing radiation containing radioactive substances), storage facilities for nuclear materials and radioactive substances and storage facilities for radioactive waste as well as requirements for systems of the state unified control and accounting of nuclear materials, radioactive substances and radioactive waste, and other regulatory documents governing nuclear, radiation and technical safety in the field of atomic energy use, which are mandatory for any person or entity working in this field; and establishes procedures for application of these documents;
- Issues permits to employees of nuclear facilities according to the established order for the right to work in the field of atomic energy use;
- Issues licenses, according to the established order, to operating organizations and organizations that perform work and render services in the field of atomic energy use for implementation of activities related to siting, designing, construction, operation and decommissioning of nuclear installations, radiation sources, storage facilities for nuclear materials and radioactive substances and storage facilities for radioactive waste (hereinafter – storage facilities), for activities related to management of nuclear materials and radioactive substances, as well as other activities in the field of atomic energy use subject to licensing by the Regulatory Body of Russia;
- Establishes requirements to a set of documents justifying nuclear and radiation safety of a nuclear installation, radiation source, storage

facility and/or activity, implementation of which requires obtaining permits (licenses) of the Regulatory Body of Russia, and requirements to the content of documents being part of this set;

- Organizes safety reviews of nuclear installations, radiation sources and storage facilities including those with involvement of independent experts;
- Within its competence organizes and implements state supervision of:
  - Compliance by federal executive authorities, authorities of federal entities of the Russian Federation, local authorities and organizations with the legislation of the Russian Federation relevant to nuclear and radiation safety assurance in the field of atomic energy use;
  - Compliance with requirements of federal standards and rules in the field of atomic energy use (except sanitary-hygienic standards, regulations and requirements in the field of radiation safety);
  - Compliance with the terms of permits (licenses) for activities in the field of atomic energy use;
  - Systems of the unified state accounting and control of nuclear materials, radioactive substances and radioactive waste;
  - Management of radioactive waste and spent nuclear materials, their treatment and disposal;
  - Ensuring physical protection of nuclear installations, radiation sources, storage facilities of nuclear materials and radioactive substances;
  - Development and implementation, jointly with other state safety regulatory bodies in the field of atomic energy use, of action plans for protection of employees of nuclear facilities and population in case of accidents at these facilities and preparedness of organizations to mitigate accident consequences;
  - Compliance with safety related requirements in designing (engineering), manufacture, storage, assembling, operation and decommissioning of equipment and systems of nuclear installations, radiation sources and storage facilities;
- Organizes studies conducted by organizations under its jurisdiction to justify principles and criteria of nuclear and radiation safety and to improve effectiveness of the state supervision of nuclear and radiation safety in the use of atomic energy, involves other research organizations, scientists and experts, including foreign ones, in conducting corresponding studies;
- Organizes certification and verification of computer codes, development and maintaining of data banks by organizations under its jurisdiction for performing safety analysis of nuclear installations, radiation sources and storage facilities, for providing supervision of systems of the unified state accounting and control of nuclear materials, radioactive substances

and radioactive waste and physical protection of nuclear installations, radiation sources, storage facilities for nuclear materials and radioactive substances;

- Establishes rules for submittal of information on operational events and safety status reports to the Regulatory Body of Russia by owners, possessors (users) of nuclear installations, radiation sources and storage facilities;
- Participates, according to the established order, in the investigation of circumstances and causes resulting in operational events at nuclear facilities affecting safety of those facilities;
- Takes part in the development of requirements and conditions that exclude a possibility of terrorist acts at the supervised nuclear facilities;
- Participates in the organization and conduct of activities on certification of equipment, products and technologies for nuclear installations, radiation sources and storage facilities;
- Maintains, in accordance with the legislation of the Russian Federation, international co-operation aimed at ensuring state supervision of nuclear and radiation safety, systems of the state unified control and accounting of nuclear materials, radioactive substances and radioactive waste, physical protection of nuclear installations, radiation sources, storage facilities for nuclear materials and radioactive substances, as well as co-ordinates foreign economic activity of organizations being under its jurisdiction;
- Performs monitoring of the fulfillment of international commitments of the Russian Federation with regard to nuclear and radiation safety assurance in the use of atomic energy;
- Submits, according to the established order, information on nuclear and radiation safety status of nuclear facilities, including early reports, to the President of the Russian Federation, Federal Assembly of the Russian Federation, Government of the Russian Federation, federal executive authorities and authorities of the Russian Federation entities on matters within its competence;
- Provides the publishing of legal and regulatory documents within its competence on issues of safety regulation in the field of atomic energy use;
- Organizes the publishing of regulatory, technical, reference and other documents needed for maintaining and improving the regulatory activity in the field of atomic energy use;
- Performs the functions, according to the established order, of a state customer for intergovernmental, federal targeted and other programs.

8.2. Regulatory Body Structure

Execution of the functions entrusted to the Regulatory Body of Russia is ensured by its Headquarters and regional bodies (regional offices) organized by Headquarters according to the established order. The organizational chart of the Headquarters and regional bodies of nuclear regulation is shown in Figure 8.

Scientific and Engineering Center for Nuclear and Radiation Safety (SEC NRS) is under the jurisdiction of the Regulatory Body of Russia.

Funds allocated to the Regulatory Body of Russia from the federal budget of the Russian Federation in 2003 and 2004 are given in Appendices 6 and 7 respectively.

The fact that the Regulatory Body of Russia performs the functions entrusted to it is an evidence of sufficiency of finance allocated for its activity.

Data on the actual number of employees of regional bodies and costs of inspections in 2002 and 2003 are given in Appendices 8 and 9 respectively.

Organizational Chart of the Federal Nuclear and Radiation Safety Authority of Russia

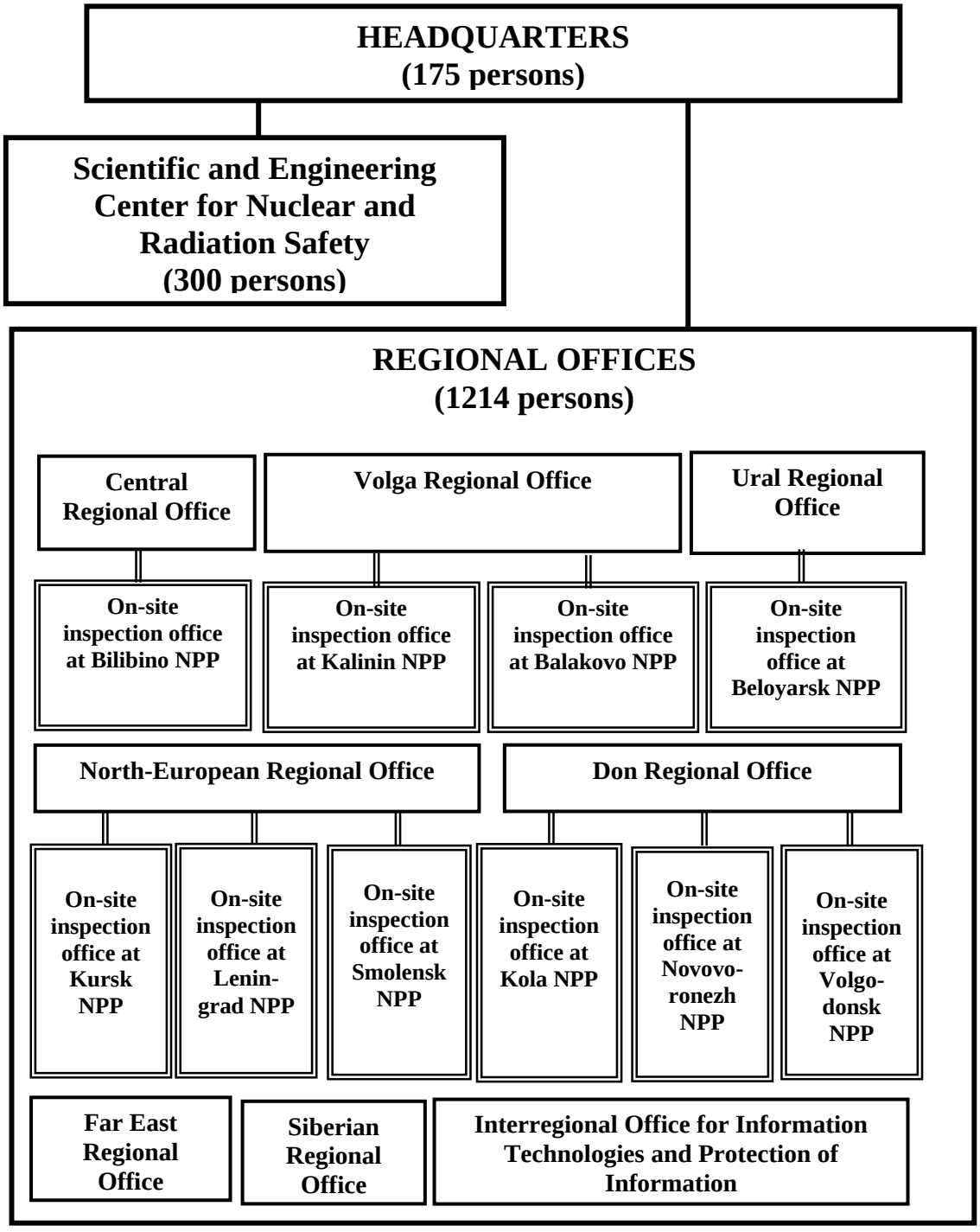


Figure 8

8.3. Arrangements for the Technical Review of Documents Justifying Safety of Nuclear Installations

Within the system of the Regulatory Body of Russia the structural units of its Headquarters, regional offices and SEC NRS arrange for the conduct of technical reviews of documents justifying safety of nuclear facilities according to the following procedure:

- Structural divisions of the Regulatory Body of Russia examine the documents submitted by an Applicant and justifying safety of a nuclear facility and/or a declared activity to identify the scope of the technical review and then assign SEC NRS to carry out the review;
- SEC NRS defines the membership of expert group and ensures participation of experts in the review. Specialists working for SEC NRS as well as specialists from other organizations not involved in the development of reviewed materials may be involved;
- SEC NRS assigns tasks to the experts and receives their opinions based on the results of each review. It arranges for interactions with license applicants in the course of the review and develops a summarized conclusion based on the reviews conducted;
- The summarized conclusion is submitted to the state safety regulatory body and is used together with the results of inspections conducted at the applicant's facilities as a basis for taking decision to grant (or not to grant) the corresponding licenses as well as for defining license terms.

8.4. Human and Financial Resources of SEC NRS

As of 1 January 2004 the actual number of SEC NRS personnel dealing with NPP safety problems was 86 including:

- Managers – 14;
- Specialists – 65;
- Technical staff – 7.

External experts are involved in SEC NRS review activities on the contractual basis. Thus, for example, 249 experts were involved in these activities in 2002 and 226 – in 2003.

In 2002 the workload in this area was 70.5 million rubles, which included:

- 16.1 million rubles – funding form the federal budget;
- 54.4 million rubles – extra-budgetary funds (contracts and international activity).

In 2003 the workload in this area was 70.1 million rubles, which included:

- 18.2 million rubles – funding form the federal budget;
- 51.9 million rubles – extra-budgetary funds (contracts and international activity).

The Regulatory Body of Russia interacts with other federal executive authorities, authorities of the federal entities of the Russian Federation and organizations responsible for the use of atomic energy in accordance with the currently effective legislative and other legal and regulatory documents of the Russian Federation.

In conclusion it should be noted that an independent Regulatory Body – the Federal Ecological, Technological and Nuclear Authority – is functioning in the Russian Federation which is subordinated to the Government of the Russian Federation and reports directly to it.

The Regulatory Body of Russia is provided with human, financial and technical resources that allow to perform the intended functions while maintaining its independence.

Article 9. Responsibility of the License Holder

The federal act on the "Use of Atomic Energy" specifies that the Operating Organization (Utility), i.e. the license holder, bears full responsibility for the safety of a nuclear installation and for the appropriate handling of nuclear materials and radioactive substances.

According to this Act the Operating Organization shall have authorities, financial, material and other resources sufficient for performing its functions.

The Operating Organization is an organization established in accordance with the legislation of the Russian Federation and recognized eligible to operate a nuclear installation and to conduct activities on siting, designing, construction, operation and decommissioning of the nuclear installation and handling of nuclear materials and radioactive substances independently or with involvement of other organizations. The Operating Organization shall have licenses to carry out each of the above mentioned activities. These licenses are to be issued by the state safety regulatory authority with the documented license conditions. The Operating Organization shall observe these license conditions in carrying out activities in the field of atomic energy use.

The Operating Organization shall ensure:

- the use of the nuclear installation only for purposes it was constructed for;
- organization and coordination of the development and implementation of Quality Assurance Programs at all stages of construction, operation and decommissioning of the nuclear installation;
- development and implementation of measures to prevent accidents at the nuclear installation and to mitigate negative accident consequences for personnel of the nuclear installation, population and the environment;
- realization of the rights of employees of nuclear facilities to have social and economic compensations;
- accounting of occupational exposure doses to individuals working at nuclear facilities;
- development and implementation, within its competence, of measures to protect personnel and population in case of an accident at the nuclear installation;
- control and accounting of nuclear materials and radioactive substances;
- providing physical protection of the nuclear installation;
- development and implementation of fire protection measures;

- radiation monitoring in the exclusion zone and in the surveillance area;
- recruitment, training and maintaining professional skills of nuclear installation employees and establishing the necessary social and living conditions for them;
- informing the public on radiation situation within the exclusion zone and surveillance area;
- execution of other authorities specified in the legal and regulatory documents.

The Operating Organization shall inform the Regulatory Body of Russia about all cases of breach of the limits and conditions of safe operation, submit systematized data on all cases of deviations from normal operation that occur at a nuclear power plant and also present the results of its inspections aimed at NPP safety monitoring and periodic reports on NPP safety status.

Thus, the principle of full responsibility of the Operating Organization for NPP safety is set forth in the Russian Federation at the legislative level. It is specified in the regulatory requirements and is the most important organizational principle of safety assurance.

Article 10. Priority to Safety

10.1. Safety Policy

The federal act on the "Use of Atomic Energy" defines the legal basis and principles for regulating relations arising from the uses of atomic energy.

The basic principle of legal regulation, as stated in this Act, is to ensure safety in the use of atomic energy.

Further regulatory stipulation of this approach is made in a number of documents of the Regulatory Body of Russia, for instance in the "General Guidelines for Assuring Nuclear Plant Safety" (OPB-88/97).

"Policy Statement" adopted in 2002 by Concern Rosenergoatom (the Operating Organization) emphasizes that safety assurance is a priority task of the Concern, and that all individuals and organizations involved in the NPP life cycle at all its stages must be guided by safety culture principles in their activities and relationships.

10.2. Safety Culture and Its Development

A package of measures aimed at enhancing safety culture has been implemented within the reported period.

In 2003 the Operating Organization developed "Measures on Safety Culture Enhancement at NPPs of Rosenergoatom Concern for 2003-2005" that cover a wide range of actions aimed at safety improvement and enhancement of safety culture.

It was noted that the practice of development of safety culture status reports and assessments had shown that it would be reasonable to analyze status and assess safety culture in the frame of "NPP Unit Annual Operational Safety Status Assessment Reports".

Guidelines for the annual self-assessment of safety culture level achieved at NPPs are used in the analysis and assessment of NPP safety culture status.

When analyzing status and assessing safety culture the following is considered:

- effectiveness of safety culture management system;
- status of safety performance;
- direct and root causes of plant and shop-level events for their prediction and prevention.

Based on NPP reports on analysis of status and assessment of safety culture, an annual summary report is issued on the assessment of safety culture in nuclear power industry where the main areas of safety culture enhancement are defined.

For example, the annual summary report on the assessment of safety culture status for 2002 presents analysis results of the main unit performance indicators (capacity factor, availability factor, fuel assembly failure rates, unavailability indicator for control and protection systems, annual collective dose). The analysis showed that major NPP unit performance indicators improved, while the downtime caused by events and failures in power unit operation decreased.

Analysis of plant and shop-level events carried out in the frame of safety culture status assessment gave a possibility to define indicators characterizing the dominating event causes and to identify areas of NPP personnel activities which are primarily needed to be focused on and require development of safety improvement measures.

Safety culture enhancement activities have been conducted in the following areas:

- improvement of operating and maintenance procedures;
- improvement of training of operating and maintenance personnel;
- development of additional procedures and training materials aimed at increasing personal awareness of the importance of safety aspects;
- improvement of activities associated with the feedback of operating experience;
- strengthening the role of supervision of different process activities;
- development of methodological materials for self-assessment of operational safety.

Safety culture improvement measures presented in the plant's reports are aimed at removing "weaknesses" revealed by the analysis of root and direct causes of NPP operational events.

10.3. Role and Functions of the Regulatory Body

The Regulatory Body of Russia is striving to solve the tasks of consistent safety improvement of nuclear installations bringing it to the internationally acknowledged level by acting within the existing set of special standards and rules on safety in generation and use of atomic energy with simultaneous development and implementation of proposals aimed at improving the legislative and regulatory framework of the Russian Federation, of licensing and inspection procedures.

Legal entities, which intend to be involved in or already deal with any type of activity associated with the use of atomic energy in the territory of the Russian Federation, must have sufficient technical potential, financial, material and other resources for its safe implementation and bear responsibility for safety of such activity, including liability for damage caused by radiation impact. The period of liability for radiation impact damage, its financial limits, right of regress and limitation of action are specified by legal acts of the Russian Federation. By no means does this liability decrease because of independent activities and responsibilities of the Regulatory Body of Russia, other state regulatory and supervisory authorities, as well as designers, suppliers, builders and other persons or entities conducting work and rendering services in the field of generation and use of atomic energy, nuclear materials and radioactive substances.

Thus, the laws and regulatory requirements in force in the Russian Federation set the priority to safety assurance with respect to all other issues relevant to nuclear installations, as required by the Convention on Nuclear Safety, and NPP operation practice confirms this.

Article 11. Financial and Human Resources

11.1. Financial Resources of the Operating Organization

Nuclear, radiation, fire and industrial NPP safety assurance activities are financed from the target funds included in the prime costs of services rendered by the Operating Organization in accordance with the specifications approved by the Federal Energy Commission of Russia (Ordinance of the Government of the Russian Federation No 1455 of 7 December 1996 "On Adding Expenses for Safe Operation of NPPs to the Prime Costs of Services of the Operating Organization").

The Operating Organization (Rosenergoatom Concern) accumulates a necessary part of financial resources for ensuring NPP safe operation.

It should be noted that over the last three years financial resources of the Operating Organization have increased essentially. This allowed to expedite implementation of measures aimed at further safety improvement of the operating NPPs.

For example, in 2003 the Operating Organization allotted funds for the following purposes:

- for improvement of nuclear, radiation, ecological, industrial and fire NPP safety - 2016000 thousand rubles;
- for extension of lifetime beyond the design life – 5580000 thousand rubles;
- for modifications and upgrading of the operating NPPs – 150000 thousand rubles;
- for NPP unit decommissioning program – 752000 thousand rubles;
- for training and maintaining professional skills of personnel – 997000 thousand rubles.

11.2. Human Resources of the Operating Organization

According to Article 35 of the federal act on the "Use of Atomic Energy" the Operating Organization provides recruitment, training and maintaining of professional skills of NPP employees.

The system of staffing and personnel training in the nuclear power sector is based on regulatory documents, and in particular on the "Rules for Organization of Work with the Personnel Employed by Nuclear Power Plants of Rosenergoatom Concern" (PORP-2000) that were developed with consideration of requirements of IAEA document "Recruitment, Training and Authorization of NPP Operations Personnel" (No 50-C-0, IAEA, 1990).

As of 1 January 2004 all nuclear power plants and Russian organizations supporting NPP operation were completely staffed with

skilled personnel needed for operation, maintenance and repair of major and auxiliary NPP equipment, for implementation of managerial, administrative and other functions.

The average listed number of personnel of NPPs and support organizations is 52440 persons.

47452 people are employed at nuclear power plants, including 36851 persons involved in generation. Number and structure of NPP personnel involved in generation are in line with the regulatory documents in force.

In accordance with the regulatory requirements each NPP is staffed with personnel having necessary professional skills and allowed to work independently according to the established order.

Authorization of operations personnel for performing certain activities is effected, if permits granted by the Regulatory Body of Russia are available.

The Government of the Russian Federation approved a list of NPP personnel positions required to get permits of the Regulatory Body of Russia to work in the field of atomic energy use.

The Government of the Russian Federation has defined that qualification requirements for employees who have to get permits according to the list of positions are specified in the industry's qualification reference books of positions of managers and specialists (employees) agreed with safety regulatory authorities in the use of atomic energy and former Ministry of Labor and Social Development of the Russian Federation. The Operating Organization specifies qualification requirements to other personnel of a nuclear power plant.

The Operating Organization provides the recruitment, training, authorization for independent work and maintaining professional skills of the operations personnel. The system of recruitment and training of NPP operations personnel is aimed at achieving, monitoring and maintaining the professional skills necessary for ensuring safe NPP operation under all modes, as well as for implementation of actions aimed at mitigation of consequences in case of an accident.

The promotion of safety culture among the operations personnel is one of the training program components. In the system of operations personnel training technical training aids are used for mastering practical skills of NPP operation, including simulators of different types allowed for use in the training of NPP personnel according to the established order. Special attention is paid to training in actions in case of potential events (including accident) that may occur in NPP operation.

The design of each NPP provides for a Training Point (Center) with a laboratory of psychological and physiological studies. Such Center is equipped with training tools and materials, technical training means and staff of specialists necessary for high-quality training of NPP personnel.

"The Annual Schedule for Work with Personnel" is developed at each NPP and approved by NPP Manager. This document is a basic one with regard to the organization of work with personnel during the year. "The Annual Schedule" has, in particular, a section on maintaining personnel professional skills, which includes:

- on-the-job training of personnel;
- regular, unscheduled and targeted briefings;
- emergency and fire protection exercises and training in emergency response actions;
- examination of knowledge of rules and standards applicable in nuclear power, job and process descriptions, operating and technical documentation;
- periodic off-the-job training to refresh theoretical knowledge and maintain practical skills in performing work tasks.

Activities to maintain professional skills are carried out annually according to programs as follows:

- 80 hours – for operating personnel of the unit control room (UCR);
- 20 hours – for other NPP personnel.

Training of personnel for NPPs and maintenance organizations is carried out regularly by NPP Training Points and specialized Training Centers in the form of periodic courses or individual training, periodic training with the use of technical training aids (simulators, imitators, mock-ups).

In 2003 in the Russian nuclear power industry the coverage of personnel by training and education services was as follows:

- in Training Centers – 1600, including:
  - operating personnel - 856;
  - maintenance and repair personnel - 417;
  - middle-level managerial staff - 162;
  - instructors - 165;
- in Training Points – more than 10000 workers and more than 4000 managerial personnel and specialists.

In addition, 610 workers and specialists, including 74 managers and 180 specialists of Rosenergoatom Headquarters were retrained at the targeted courses organized by the Regulatory Body of Russia and in the Russian higher education institutions.

19 NPP Managers, Chief Engineers and persons substituting these positions have passed psychological and physiological examination in the Center for Occupational Pathology of the former Russian Federation

Ministry of Health to obtain permits for work in the field of atomic energy use.

To improve the training process, maintain and improve professional skills of NPP personnel, the full-scope simulator of RBMK-1000 unit was commissioned at Leningrad NPP in 2003.

The educational system in the Russian Federation provides for the training of engineers for nuclear power sector.

The Russian Operating Organization has the necessary financial resources that enable to deliver training and retraining of personnel at all levels.

All nuclear power plants are staffed with skilled personnel.

Maintaining NPP employees' skills and retraining of workers, engineers and technical staff is carried out with the use of full-scope simulators and other modern technical training aids.

Article 12. Human Factor

12.1. Methods to Prevent Human Errors

Continuous work aimed at preventing, detecting and correcting NPP operations personnel errors is underway to solve the issues related to ensuring safe operation of nuclear units. Its methods and ways depend on a number of factors including analysis of personnel errors made in the course of personnel professional activities, nature of man-machine interface and NPP operating experience feedback.

Failures of plant equipment and systems that occurred due to erroneous personnel actions are investigated by a commission, which necessarily includes psychology experts. The psychology experts on the commission for investigation of each specific event work in accordance with the guide "Methodology for Psychology Experts on Personnel Erroneous Action Cause Analysis Related to Investigation of NPP Operational Events", RD EO 0131-98, issued by Rosenergoatom. During investigation a psychological analysis of causes of personnel erroneous actions in each specific incident is carried out. The analysis results in identifying true causes, which led to human error as well as the factors (organizational, psychological) that triggered them, and the appropriate measures to eliminate the causes are developed.

The work is carried out to analyze the man-machine interface. In particular, an analysis of ergonomic characteristics has been done in the work places of UCR operator, turbine building walkdown operator, senior duty electrician. The work performed has resulted in recommendations on improvement of UCR mimics, enhancement of lighting, ventilation and layout of the above work places.

The operating experience feedback systems are in place at NPPs. All significant deviations from normal operation modes of NPP equipment and systems are subject to investigation by the commission.

Investigation results in finding the causes of the event, including those associated with the organization of work and human factor. Basing on the analysis of causes that triggered NPP operational event the corrective actions are developed to prevent future recurrence of similar incidents.

NPP generation divisions on a monthly basis arrange for personnel training to analyze NPP operational events that occurred. When performing checks of operations personnel knowledge the attention is focused on how they know the signs of event initiation, progression and ways to eliminate operational events with equipment they operate and which occurred at NPP including those involving human errors.

To ensure nation-wide NPP operating experience feedback Rosenergoatom Concern has organized and maintains the industry-level information and analytical system of NPP operating experience.

In the frame of this system the information on various operational data both for Russian and foreign NPPs is collected, processed, stored, analyzed and disseminated. These materials are used as a basis for NPP operational event analysis followed by identification of measures aimed at preventing similar incidents in future.

The following actions are undertaken at all nuclear power plants to prevent, detect and correct personnel errors:

- high quality training of operating and maintenance personnel for specific positions (professions) which employs state-of-the art training aids and effective pedagogical techniques;
- periodic training courses for operating and maintenance personnel to keep their competence at a level that is required for ensuring safe operation of plant equipment;
- sessions of psychological support for the operating personnel who are to take important decisions involving lectures and practical training and role games on relevant topics;
- emergency in-plant drills involving operating shifts of NPP major divisions for personnel to master self-control techniques, team work, and prevention of erroneous actions;
- analyses of operating experience of the Russian and foreign NPPs based on the information received;
- sessions with operations personnel to discuss the occurred operational events affecting equipment and systems of the nuclear power plant.

Implementation of the above measures allows for ensuring and maintaining the operations personnel's knowledge and skills required for safe operation of a nuclear power plant.

12.2. Administrative, Managerial and Organizational Decisions Aimed at Human Factor Consideration

In the reported period the work to prevent, detect and correct personnel errors was carried out on the basis of corresponding administrative, managerial and organizational decisions. It was aimed at training and maintaining the competence of NPP personnel; at updating, considering the accumulated experience in NPP operation, the existing and developing the lacking operational documentation which regulates professional activities of the operations personnel related to maintenance and repair of process equipment and systems of a nuclear power plant.

In 2002–2003 administrative, managerial and organizational decisions were aimed at solving the issues of recruitment, staffing, training and granting permits for independent work to operations personnel of nuclear units to be commissioned in 2004-2006 and at resolving issues of

training and maintaining competence of personnel of first stages of these nuclear power plants.

12.3. Role of the Regulatory Body with Regard to Human Performance

The Regulatory Body of Russia focuses its attention on the supervision of how professional, organizational and ergonomic causes of NPP personnel errors affect NPP safety.

Within its supervisory activities the Regulatory Body analyzes the results of practical work performed by NPP personnel to ensure plant safety. Operational event reports and annual NPP operational safety status reports are the primary information sources here. The Regulatory Body of Russia maintains a database on NPP operational events.

The results of analysis of the above information are presented in the annual reports of SEC NRS. These reports provide the following information: statistical data on NPP personnel errors, weaknesses in the work of NPP managerial staff, cases of poor safety culture, analysis of direct and root causes of errors and weaknesses, analysis of corrective actions developed to prevent recurrence of NPP personnel errors, trends in indicators of NPP personnel errors, proposals for improvement of training level of NPP managerial, operating and maintenance personnel.

The Regulatory Body of Russia pays serious attention to supervision of the necessary level of NPP personnel professional skills. According to the currently effective guiding documents the Regulatory Body of Russia exercises the following types of control to ensure the required professional skills of NPP personnel:

- examination of NPP personnel knowledge of standards and rules in the field of atomic energy use;
- inspections at NPPs to check if the necessary professional level of NPP personnel is provided;
- supervision of compliance with the terms of the licenses issued by the Regulatory Body of Russia.

SEC NRS has developed a procedural document "Recommendations for Analysis of Human Factor Impact on NPP Safety" (DNP-3-04/98) to be used for the training of personnel involved in the investigation of causes of NPP operational events.

The Regulatory Body of Russia has developed a "Guide for the Organization of Supervision of Providing the Required Professional Skills of NPP Operations Personnel and Employees who Implement Institutional Control of Nuclear and Radiation Safety of Nuclear Power Plants" (RD-04-28-97).

This Guide establishes the order and requirements to be complied with while exercising control of necessary professional skills of NPP

management, personnel involved in institutional control of NPP nuclear and radiation safety, NPP staff involved in process operations, personnel responsible for physical protection and accounting and control of nuclear and radioactive substances during NPP operation.

According to the federal act on the "Use of Atomic Energy" NPP employees of certain categories (managerial personnel, operating personnel and personnel involved in institutional control of nuclear and radiation safety) are allowed to fulfill their duties only if they have permissions (licenses) issued by the Regulatory Body of Russia.

The Government of the Russian Federation approved a list of positions of NPP employees who have to obtain work authorizations in the field of atomic energy use depending on activities implemented by them.

One of prerequisites for an employee to get a permit of the Regulatory Body of Russia is that he/she does not have medical contraindications including psychological and physiological ones. The Government of the Russian Federation set forth a list of medical contraindications and a list of positions covered by thereof, as well as requirements to medical and psychological and physiological examinations.

Since 01.01.2001 the Regulatory Body of Russia has put into effect "Provisions for Issuing Permits by Federal Nuclear and Radiation Safety Authority of Russia to Personnel of Nuclear Power Plants to Conduct Activities in the Field of Atomic Energy Use".

Introduction of permits granting system allows to implement a proper monitoring of the entire system of NPP personnel training and of its quality.

The Regulatory Body of Russia carries out studies of human factor impact on NPP safety. The results of these studies are applied in exercising of regulatory and supervisory activities and have been reported to IAEA working groups at the meetings on international experience exchange.

Analysis of NPP personnel performance indicators for the recent years demonstrates that the number of cases showing deficiencies in personnel training has a decreasing trend. For example, in 2001-2003 there were 14 NPP personnel errors per year, while the number of personnel errors in 2000 was 19.

Thus, prevention of personnel errors, identification of deficiencies in personnel training, maintenance of high professional skills is essential within the system of measures aimed at NPP safety improvement.

In the Russian Federation procedures and requirements for control of professional skill level of managerial, operating and other NPP personnel are established at the governmental level.

Article 13. Quality Assurance

Russia pays utmost attention to quality assurance at all stages of nuclear installation development and operation.

The priority to high quality of designing and constructing nuclear power plants is reflected in the policies exercised at all levels of control over the use of atomic energy.

NPP quality assurance requirements have become the regulatory ones and are reflected in the basic standards and rules applicable in Russia.

To further develop quality assurance systems at nuclear power plants in line with the current requirements applied to quality assurance systems Rosenergoatom Concern developed in 2002 the "Work Program to Obtain Certificates of Compliance with Requirements of Standards GOST RISO 9000-2001 and GOST RISO 14001-98".

This Program envisages the development of the following organizational measures for each Rosenergoatom's enterprise, including nuclear power plants:

- drafting of a work program for preparation to and certification of quality management and environment status control systems;
- organization of work to standardize processes and approve Rosenergoatom's internal standards;
- drafting of a quality and certification-related training program for personnel of nuclear power plants, enterprises, and Rosenergoatom Headquarters;
- improvement of Rosenergoatom Headquarters and its branches' organizational structure as relates to the quality management system;
- regular seminars to exchange experience in quality management and certification of quality management systems.

In 2003 the preparatory stage was completed to certify quality assurance systems of Balakovo NPP, and in 2004 it is planned to conduct certification audits and obtain the certificates of compliance with the Russian standards. The experience to be obtained will be extended to other nuclear power plants.

Similar quality certification activities are carried out in the All-Russian Research Institute for Nuclear Power Plant Operation (VNIIAES) which provides scientific and technical support to nuclear power plant operations.

In 2002-2003 in accordance with the regulatory document issued by the Regulatory Body of Russia the "Requirements to Quality Assurance Program for Nuclear Power Plants" (NP-011-99) all nuclear power plants revised the existing NPP operational quality assurance programs and developed new quality assurance programs (POKAS) covering the activities carried out at NPPs.

For example, the POKAS(PSE) program has been developed – the quality assurance program for activities to extend unit lifetime; which is a supplement to POKAS(E) program - quality assurance program in operation.

Thus, the utmost attention is paid to high quality assurance at all stages of nuclear installation development and operation in Russia.

Article 14. Assessment and Review of Safety

According to the practice adopted in Russia the procedures for assessment and review of safety are exercised systematically throughout NPP life cycle as stipulated in the Convention on Nuclear Safety.

According to the federal act on the "Use of Atomic Energy" the Operating Organization and the Regulatory Body of Russia perform continuous monitoring of all the activities important for nuclear power plant safety.

Assessment and review of safety are performed by:

- the Operating Organization (Utility) with involvement of research and design organizations, which develop nuclear power plant and reactor installation (RI) designs, and other independent organizations;
- the Regulatory Body of Russia with involvement of independent highly qualified experts;
- international organizations (IAEA, WANO, etc.) in the course of missions like OSART, PROSPER, technical visits and peer reviews of nuclear power plants.

14.1. Safety Assessment by Regulatory Body of Russia for Licensing Purposes

According to the applicable legislation the Utility must obtain licenses for siting, construction, operation and decommissioning of nuclear power plants.

In the course of obtaining licenses for any stage of a nuclear power plant life cycle the Utility (applicant) submits documents to justify nuclear and radiation safety of a nuclear installation. The composition of the set of documents is determined by the Regulatory Body in its document the "The Requirements to the Composition and Content of Documents to Justify Nuclear and Radiation Safety of Nuclear Facility, Storage Facility, Radiation Source and/or a Declared Activity (for Nuclear Power Plants)". The submitted documentation is thoroughly inspected and reviewed. On the basis of obtained results the Regulatory Body of Russia makes a decision of granting/not granting the license. Only when the safety assessment results are positive the license is granted to the Utility which operates the nuclear power plant.

14.1.1. Safety Assessment at Nuclear Power Plant Construction Stage

To obtain NPP unit construction license the Utility submits to the Regulatory Body of Russia a NPP Preliminary Safety Analysis Report; the necessary design and other documentation including designs of RI, Process Control System and safety important systems; reports on R&D performed; quality assurance programs; probabilistic safety assessment (PSA) Level 1 and expert conclusions from the regulatory body supervising the use of natural resources, State Sanitary Inspectorate of Russia (Gossanepidnadzor), fire safety regulatory body and consents from federal and local administrations for the siting and construction of the nuclear power plant.

Thus, the basic expert review and evaluation of design solutions and measures to ensure safety of nuclear power plants under construction is done at the construction licensing stage of the nuclear power plant.

14.1.2. Safety Assessment at Nuclear Power Plant Operation Stage

All existing Russian nuclear units have operation licenses issued by the Regulatory Body of Russia. The operation licenses are granted by the Regulatory Body of Russia only after the assessment of safety of a NPP unit basing on the scrutiny and review of documents submitted to support the Utility's application, and after inspections to check safe operating conditions of a NPP unit.

In the course of documentation review to grant the license inspections are carried out for:

- assessment of issues of safety assurance directly at NPP;
- in-situ verification of the validity of the information submitted;
- evaluation of capabilities and conditions of the license applicant to conduct the declared activity.

At present the Regulatory Body of Russia issues licenses for up to 5 years and carries out NPP safety evaluations with the same frequency.

Information on operation license issuing process and the terms of the license validity is given in Appendix 1.

14.2. Audits and Inspections of Operating Nuclear Power Plants

Pursuant to the requirements of Article 35 of the federal act on the "Use of Atomic Energy", the Utility continuously monitors safe operation of NPPs at all stages of nuclear installation life cycle.

The system of audits and inspections implemented by the Utility aims at early identifying and preventing deficiencies in the operation of a nuclear power plant.

According to the regulatory requirements the operability tests of safety systems and other NPP safety related systems are carried out periodically.

The Utility conducts comprehensive and targeted audits of NPP safe operation, checks of NPP preparedness for autumn-winter season loads and inspection of how the conditions of licenses granted by the Regulatory Body of Russia are followed.

The Utility also exercises continuous monitoring and conducts inspections of equipment status through technical examinations of equipment and piping and through implementation of in-service inspection programs with regard to condition of metal of components and piping. Assessment of equipment status and prediction of its safe operation life is done basing on the inspection results.

Annually each nuclear power plant appoints a commission and conducts checks of nuclear safety assurance at each NPP unit.

The information resulting from the monitoring and inspection activities of the utility is documented in the form of reports and duly forwarded to the Regulatory Body of Russia.

Issues of safe operation of Russian NPPs were also addressed by experts from international organizations. In 2002-2003 WANO Moscow Center conducted Peer Reviews at Balakovo, Leningrad and Smolensk NPPs.

14.3. Assessment of Equipment In-service Aging

According to the requirements set forth in the "General Guidelines for Assuring Nuclear Plant Safety" (OPB-88/97), the Utility develops programs for performance checks of systems and elements, evaluation of their aging processes as well as for replacement of equipment with expired lifetime. There exists a KOPUR Program (control, assessment, prediction, lifetime management of unit components) to assess the status and to manage component lifetime.

The KOPUR Program provides for:

- monitoring of lifetime characteristics – to periodically assess whether the current service life characteristics of components correspond to the requirements established in the regulatory and design documentation;
- assessment of lifetime characteristics – to determine their actual numerical values;

- prediction - to assess residual lifetime of components and equipment;
- management of lifetime characteristics – to ensure compliance with the requirements established in the design regarding lifetime characteristics and operating life of equipment and/or possibility to use it beyond its design life.

14.4. Operational Safety Assessment of Nuclear Power Plants

Since 1991 all Russian operating NPPs have been carrying out annual operational safety assessments for each NPP unit.

Such assessments are conducted in accordance with the applicable "Provisions for Annual Operational Safety Status Assessment Reports for NPP" (RD EO 0143-99) and under supervision of the Utility, the results being documented in a special report.

The safety assessments of NPP units are conducted to:

- check on the actual conditions of safety systems and other systems and equipment important for NPP safety;
- analyze conditions of physical safety barriers and accident localization/confinement systems;
- assess radiation situation at the nuclear power plant and in the environment;
- check on how the upgrade programs for systems and equipment are implemented and to evaluate how the work performed influences NPP unit safety;
- check on the status of nuclear, radiation, technical and fire safety at NPPs;
- review and assess operational events and human errors that occurred;
- identify measures to improve safety and reliability of further operation of a NPP unit.

Annual NPP unit safety assessment reports, as approved by the Utility, are submitted to the Regulatory Body of Russia for review and consideration in the supervisory activity.

Basing on the annual safety assessment reports VNIIAES issues an annual summary safety report which analyzes and assesses safety of all NPPs within the industry. Such reports are forwarded to the Utility, nuclear power plants and Regulatory Body of Russia.

Basing on the analysis of information on NPP operational events and annual safety assessment reports for NPP units SEC NRS issues annual reports which describe trends in performance indicators as regards safety aspects, status of the most substantial safety issues, proposals concerning

the use of NPP operating experience in regulatory activities. These reports are forwarded to interregional offices of the Regulatory Body of Russia and the Utility.

Safety assessments of NPP units conducted in 2001-2003 showed that the acceptable safety level is maintained at all operating NPPs and measures are in place to further improve their reliability and safety. During this period there remained an improvement trend of such operational safety indicators as the number of NPP operational events; number of reactor emergency protection (AZ) actuations on demand; total number of equipment failures and safety system failures; number of personnel errors; and number of cases of poor safety culture. Quantities of gaseous and aerosol releases to the atmosphere and discharges of radionuclides with liquid effluents did not exceed the reference levels. Content of radionuclides in soil, vegetation, agricultural products, water reservoirs were at the level of "zero background". Personnel exposures did not exceed the reference levels.

14.5. In-depth Safety Assessment of First Generation Nuclear Power Plant Units

In-depth Safety Assessment (ISA) of the first generation NPP units has been conducted as scheduled since 1997 in accordance with the Nuclear Safety Account Projects Agreement between the European Bank for Reconstruction and Development and the Government of the Russian Federation of 9 June 1995.

In 2001–2003 the work regarding the in-depth safety assessments for NPP units remained a priority as per the "Recommendations for In-depth Safety Assessment of Existing Nuclear Power Plant Units with VVER and RBMK Reactors (ISA NPP)", RB G-12-42-97.

In 1999-2003 the Utility conducted in-depth safety assessment of the following nuclear units:

- Novovoronezh-3,4;
- Leningrad-1,2,3;
- Kola-1,2;
- Kursk-1,2;
- Bilibino-1–4.

Table 14.1 shows the data that describe the performing of Probabilistic Safety Assessments Level 1 for existing NPP units.

Table 14.1 – Results of Probabilistic Safety Assessments (PSA-1) Performed for Existing NPP Units

Name of NPP, unit number	Type of reactor	PSA-1 performing Integrated core damage risk value, 1/r·year
Balakovo-1	VVER	8·E-5
Balakovo-2	VVER	8·E-5
Balakovo-3	VVER	8·E-5
Balakovo-4	VVER	8·E-5
Bilibino-1	EGP-6	1·E-5
Bilibino-2	EGP-6	1·E-5
Bilibino-3	EGP-6	1·E-5
Bilibino-4	EGP-6	1·E-5
Kalinin-1	VVER	3.2·E-5
Kalinin-2	VVER	PSA-1 scheduled for 2004
Kola-1	VVER	2.9·E-5
Kola-2	VVER	3.09·E-5
Kola-3	VVER	7.9·E-5
Kola-4	VVER	7.9·E-5
Kursk-1	RBMK	6.2·E-5
Kursk-2	RBMK	4.06·E-5
Kursk-3	RBMK	PSA-1 scheduled for 2005
Kursk-4	RBMK	PSA-1 scheduled for 2005
Leningrad-1	RBMK	1·E-5
Leningrad-2	RBMK	2.3·E-5
Leningrad-3	RBMK	2.5·E-5
Leningrad-4	RBMK	PSA-1 scheduled for 2005
Novovoronezh-3	VVER	3.44·E-5
Novovoronezh-4	VVER	5.12·E-5
Novovoronezh-5	VVER	6.9·E-4*
Smolensk-1	RBMK	PSA-1 scheduled for 2004
Smolensk-2	RBMK	PSA-1 scheduled for 2005
Smolensk-3	RBMK	1·E-5
Rostov-1	VVER	1·E-5

Note: * The value to be clarified considering the implementation of additional safety improvement measures.

The obtained through PSA-1 core damage frequencies for all NPP units do not exceed the permissible value of 10^{-4} per year of operation that is in compliance with IAEA recommendations (INSAG-12) for existing NPP units.

The work performed on modernization and safety improvement of NPP units and their in-depth safety assessments allowed for obtaining licenses for life extension of a number of units beyond their design service life as well as obtaining long-term licenses for operation of the corresponding units.

14.6. Nuclear Power Plant Safety Inspections by the Regulatory Body

The Regulatory Body of Russia has arranged for inspection activities to control whether the nuclear power plants meet the safety regulatory requirements, to assess the Utility's activities in the area of NPP safety improvement, to implement measures to eliminate deviations from the regulatory safety requirements and to supervise over the Utility's compliance with license conditions. These inspection activities include, primarily, the organization and conduct of inspections of NPP nuclear and radiation safety conditions at different stages of their life cycle.

The scope of inspection activities can be judged by the 2003 results.

During 2003, in accordance with the Comprehensive Work Plan of the Regulatory Body of Russia, the experts from the Headquarters and interregional offices conducted integrated inspections of nuclear and radiation safety of Kola NPP (four units with VVER-440), Balakovo NPP (four units with VVER-1000) and Bilibino NPP (four units with EGP-6). NPP inspections revealed a number of deficiencies with relevant directives issued aimed at their elimination.

The interregional structural units of the Regulatory Body of Russia carried out inspections as per their work plans. In 2003 the total number of inspections conducted at operating NPP units, enterprises and organizations involved in atomic energy use was 3320 including: 3 integrated, 1540 targeted and 1777 operative inspections.

Inspections carried out by the Regulatory Body of Russia in 2003 allowed for:

- assessing the actual status of the equipment and organization of work to ensure safety at 3 units with RBMK-1000, VVER-440 and EGP-6 reactors which had been in operation for 30 years;
- assessing the actual conditions of structural elements of main buildings and structures of NPPs;

- maintaining NPP emergency preparedness level and ability to implement measures for nuclear power plant personnel and general public protection, as previously achieved;
- monitoring closely NPP safety status and be aware in detail and regulate the actual state of the art at NPP.

Other Regulatory Body's activities related to nuclear and radiation safety assessment of nuclear power plants are:

- review of annual reports of the Utility regarding the safety level achieved at specific NPP units;
- analysis of NPP operational events;
- analysis of annual reports produced by NPP in-plant commissions to define the status of nuclear safety.

It follows from the above that the safety assessments being carried out as well as integrated and targeted inspections systematically performed are aimed at prevention of events and at further improvement of nuclear plant safety which is in line with the requirements set forth in the Convention on Nuclear Safety.

Article 15. Radiological Protection

15.1. Radiological Protection Legislation, Standards and Regulations

The following acts and regulatory documents regulate radiological protection of nuclear power plant personnel, of the public and the environment in the Russian Federation:

- Federal act on the "Use of Atomic Energy";
- Federal act on the "Radiation Safety of the Public";
- Federal act on the "Sanitary and Epidemiologic Welfare of the Public";
- Federal act on "Environmental Protection";
- Radiation Safety Standards (NRB-99);
- Main Sanitary Regulations for Radiation Safety Assurance (OSPORB-99);
- General Guidelines for Assuring Nuclear Plant Safety (OPB-88/97);
- Sanitary Regulations for the Design and Operation of Nuclear Plants (SP AS-03);
- Radiation Safety Regulations for NPPs in Operation (PRB-AS-99);
- Other nuclear industry's regulations and standards enacted by the Regulatory Body of Russia and the former Ministry of Health of the Russian Federation.

The federal act on the "Use of Atomic Energy" sets out a legal framework and principles for regulating relationships arising during the application and use of atomic energy and covers health, safety, and environmental aspects of nuclear energy.

The federal act on the "Radiation Safety of the Public" sets out a legal framework for the radiation protection of the public and personnel with the aim of protecting their health. The act sets major radiation protection concepts and standards, measures to assure radiation protection, and the Russian Federation authorities and the authorities of federal entities with regard to radiation protection issues.

The act on the "Radiation Safety of the Public" and the NRB-99 "Radiation Safety Standards" take into consideration the recommendations of the International Commission on Radiological Protection (ICRP publication, 1990, issue No 60) and set out new personnel exposure limit, that is, an average value of 20 mSv/year over 5 consecutive years but not more than 50 mSv/year.

NRB-99 "Radiation Safety Standards" set out standards and requirements for ionizing radiation impact and in particular regulate the following:

- exposure of personnel and the public during normal operation of a nuclear power plant or to other source of man-induced ionizing radiation;
- exposure of personnel and the public during a radiation accident;
- exposure of personnel of industrial enterprises and the public to natural sources of ionizing radiation;
- medical exposure to the public.

OSPORB-99 document regulates radiological protection under all conditions of exposure to ionizing radiation covered by NRB-99 standards.

SP AS-03 Sanitary Regulations set out and regulate the application of sanitary-hygienic standards in support of radiological protection of personnel, the public and the environment during designing, construction, operation of NPPs.

With due account of the currently attained safety levels at nuclear power plants under normal operating conditions (when radiation dose to members of the public due to actual plant releases and effluents is below 10 μSv/year for each radiation hazard) radiation risk for the public with NPPs in operation is considered absolutely acceptable ($< 10^{-6}$ per year). In view of this the SP AS-03 Sanitary Regulations set levels of permissible releases (PR) and permissible effluents (PE) based on the radiation dose to the public of 10 μSv/year.

OPB-88/97 Guidelines are the major regulatory document, which regulates the safety of nuclear power plants as a potential source of radiological impact on personnel, the public and environment. It sets out objectives, targets and major safety criteria as well as major principles and the nature of technical and organizational safety assurance measures.

15.2. Radiological Impact on Nuclear Power Plant Personnel

The annual assessments of Russian NPP operational safety status show that radiological situation at all Russia's nuclear power plants is consistent with the regulatory documents requirements including those of Article 15 of the Convention on Nuclear Safety.

The Russian nuclear Utility systematically pursues dose reduction policy. The "reference" individual NPP personnel exposure levels of 40, 30 and 20 mSv/year were introduced in 1991, 1993 and 1997 respectively. Radiation Safety Standards (NRB-99) for plant personnel set the following permissible exposure levels: 100 mSv per any five consecutive years but not more than 50 mSv/year.

Reductions in exposure to plant personnel have been achieved at Russian NPPs due to technical and organizational radiological protection and labor protection improvements. As a result a downward trend in nuclear power plant personnel exposure is observed every year.

Actual data on Russian NPP personnel exposures by reactor type for the period of 2001-2003 are presented in Tables 15.1-15.2.

Tables 15.1-15.2 show that permissible exposure levels for nuclear power plant operation established in Russia are not exceeded and a stable decreasing trend can be seen in plant personnel exposures.

Table 15.1 - Average Individual Doses to NPP Personnel and Seconded Staff in 2001-2003

NPP, Units, Reactor type	2001		2002		2003	
	Average exposure, mSv/year	% of the 20 mSv value	Average exposure, mSv/year	% of the 20 mSv value	Average exposure, mSv/year	% of the 20 mSv value
VVER plants						
Balakovo (1-4) - VVER-1000	0.74	3.7	0.70	3.5	0.67	3.3
Volgodonsk 1 - VVER-1000	0.015	0.075	0.074	0.37	0.13	0.65
Kalinin (1-2) - VVER-1000	1.00	5.0	0.71	3.6	0.62	3.1
Kola (1-4) - VVER-440	2.08	10.4	1.84	9.2	1.92	9.6
Novovoronezh (1 - VVER-210, 2 - VVER-365 - shutdown); Units 3,4 - VVER-440 Unit 5 - VVER-1000	3.10	15.5	2.90	14.5	2.64	13.2
Median value for VVERs	1.44	7.2	1.30	6.5	1.22	6.1
RBMK plants						
Kursk (1-4) - RBMK-1000	4.30	21.5	4.44	22.2	3.61	18.0
Smolensk (1-3) - RBMK-1000	4.60	23.0	4.59	23.0	2.32	11.6
Leningrad (1-4) - RBMK-1000	4.00	20.0	3.51	17.5	3.53	17.6
Median value for RBMKs	4.30	21.5	4.20	21.0	3.19	16.0
Nonstandard Units						
Beloyarsk (1 - AMB-100, 2 - AMB-200 - shutdown); 3 - BN-600	1.72	8.6	1.55	7.7	1.03	5.1
Bilibino (1-4) - EGP-6	5.31	26.5	5.19	26.0	4.38	21.9
Median value for nonstandard units	2.57	12.8	2.47	12.3	2.00	10.0
Overall median value for all NPPs (all Units)	2.90	14.5	2.80	14.0	2.22	11.1

Table 15.2 - Collective Exposure Doses to NPP Personnel and Seconded Staff (S) at One Operating Nuclear Unit during One Year

NPP, Units	S, man·Sv/unit		
	2001	2002	2003
VVER plants			
Balakovo	0.68	0.66	0.65
Volgodonsk	0.03	0.16	0.25
Kalinin	1.24	0.94	0.87
Kola	1.10	1.01	1.11
Novovoronezh (3 Units in operation)	3.36	2.81	2.52
Novovoronezh (Units 1 and 2 – shutdown)	0.25	0.35	0.34
Median value for VVERs (Units in operation)	1.41	1.22	1.18
Median value for VVERs (all Units)	1.26	1.11	1.08
RBMK plants			
Kursk	6.20	6.50	5.29
Smolensk	7.21	7.19	3.60
Leningrad	4.74	4.19	4.15
Median value for RBMKs	5.94	5.85	4.40
Nonstandard Units			
Beloyarsk (Unit 3)	0.33	0.69	0.64
Beloyarsk (Units 1 and 2 shutdown)	1.26	0.92	0.54
Bilibino	0.69	0.72	0.74
Median value for nonstandard operating Units	0.62	0.71	0.73
Median value for all nonstandard Units	0.80	0.77	0.67
Median value for shutdown Units	0.75	0.63	0.44
Median value for all Units (Units in operation)	2.94	2.83	2.29
Median value for all NPPs (all Units)	2.68	2.57	2.07

15.3. Radiation Monitoring of the Environment

All Russian NPPs are equipped with release air purification systems that assure effective entrapment of inert radioactive gases (IRG), radioactive aerosols and iodine radionuclides. Upgrading of nuclear power plant processes and implementation of advanced gas and aerosol purification technologies resulted in a notable (by one order of magnitude) reduction of off-site radioactive releases into the atmosphere.

Tables 15.3 and 15.4, respectively, contain absolute and relative values (% of permissible release) of daily and annual averages of gas and aerosol releases of Russian NPPs in 2003.

The above activity releases produce negligible radiation exposure to the public in the vicinity of a nuclear power plant which is below 0.01 mSv/year, which accounts for less than 1% of annual external exposure to natural (background) radiation.

As in the previous years gas and aerosol releases in 2003 were significantly below the permissible levels. Release of inert radioactive gases in plants operating channel-type reactors did not exceed 26% of the permissible release (PR). Releases of inert radioactive gases in VVER plants were below 12% of the permissible release. Iodine release values are within a 0.23–6.7% range of PR.

Releases of radionuclides into the atmosphere for VVER plants do not exceed those for PWR plants in the leading foreign countries.

Table 15.3 - Daily Averages of Gas and Aerosol Releases for Russian NPPs in 2003

NPP	IRG, TBq/day	I-131, MBq/day
Balakovo	0.0015	0.44
Volgodonsk	0.0204	1.06
Kalinin	0.0460	0.11
Kola	0.0630	2.79
Novovoronezh	0.2109	3.29
Kursk	0.9698	8.96
Smolensk	0.5970	1.46
Leningrad	1.0301	3.15
Beloyarsk	0.0062	No release
Bilibino	1.4080	Below detection level

Table 15.4 - NPP Annual Gas and Aerosol Releases in 2003

NPP	IRG		I-131		Cs-134		Cs-137		Co-60	
	TBq/yr	%PR	MBq/yr	%PR	MBq/yr	%PR	MBq/yr	%PR	MBq/yr	%PR
Balakovo	0.56	0.08	159.0	0.9	9.32	1.0	19.9	1.0	15.7	0.2
Volgodonsk	7.45	1.1	389.0	2.2	6.75	0.7	12.0	0.6	74.3	1.0
Kalinin	16.8	2.4	40.9	0.2	1.44	0.2	2.24	0.1	4.12	0.06
Kola	22.9	3.3	1020.0	5.7	10.4	1.2	97.5	4.9	123.0	1.7
Novovoronezh	77.0	11.2	1200.0	6.7	32.0	3.5	160.0	8.0	550.0	7.4
Kursk	354.0	9.6	3270.0	3.5	*	-	26.8	0.7	69.2	2.8
Smolensk	218.0	5.9	532.0	0.6	5.51	0.4	18.6	0.5	14.0	0.6
Leningrad	376.0	10.2	1150.0	1.2	58.9	4.2	156.0	3.9	151.0	6.0
Beloyarsk	2.25	0.3	-	-	0.043	0.005	44.6	2.2	0.9	0.01
Bilibino	514.0	25.7	*	-	*	-	*	-	*	-

Note: * - below MDA (minimally detectable activity of radionuclide in the release).

Systematic activity concentration measurements in the NPP vicinity made in the area within the radius of 30 km and in monitoring stations located at a distance of up to 50 km to measure radioactive material concentrations in the air and in the water, soil and plant life, agricultural products and foodstuffs confirm that nuclear power plant operation has no detrimental effect on the environment.

Many years of observations of the radiation situation in the areas in the vicinity of NPPs showed that the content of radionuclides released from NPPs (Cs-137, Co-60, etc.) into the environment was insignificant ("trace" amounts).

Hence, the above data testify that Russian NPPs respect regulations on the radiation protection of the public and the environment.

15.4. Supervision over Radiological Protection of Nuclear Plant Personnel, the Public and the Environment

Supervision over the radiation protection of the nuclear power plant personnel, the public and the environment in the areas in the immediate vicinity of NPPs was performed by the Federal Administration of Medical-Biological and Extreme Issues under the former Ministry of Health of Russia which performed the functions of the former Gossanepidnadzor and by its territorial bodies.

The Federal Ecological, Technological and Nuclear Authority inspects the compliance with radiation protection codes and standards and the fulfillment of the conditions of nuclear power plant operation licenses.

NPPs' Radiological Protection Groups monitor on a continuous basis the plant radiological protection status, gas and aerosol releases and liquid effluents that could affect the public and the environment. The results are incorporated in the monthly, quarterly and annual reports on radiation monitoring in nuclear power plants and are provided by nuclear power plants to the regulatory bodies. The Utility monitors and reviews urgent and routine information coming from the plants on a continuous basis. The review findings are covered in the annual reports.

The Regulatory Body of Russia systematically conducts comprehensive and target inspections involving the former Gossanepidnadzor to assess the radiation safety status of specific NPPs. Based on the inspection findings nuclear power plants are provided with appropriate directions and recommendations.

It follows from the above that the Russian Federation possesses the legislative and regulatory basis which provides for radiological protection of NPP personnel, the public and the environment during nuclear installations operation.

Data on personnel exposures and results of radiation surveys in the areas in the immediate vicinity of nuclear power plants given above indicate a yearly downward trend in personnel exposures while radiation impact on the public and environment (with NPPs operating under normal operation conditions) caused by gas-aerosol releases and liquid effluents creates additional radiation risk which is considered absolutely acceptable (< 10^{-6} per year).

Article 16. Emergency Preparedness

16.1. Federal Acts, Codes and Regulatory Requirements. Issues of NPP On-site and Off-site Emergency Preparedness

The issues of personnel and public protection in case of accidents at nuclear plants are regulated in Russia by quite a number of federal acts, regulatory requirements and national codes. These acts, codes and requirements have been developed taking account of the Russian and international experience and also considering the recommendations contained in the following IAEA safety guides:

- "Preparedness of Public Authorities for Emergencies at Nuclear Power Plants. A Safety Guide", No 50-SG-G6, Vienna, 1982;
- "Preparedness of the Operating Organization (licensee) for Emergencies at Nuclear Power Plants", No 50-SG-06, Vienna, 1982.

These currently existing Russian acts, codes and other documents regulating the issues of NPP on-site and off-site emergency preparedness include the following:

- Federal act on the "Use of Atomic Energy";
- Federal act on the "Protection of the Public and Territories against Emergencies of Natural and Man-induced Origin";
- Federal act on the "Radiation Safety of the Public";
- Russian Federation Government Ordinance on the Unified State System for Preventing and Eliminating Emergencies (Approved by the Russian Federation Government Ordinance No 794 of 30 December 2003);
- "General Guidelines for Assuring Nuclear Plant Safety" (OPB-88/97);
- "Code on the Order of Declaring Emergency Situation, Early Transmittal of Information and Organization of Urgent Assistance to Nuclear Plants in Case of Radiological Hazards" (NP-005-98);
- "Typical Content of the Action Plan for Personnel Protection in Case of Nuclear Plant Accidents" with Amendment No 1 of 30 August 2002 (NP-015-2000).

As mentioned in the first National Report, the above acts and codes are aimed at preventing the occurrence and progression of emergencies and at mitigation of the damage incurred.

They define the standards in the area of protecting the citizens of the Russian Federation and foreign citizens as well as environment against emergencies of natural and man-induced origin; organization principles, content of means and capabilities and interaction of participants during

liquidation of emergencies should they occur at nuclear plants, the tasks and functions of the Inter-agency NPP Urgent Assistance Team.

16.2. Implementation of Measures to Provide Emergency Preparedness. Nuclear Plant Emergency Preparedness Plans

In accordance with existing acts and codes a Unified State System for Preventing and Eliminating Emergencies (RSChS) organizationally managed by the Russian Federation Ministry for Civil Defense, Emergency Management and Liquidation of the Consequences of Natural Calamities (MChS of Russia) has been established and is functioning in the Russian Federation.

This System covers all territories (regions) of Russia. According to the federal act on the "Protection of the Public and Territories against Emergencies of Natural and Man-induced Origin" the Russian Federation Government Ordinance No 1094 of 13 September 1996 approved the classification of emergencies of natural and man-induced origin. This classification is given in Table 16.1.

Classification of emergencies is a basis for the formation and early organization, at different levels, of the management of appropriate means and resources for the liquidation of emergencies and of their consequences.

MChS of Russia organizes interaction and coordination of activities of ministries, agencies and organizations also during elimination of NPP accident consequences beyond the exclusion zones of affected plants. MChS of Russia organizes the preparation and use of emergency response and rescue teams for early identification of emergencies and elimination of their consequences.

An Industry-level System for Preventing and Eliminating Emergencies (OSChS) has been established and is functioning within the Federal Agency for Atomic Energy for prevention and elimination of emergencies at nuclear plants and other nuclear installations.

Table 16.1 - Classification of Emergencies of Natural and Man-induced Origin

Type of emergency	Number of affected individuals	Number of individuals with disrupted life conditions	Material damage (number of minimum salary sizes)	Means and resources for emergency liquidation
Local	Up to 10	Up to 100	Up to 1000	Of a certain installation, enterprise, organization
District-level	11-50	101-300	1000-5000	Of local administration
Territorial	51-500	301-500	5000-500000	Of executive authorities of a RF entity
Regional	51-500	501-1000	500000-5000000	Of executive authorities of a RF entity in the zone of emergency
Federal-level	Above 500	Above 1000	Above 5000000	Same
Trans-boundary	Impacts going beyond RF territory			On decision of the Russian Federation Government

Schematic of the system for prevention and liquidation of emergencies existing in Russia is shown in Figure 16.1.

EMERGENCY PREVENTION AND LIQUIDATION SYSTEM

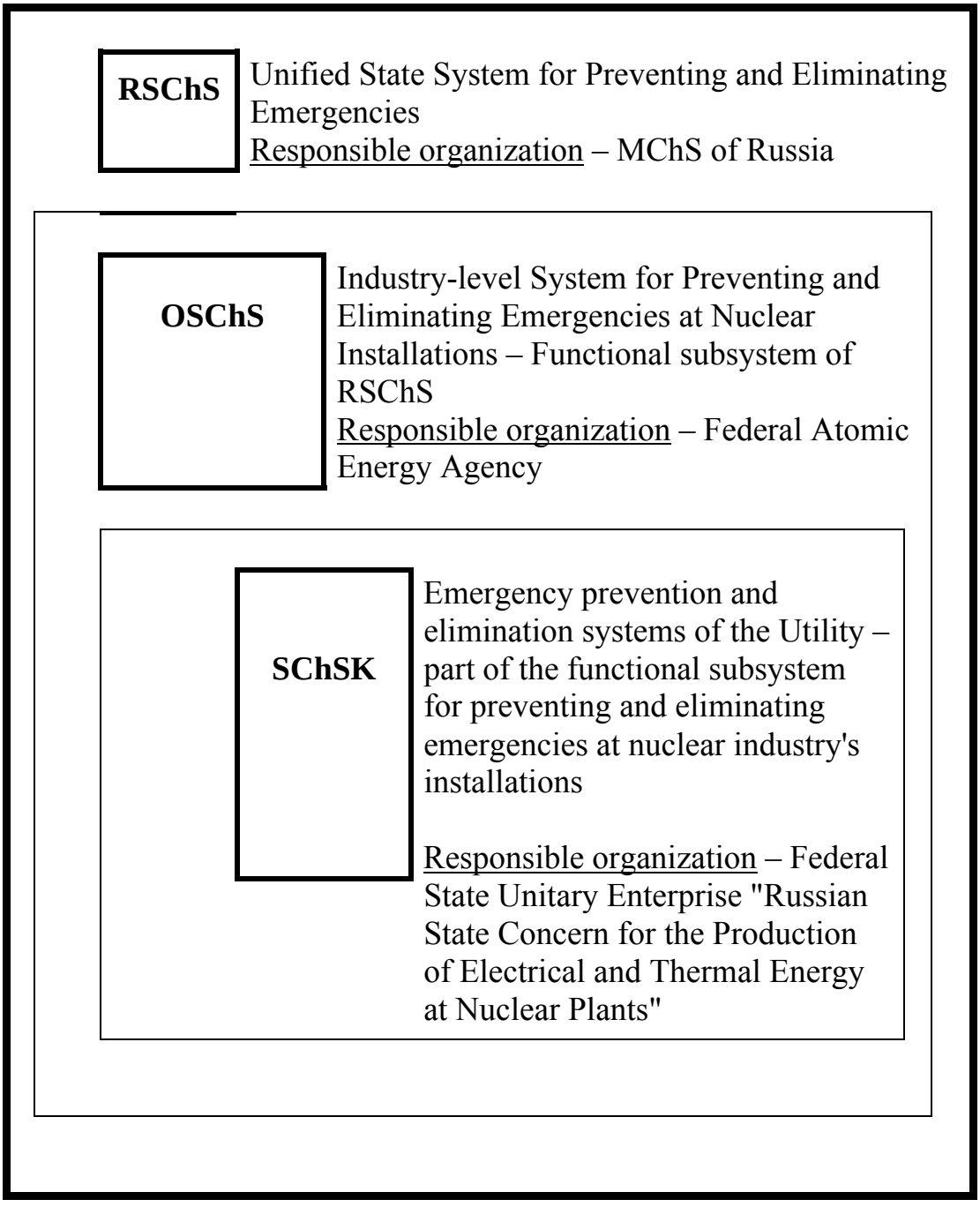


Figure 16.1

According to the OSChS Manual, all operating nuclear plants possess organizationally viable plant-level (installation-level) systems for emergency prevention and mitigation. To ensure constant preparedness of means and resources in case of radiological hazards, all nuclear plants have developed and approved "Action Plans for Personnel Protection in Case of Nuclear Plant Accident" in accordance with the requirements of the OPB-88/97 General Guidelines and with the "Typical Content of the Action Plan

for Personnel Protection in Case of Nuclear Plant Accidents" (NP-015-2000). These plans establish the order of notification about an emergency, define criteria for decision taking and personnel actions in emergencies, personnel protection measures as well as the order of NPP interaction with territorial divisions of the Russian MChS and other external organizations and local authorities.

Organizational-technical and other measures for giving assistance to the population living in the vicinity of operating NPPs are defined in the "Plans of Public Protection in Case of a General Radiological Accident at a Nuclear Plant".

Such plans have been developed and approved by executive authorities of appropriate territories of the Russian Federation entities. These plans define the scheme of coordination and interaction of NPP-level and territorial divisions of Russian MChS between themselves and with other ministries and agencies involved in the implementation of actions to protect the public against accident consequences.

Major and back-up means of communication with the Federal Atomic Energy Agency and with other higher level organizations, federal safety authorities, territorial management bodies for civil defense and emergencies of the Russian MChS and local authorities are existing in the Utility and at every nuclear plant.

Communication and notification systems available at nuclear plants ensure timely warning and exchange of necessary information with all the involved organizations in case of occurrence of a NPP emergency.

Efforts for the prevention and liquidation of radiological and non-radiological emergencies at nuclear plants are organized and supported by the Utility.

The vital element in the structure of NPP emergency support is the Emergency Response Center (ERC) of the Rosenergoatom Concern and the Situation & Crisis Center (SCC) of the Federal Atomic Energy Agency.

The role of the above centers in the enhancement of NPP emergency preparedness is defined in the "Code on the Order of Declaring Emergency Situation, Early Transmittal of Information and Organization of Urgent Assistance to Nuclear Plants in Case of Radiological Hazards" (NP-005-98) and in the "Procedure of Informing SCC on the Current Status of Nuclear Facilities and on the Occurrence of Abnormal Situations" as follows:

- assuring availability of emergency prevention and mitigation system;
- collection of objective information on the current status of NPP units;
- continuous monitoring of the state of activities at NPPs;

- checking NPP and communication channels preparedness for permanent information interface;
- analysis of the situation on the basis of the data obtained;
- prompt prediction of situation at a NPP and in the surveillance zone;
- timely notification about emergency;
- providing engineering support to the affected NPP, maintaining interaction with the Technical Support Centers of the organizations of General Designers, Scientific Coordinators and of other major organizations of the nuclear industry;
- advising involved organizations and agencies on the state of activities at a NPP via the on-duty communication channels;
- notification of the NPP Emergency Assistance Team (OPAS);
- organization of interaction with the affected NPP, with the involved ministries and agencies, with the mass media and the public;
- monitoring of the progress with actions implementation.

SCC and ERC actions have been coordinated, and the Centers are functioning in the round-the-clock regime.

At the facility (plant) level NPP Manager is responsible for the performance of emergency prevention and liquidation activities within NPP exclusion zone and also for the implementation of the "Action Plan for Personnel Protection in Case of Nuclear Plant Accident".

The order of implementing measures to assure Russian NPPs emergency preparedness and initiating the "Action Plan for Personnel Protection in Case of Nuclear Plant Accident" is defined by the existing "Code on the Order of Declaring Emergency Situation, Early Transmittal of Information and Organization of Urgent Assistance to Nuclear Plants in Case of Radiological Hazards" (NP-005-98).

This Code specifies the categories and symptoms of NPP operational events (given in Appendix 10 to this Report) as well as criteria for declaring "Emergency Preparedness" and "Emergency Situation" states at nuclear plants.

16.3. Measures to Inform the Public Concerning Emergency Preparedness

The following order of informing about NPP emergencies has been established in Russia.

After declaring the states of "Emergency Preparedness" or "Emergency Situation" and initiation of the "Action Plan for Personnel Protection in Case of Nuclear Plant Accident" NPP Shift Supervisor (or a

NPP official on his command) immediately informs on the plant situation the officials as per established list (including on-duty engineer of the SCC of the Federal Atomic Energy Agency, on-duty dispatcher of the Rosenergoatom Concern, Head of the NPP resident inspectors team of the Regulatory Body of Russia, head of local administration etc.).

NPP Manager (or the person discharging his duties) informs the top managers of the Utility, the Chairman (or Deputy Chairman) of the Emergency Management Commission of the Federal Atomic Energy Agency on the causes of declaring "Emergency Preparedness" or "Emergency Situation" and initiating the "Action Plan for Personnel Protection in Case of Nuclear Plant Accident".

The management of the Utility informs the head of the Federal Atomic Energy Agency, the Chairman of the Emergency Management Commission of the Federal Atomic Energy Agency, the head of the Regulatory Body of Russia on the accident that occurred and on the actions taken. The Chairman of the Emergency Management Commission of the Federal Atomic Energy Agency informs international organizations and the mass media on the accident that occurred and on the measures taken to mitigate and localize the accident. The head of the Federal Atomic Energy Agency informs the central executive authorities on the accident that occurred and on the measures taken and whether the need exists to assist the Federal Atomic Energy Agency to eliminate the accident and mitigate its consequences.

16.4. Training and Emergency In-plant Drills

To prepare NPP personnel for actions in accident conditions the following activities are conducted: special training, emergency exercises and in-plant drills.

Training of Utility staff members, NPP personnel and of supporting organization employees is conducted in accordance with the requirements of the Russian Federation Government Ordinance No 738 of 24 July 1995 "The Order of Training the Public in the Protection Against Emergencies of Natural and Man-induced Origin".

The order of training the Utility staff members, NPP personnel and members of their families, supporting organization employees to act in emergencies is defined in the "Guide for the Organization and Implementation of Measures for Civil Defense, Emergency Prevention and Liquidation at Nuclear Plants" (RD EO 0074-97).

Training of administration authorities' specialists, preparation of means and resources of the emergency prevention and liquidation system, training of NPP personnel and of supporting organizations' employees is conducted according to special programs developed for them in the

Civilian Protection Academy of the Russian MChS, in the Special Inter-branch Center of the Federal Atomic Energy Agency as well as at the civil defense courses on the regional and city level.

Training of NPPs' special departmental unit formations is conducted in accordance with the "Manual on the Structure, Number, Equipment and Training of a NPP Special Departmental Unit Formation".

Annual exercises and drills are planned and conducted in the utility, at nuclear plants, in supporting organizations and enterprises to improve emergency prevention and liquidation system, to check the preparedness of administration bodies, means and resources for actions in emergencies, namely:

In the Utility:

- educational-methodological sessions of the NPP Emergency Assistance Team (OPAS) - at least once a year;
- emergency exercises of the OPAS Team, NPP, Emergency Technical Centers, means and capabilities of involved ministries and agencies - annually at one of the Utility's NPPs.

At the nuclear plants:

- educational-methodological sessions of the managerial and command staff of the civil defense - at least once a year;
- drills to make NPP prepared for actions in emergencies - twice a year;
- drills for personnel, workers and employees to act on receiving the warning signal "Attention!" and verbal messages about the accidents - twice a year;
- communications drills - twice a year;
- integrated exercises to handle all the measures envisaged by the "Action Plan for Personnel Protection in Case of a Nuclear Plant Accident" with participation of the plant emergency management commissions - every year.

In 2002 an integrated emergency exercise of the OPAS Team was conducted at Kursk NPP, and a tactical antiterrorist exercise "Atom-2002" at Kalinin NPP.

In 2003 an integrated emergency exercise of the OPAS Team was conducted at Smolensk NPP and the "Atom-2003" tactical antiterrorist exercise at Leningrad NPP.

In 2004 the "Atom-2004" antiterrorist exercise was conducted at Kola NPP to drill cooperation of the OPAS Team, of Rosenergoatom Emergency Response Center and its divisions with the special divisions of law enforcement departments and medical services.

16.5. Emergency Technical Centers

To comply with the Russian Federation Government Ordinance No 246 of 25 March 1993 "Establishment of Emergency Technical Centers for the Liquidation of Emergencies at Nuclear Installations of the Russian Federation" several Emergency Technical Centers (ETCs) were organized. Available in the town of Novovoronezh is the industry's ETC intended for giving assistance to NPPs in emergencies which is part of the unified national system of emergencies prevention and liquidation. ETC at the Radium Institute in St. Petersburg is cooperating with the Leningrad NPP.

16.6. State Regulatory Activity in the Area of Emergency Preparedness Assurance at Nuclear Plants

In its activity to supervise the assurance of emergency preparedness the Regulatory Body of Russia is guided by the acts, codes and documents mentioned in Section 16.1 and in the "Code on the Procedure for NPP Operational Event Investigating and Accounting", NP-004-97 (PNAE G-12-005-97), which specifies the categories of NPP operational events to be reported, the order of notification and further informing on the event, the event investigation procedure.

The main objectives of the Regulatory Body of Russia in assuring emergency preparedness are to organize and conduct federal supervision over the development and implementation of measures to prevent accidents at the supervised installations and to supervise the preparedness of organizations and enterprises for elimination of their consequences as well as involvement in the development of criteria, regulations and standards in the area of assuring NPP emergency preparedness.

These tasks are being fulfilled by the Regulatory Body of Russia in the following way:

Licensing activity

In accordance with the Licensing Provisions and established procedures the materials to demonstrate the assurance of nuclear and radiation safety in NPP operation include accident liquidation procedures, guides for the management of beyond design basis accidents, action plans for personnel protection in case of a nuclear plant accident. The justification documents also contain information on NPP personnel training and proficiency including preparedness of personnel to respond to design and beyond design basis accidents.

The mentioned materials are studied during the conduct of NPP safety review. The result of this review is the expert conclusion which contains the findings regarding the feasibility and sufficiency of

engineering and organizational solutions that assure NPP and Utility's preparedness for the elimination of accidents and their consequences.

The expert conclusion may contain proposals for the terms of the license with regard to enhancing NPP and/or Utility emergency preparedness.

Inspection activity

One of the areas of the activity of the Regulatory Body of Russia is the audit of NPP preparedness for the elimination of accidents and their consequences.

These audits of NPP emergency preparedness include the verification and assessment of:

- the status of documentation which specifies NPP personnel actions during accidents (accident elimination procedures, guide for the management of beyond design basis accidents, plan of personnel protection measures);
- the organization of personnel training in terms of developing and maintaining the skills for NPP unit control during accidents;
- the availability of emergency notification system including the technical status of communication channels;
- the status of protected control points for emergency actions management, availability of equipment and documentation;
- the provision of measures to protect NPP personnel in case of a radiological accident as regards the availability of appropriate emergency-technical services and means;
- the plans and programs for conducting emergency drills and exercises at NPPs including interaction with the local and federal authorities to assure the preparedness for the implementation of public protection measures.

If necessary, this audit may cover other aspects of emergency preparedness to take account of plant-specific features.

Actions in case of NPP operational event occurrence

When events occur with the symptoms and consequences of radiological accidents, the Regulatory Body of Russia establishes Event Investigation Commissions except cases where the President or the Government of the Russian Federation take appropriate decision on the formation of the Governmental Commission.

Once the state of "Emergency Preparedness" or "Emergency Situation" is declared, the order of notification and actions is defined by the "Code on the Order of Declaring Emergency Situation, Early Transmittal of

Information and Organization of Urgent Assistance to Nuclear Plants in Case of Radiological Hazards" (NP-005-98).

In this case the representative of the Regulatory Body of Russia acts within the NPP Emergency Assistance Team (OPAS). The major tasks of the representative of the Regulatory Body of Russia in the OPAS Team are as follows:

- monitoring of the completeness and timeliness of actions taken to bring the affected NPP unit to a safe condition including the restoration of critical safety functions, to eliminate accident consequences and to timely initiate and implement personnel protection plan;
- periodic notification of the management of the Regulatory Body of Russia of the current status of nuclear and radiation safety at the affected NPP and on post-accident recovery actions.

The management of the Regulatory Body of Russia acting as an independent body reports on the accident that occurred and on the actions taken or being taken to the central and local federal authorities of the Russian Federation if necessary and also organizes interaction with the mass media.

Thus, proper attention is paid in Russia to the issues of emergency preparedness. The Federal Atomic Energy Agency has an Industry-level System for Prevention and Elimination of Emergencies at NPPs. An important role in the emergency management activity rests with the Situation and Crisis Center of the Federal Atomic Energy Agency and with the Emergency Response Center of the Rosenergoatom Concern.

Emergency drills and regional and plant-level exercises are systematically conducted to make NPP personnel prepared for actions in emergencies.

Article 17. NPP Siting

17.1. Established Order and Principles of NPP Siting. Licensing Requirements

Selection of a nuclear power plant site and finding it suitable for NPP location, construction and safe operation is regulated by the federal acts, federal standards and regulations, guidance documents of the Regulatory Body of Russia, construction norms and regulations and other documents, whose listing and substance are presented in the first National Report of the Russian Federation on the Fulfillment of Commitments Resulting from the Convention on Nuclear Safety.

Over the period reported the Regulatory Body of Russia has revised the existing federal norms and regulations in the field of atomic energy use and put the following new ones into force:

- "Siting of Nuclear Power Plants. Basic Safety Criteria and Requirements" (NP-032-01), thus making the similar document of 1993 invalid.

This document put into effect on 30 April 2002 sets forth basic criteria and requirements to newly deployed NPPs with all types of reactors considering the impact of natural and man-induced processes, phenomena and factors as well as the impact of NPP operation on the population and environment.

While justifying the appropriateness of a site for NPP construction the following should be taken into account:

- impact of natural and man-induced processes, phenomena and factors on NPP safety;
- NPP radiation impact on the population and environment;
- specific characteristics of NPP siting area;
- implementation of required technical and engineering measures of civil defense;
- size of exclusion zone and of protective measures planning area.

The document describes sites, which are not permitted for NPP siting as well as those that are considered unfavorable for NPP siting.

NPP siting is permitted in the unfavorable areas and zones with hazardous natural and man-induced processes, phenomena and factors provided technical and administrative measures ensuring safety are implemented.

The document contains detailed characteristics of natural and man-induced processes, phenomena and factors and requirements for accounting NPP impact on the population and environment.

- "Standards for Designing Seismically Resistant Nuclear Power Plants" (NP-031-01), thus making the similar document of 1987 invalid.

This document brought into effect on 1 January 2002 sets forth the requirements to safety of surface-based nuclear power plants with all types of reactors under seismic impact, to determining a NPP component seismic category; seismic impact parameters, seismic resistance of NPP structures and building foundations, process and electrical equipment, automation and communication means.

The regulations are revised taking into account the provisions of the federal laws of Russia as well as the IAEA guides' recommendations (No 50-SG-D15, Vienna, 1992 and No 50-SG-S1 (rev. 1), Vienna, 1994).

17.2. Order of Reassessment and Consideration of Factors Affecting Safety

Presently the order of reassessing and considering factors affecting NPP sites is specified by existing legislation and regulatory documents. NPP construction licensing appears to be necessary to resume (continue) or begin the construction and assembly activities at NPP sites.

In certain cases the above procedure involves the updating of design documentation, development of additional documents, identification and removal of possible inconsistency of design documentation with updated requirements of the regulatory documents.

Follow-up State Environmental Review for Kalinin NPP Unit 3 construction project conducted in 2003 is a particular example of reassessment of NPP site characteristics. Considering the situation of Kalinin NPP Units 1-2 operation as well as the amendments to the legislation and standards it was decided, in particular, to construct cooling towers to reduce temperature of lake water.

Article 18. Design and Construction

18.1. Regulatory Basis for NPP Design and Construction

A detailed description of Russian basic principles adopted for NPP design and construction and contained in the federal standards and regulations was presented in the previous National Reports of the Russian Federation on the Fulfillment of Commitments Resulting from the Convention on Nuclear Safety with the outcomes of their development since 2000 presented in this Report.

The analysis given in the IAEA document "Comparison of the Russian Nuclear Power Plant Safety Concept Contained in OPB-88 and the Next Lower Level Norms/Rules with the NUSS Requirements", IAEA, VVER-RD-69, 1994 has confirmed that Russian basic principles, standards and requirements in the field of safety are, in their essence, similar to the international standards developed in the frame of IAEA Nuclear Safety Standards (NUSS) Program. In particular, OPB-88/97 sets forth the requirement to ensure NPP safety through successive implementation of defense-in-depth concept. The need for approbation by previous experience or tests, research, by operating experience and technical and administrative solutions made to ensure NPP safety is another fundamental principle of safety stated in OPB-88/97. These solutions should be in compliance with the requirements of the regulatory documents.

During licensing process the Regulatory Body of Russia oversees the observance of basic safety criteria and principles specified in the regulatory documents for NPP unit design and construction.

18.2. Improvement of NPP Unit Defense-in-Depth Levels

Previous Reports noted that designs of all nuclear units in Russia implement a system of physical barriers successively arranged in the way of ionizing radiation propagation and radioactive substance releases to the environment.

Technical and administrative measures to protect and maintain the effectiveness of physical barriers constituting defense-in-depth levels are implemented at all operating units and are continuously upgraded. Considering operational experience gained and up-to-date level of science and technology development, these measures are implemented at NPPs, whose construction is nearing completion as well as in new NPP designs. While selecting NPP site the following requirements are to be met:

- Siting for newly designed NPP and reassessment of existing NPP sites is implemented on the basis of the requirements of the new document NP-032-01 "Siting of Nuclear Power Plants. Basic Safety Criteria and Requirements" (see Article 17 of this Report). While developing NPP

construction project justification, the requirements and criteria of this document should be met in full. For operating NPPs existing deviations are compensated by technical and administrative measures.

- Exclusion zone boundary for each newly designed and constructed NPP is established in accordance with NPP sanitary standards and regulations.

To renew the license for operating NPPs, the assessment is conducted to check that predicted doses to the population at the boundary of protective measures planning area and beyond do not exceed the values set forth by the existing radiation safety standards in case of beyond design basis accidents with maximum permissible emergency release of radioactive substances to the environment.

- Newly developed designs of VVER-1000 and VVER-1500 reactors retain traditional conservative approach attributed to Russian nuclear units providing for reliability margin of safety related system components and inertial nature of the transient.

Advantages of this approach realization in the operating NPP designs have been confirmed during safety analysis from the viewpoint of present analyses of such events as, for example, anticipated transients without scram. In-depth safety assessment of light water reactors has demonstrated that design margins provide personnel with sufficient time period to manage the accidents of such type.

The ongoing introduction of uranium-erbium fuel at RBMK-1000 units improves core neutron physics characteristics. Reactor core safety is enhanced by the implementation of cluster-type control rods.

- In accordance with the requirements of RD-04-27-2000 quality assurance programs should be submitted to obtain a license for the design, engineering and manufacture of nuclear installation components.

18.3. Application of Good Practices and Proven Technologies in NPP Designs and during Construction

Fundamental principle of implementation of new technical and administrative solutions, while developing new NPP designs and upgrading existing units, is the verification of compliance with design parameters by direct testing or representative sample testing. Experiences with similar system and equipment operation or with organizational procedures are taken into account here.

There are large out-of-pile experimental centers in nuclear industry in Russia. Unique experimental installations and test rigs of various scales, which simulate NPP component and structural elements, have been developed and put into operation. These test rigs are used to conduct

experimental research to improve performance of systems and components of VVER and RBMK units as well as to justify their safety.

An example of such an approach is the assessment of low pressure ECCS second stage water accumulator efficiency for V-392 reactor installation design; these accumulators being absent in the basic design of VVER-1000 plant and should passively provide for core heat removal in case of pressure drop in the primary circuit below 1.5 MPa within ~24 hours. During the development of this system's design the experience with RBMK-1000 first generation units upgrading was used when the normal hydro-accumulator subsystem of ECCS based on passive principle of water supply to the primary circuit was tested and operated.

18.4. Realization of Reliable Operation Requirements in NPP Designs Considering Man-Machine Interface

The Rules for Design and Safe Operation of Nuclear Power Installation Components and Piping (PNAE G-7-008-89) specify that equipment and piping design and layout should provide for the possibility for their inspection and repair. This requirement is implemented in the designs of all operating NPPs.

In accordance with OPB-88/97 requirements NPP designs provide for the means which help to eliminate personnel single failures or mitigate the consequences thereof and also during maintenance operations.

To further promote the OPB-88/97 general requirements for process control the regulatory document "Requirements to NPP Safety Related Control Systems" (NP-026-01) was put into effect in 2001.

To improve personnel support system of the unit control room during assessment of plant status, an information and computation system with a safety parameter display system (SPDS) function is being implemented at some units.

Major results of this activity should be:

- increase of information scope regarding unit status as a result of more reliable identification of the occurred event, improved parameter recording, search and restoration as well as availability of more information on transient or accident scenario;
- reduction of operator's errors through establishing the man-machine interface at an advanced level using increased capacities of the system;
- safety improvement under pre-accident and accident conditions;
- delivery of unit data to the users through NPP local area network.

SPDS implementation facilitates finding the optimal solution to the man-machine interface issue.

18.5. Licensing Process for NPP Design and Construction

In accordance with the federal act on the "Use of Atomic Energy" the following licenses for NPP design and construction in the field of atomic energy use must be granted:

- license to the Operating Organization for construction of each unit;
- licenses to the organizations performing work for or rendering services to the Operating Organization. These licenses are granted to all sub-contractors including those conducting NPP design.

To obtain the license for the design work it is also necessary to submit to the Regulatory Body of Russia an application supported by a package of justification documents.

According to RD-04-27-2000 document, it is necessary to submit the documents demonstrating that the Designer is capable of producing NPP design with high quality and assuring nuclear and radiation safety in line with the requirements of the Russian legislation and existing regulatory documents. For this purpose the Designer should possess the required material and technical resources, services, quality assurance programs, competent specialists and must be able to provide guidance and support to the design and architect-engineering efforts during NPP construction (including component manufacturing and assembly), commissioning, operation (including maintenance) and decommissioning.

To obtain the license for NPP unit construction the Operating Organization should submit to the Regulatory Body of Russia an application for granting the license supported by a package of required documents which demonstrate the Applicant's capability to perform construction activities independently or with involvement of external organizations.

According to the requirements of the RD-04-27-2000 document, the package of documents justifying nuclear and radiation safety to obtain the construction license should include:

- NPP Preliminary Safety Analysis Report (PSAR);
- General Quality Assurance Program – POKAS(O);
- specific Quality Assurance Programs for different activities;
- design documents (including the designs of RI, Process Control System, safety-related systems and also the description of physical protection), testing and development work reports referred to in the PSAR;
- PSA Level 1.

Quality assurance programs are developed in accordance with requirements of the Regulatory Body of Russia stated in the document

entitled "Requirements to the Quality Assurance Program for Nuclear Plants" (NP-011-99).

Information presented in NPP PSAR is based on the materials of NPP design, of RI and safety-related systems engineering designs. This information should be sufficient to provide for an adequate understanding of NPP design, safety concept, on which this design is based, QA program and the main operation principles envisaged by the Operating Organization.

On the basis of information contained in NPP PSAR the Regulatory Body of Russia assesses the adequacy of safety justification of NPP construction, commissioning, operation and decommissioning on a specific site to avoid an excess of established exposure limits for personnel and public and violation of standards for radioactive substance releases and concentrations in the environment during normal operation and during the design basis accidents as well as the possibility to limit this impact during beyond design basis accidents.

The safety concept described in NPP PSAR should meet the requirements of the existing regulatory documents.

PSAR shall address the issues of NPP unit decommissioning. Basic principles and requirements for decommissioning safety are contained in the regulatory document "Code for Safety Assurance during NPP Unit Decommissioning" (NP-012-99).

The matters of supervision over design work (architect-engineering work) are addressed in the "Procedures for the Conduct of Supervision over the Design (Architect-engineering) of the Atomic Energy Utilization Facilities" (RD-03-51-99). They include:

- compliance on the part of the organizations which conduct the designing (architect-engineering) of atomic energy utilization facilities (hereinafter referred to as "supervised organizations") with the Russian Federation legislation regarding nuclear and radiation safety assurance in the area of atomic energy use;
- compliance on the part of the supervised organizations with the requirements of standards and regulations while developing design (architect-engineering) documentation;
- compliance on the part of the supervised organizations with the conditions of design licenses;
- provision by the supervised organizations of the required proficiency level of specialists involved in the design (architect-engineering) of the atomic energy utilization facilities.

The results of inspections conducted are documented in accordance with the procedure specified in the "Provisions for State Supervision over Safety in the Use of Atomic Energy" (RD-03-43-98).

The decision to grant or not to grant the license is taken by the duly authorized officers of the Regulatory Body of Russia based on the results

of verification of validity of the information contained in the documents submitted to obtain the license, on the results of review of the documents justifying nuclear and radiation safety of the facility, on the results of inspections. This decision is formalized in the corresponding document.

It follows from the above that the regulatory framework for NPP design and construction, which is in compliance with the international safety standards and requirements, has been established in the Russian Federation.

NPP design and construction work is performed only if the appropriate license (permission) granted by the Regulatory Body of Russia is available.

Article 19. Operation

19.1. Safety Case and Obtaining Licenses for NPP Units Operation when Constructed

The order of obtaining a license for NPP unit operation specified by the "Provisions for the Licensing of Activities in the Area of Atomic Energy Use" has not sustained any changes since the time of preparation of the previous National Report.

Volgodonsk NPP Unit 1, the latest commissioned in Russia, was put into operation according to this order. All major activities related to NPP commissioning were conducted in the frame of the construction license.

Decision to grant the license for unit operation was taken by the Regulatory Body of Russia after the review of the application justifying documents submitted by the Operating Organization.

The structure of documents, which should justify nuclear and radiation safety of unit to be put into operation when constructed, is specified in the RD-04-27-2000 document. To get the operation license the Operating Organization submitted operational documentation and other documents related to NPP unit operational safety including "Unit Commissioning Program", criticality program with experiment conduct methodology as well as power raising program.

When commissioning a NPP unit the reports on criticality and power raising and pilot operation of NPP unit (each report is submitted upon the completion of work phase before the next one starts) were submitted to the Regulatory Body of Russia. Additionally, when tests were completed all changes and deviations were taken into account in the final update of technical safety justification (safety analysis report) and in the operational documentation.

NPP unit bringing to criticality and power raising was performed once the Regulatory Body of Russia had completed verification of actual unit preparedness for start-up.

The existing practice of granting licenses for NPP unit operation when it is constructed provides for the compliance of the constructed installation with design and safety requirements.

Presently, the activity to license Kalinin NPP Unit 3 operation is under way.

19.2. Adopted System for Safe Operation Limits and Conditions Updating

Technical Specification of Safe Operation is a basic document specifying the operation of each unit. It sets forth safe operation limits and conditions which are justified at the stage of design development and

are updated using the results of pre-commissioning operations, criticality and power raising. Additionally, the Technical Specification defines the rules and main methods of plant safe operation, general order to perform operations related to NPP safety.

The order for making changes to the design and operating documentation including that related to making changes to NPP safe operation limits and conditions is specified in the RD-03-19-94 Guidance Document of the Regulatory Body of Russia entitled "Basic Guidelines for the Preparation, Review, and Taking Decisions to Modify the Design, Architect-Engineering, Technological and Operational Documentation Affecting the Assurance of Nuclear and Operational Safety". In doing so, safe operation limits and conditions may be revised as a result of the amendments made. All modifications leading to changes to or updating safe operation limits and conditions are made on the basis of detailed review of Safety Cases described in appropriate documents, scientific-technical reports, calculations and other materials. Additionally, relevant changes are introduced to the design and operating documentation along with updating of the Technical Specification, i.e. the operation licensing bases are changed.

The permission to change license conditions requested by the Applicant is granted by the Regulatory Body of Russia after a review of justifying documents.

Revision and updating of safe operation limits and conditions may be performed on the basis of safety analysis results or in-depth safety assessment conducted if the license is renewed as stated in Article 14 of this Report.

19.3. Existing Practice of Regulating Nuclear Installation Maintenance and Repair as well as Inspections and Testing

In Russia there exists a Unified NPP In-Service Maintenance and Repair System (M&R System) which covers NPPs of different types and takes account of reactor and major equipment design features.

A complete list of documents which should be available at an existing NPP unit, including maintenance, repair, verification and tests, is specified by "Basic Rules for Assuring Nuclear Plant Operation" (RD EO 0348-02).

On the basis of the existing M&R System documents, the management of each NPP develops a specific M&R Program. To implement this M&R Program schedules for all types of NPP components and systems maintenance are developed and approved. The works are carried out in accordance with safety-related system maintenance and

repair regulations available at each NPP unit and in accordance with the schedule approved by the plant management.

NPP component and system maintenance is mainly performed by NPP personnel and covers the surveillance over changes in parameters of operating equipment for early correction of deviations, implementation of preventive measures and specified tests of equipment, instrumentation and systems.

All maintenance operations are performed by the plant maintenance personnel and contractor organizations, which have the license of the Regulatory Body of Russia.

Scheduled preventive maintenance is performed irrespectively of the actual technical status of equipment at the moment of maintenance with a frequency and in a scope specified by existing standards.

Frequency and scope of NPP equipment and systems scheduled maintenance and repair are conditioned by the need to maintain their reliability in accordance with the safe operation conditions and operational limits specified in the NPP design. The need to perform unplanned maintenance and repair of equipment and systems is defined based on the results of surveillance of their status.

The technical specification of checks and tests approved as appropriate regulates safety-related system inspections and tests.

The system of nuclear power plant inspections by the Regulatory Body and Operating Organization is realized on the basis of annual schedules of planned inspections. NPP inspection issues are addressed in detail in this Report when reviewing Article 14.

The results of inspections and checks conducted by the Operating Organization are documented in relevant acceptance reports with indication of revealed deficiencies and drawbacks as well as measures to eliminate them.

19.4. The Order of Reporting NPP Safety-Significant Operational Events

The order of NPP operational event investigating and reporting is set forth in the document "Code on the Procedure for NPP Operational Event Investigating and Accounting" NP-004-97 (PNAE G-12-005-97). This Code was developed taking account of the IAEA recommendations (Safety Guide No 93 "A System of Reporting Unusual Events at Nuclear Power Plants" and the IAEA-TECDOC-632 "ASSET Guidelines", 1991 edition).

The above regulatory document specifies:

- NPP operational event categories;
- operational event reporting process;
- operational event investigation process.

The categories are divided into:

- "accidents" – by the extent of on-site and off-site radiation impact;
- "incidents" – by the extent of defense-in-depth degradation and on-site radiation impact.

NPP events resulting in deviations from normal operation, breach of established safe operation limits and/or conditions are referred to as NPP operational events.

All NPP events with operational event signs and consequences are promptly reported by the plant management within 1 hour to the Operating Organization and the Regulatory Body of Russia followed by more detailed information in the form of preliminary report transmitted within 24 hours.

During the subsequent 15 days a commission investigates the event and then the plant transmits to the Regulatory Body of Russia and to the Operating Organization a full report on the event that occurred, including corrective actions to prevent similar events in future. Each event is rated by the International Nuclear Event Scale (INES).

A computerized database for NPP operational event recording and analyzing is functioning in the Operating Organization and maintained by VNIIAES.

The analysis of Russian NPP operational events that occurred in 2003 shows that 19 events out of 51 do not fall under the INES criteria, i.e. they are "out of scale", and 30 events belong to Level "0". Only 2 events out of the total number of NPP operational events are rated as safety-relevant or as Level "1" events by INES.

Distribution of NPP operational events rated by INES for the period of 2001-2003 is given in Appendix 11, and operational event trends for 2001-2003 are shown in Appendix 12.

The presented data show that the number of operational events at Russian NPPs is decreasing annually, and their "severity" by INES scale is rather low.

A review of all the events indicating their direct and root causes and the corrective actions taken to preclude the recurrence of similar events is issued on a quarterly basis. The readers of this review are the members of managerial staff, operations staff and maintenance personnel of the relevant major plant divisions.

A comparative report on NPP safety-significant events is issued on a quarterly basis and disseminated among all personnel who affect safety.

The Russian nuclear power plants analyze all information and reports on NPP events (incidents) coming from VNIIAES, WANO, IAEA and from other NPPs. Out of these they select those events that may be of interest for the training of respective NPP operating personnel. The events are analyzed by training department instructors and further used in the

course of NPP personnel training and maintaining proficiency as training materials.

Information and reports on operational events analyze operational events at foreign and Russian NPPs that are safety-and-reliability-significant and associated with deficiencies in personnel training (personnel errors) as well as give the recommendations developed for operating personnel to prevent such events. The above documents are disseminated to NPPs for discussions with operating personnel and to the organizations rendering scientific and technical support to NPP operation.

19.5. Personnel Actions in Case of Accidents and Emergencies

When eliminating accidents and emergencies the operations personnel are guided by the procedure on accident and emergency elimination.

The procedure for elimination of emergencies and accidents determines the operating personnel actions to restore the normal status of NPP unit. This procedure addresses initiating events and emergencies involving equipment and systems as well as deviations from the specified parameters that lead or may lead to an accident. For each initiating event of an accident, out of those potential, they also consider conditions of its occurrence and accident progression sequences that may lead to the most severe consequences (conservative approach).

Prevention of initiating event progression to design basis accidents and of design basis accidents development into beyond design basis accidents is ensured by the functioning of safety systems. Safety systems are continuously upgraded at operating units. In the period since the previous Report activities related to safety system upgrading have been conducted in the frame of grant-supported projects at NPP sites in the Russian Federation financed under the TACIS program. According to this program, in particular, obsolete safety valves, which do not meet the requirements of existing standards and regulations, have been replaced with new ones along with storage batteries; as well as new and rather efficient filtering devices protecting low pressure ECCS pumps against thermal isolation getting into them under primary circuit pipe break scenario have been implemented as well.

Projects of next generation NPPs include new safety systems based on passive principle, which improves reliability of performance of the required safety functions.

Availability of a Guide for beyond design basis accident management, which provides for measures to prevent evolution of beyond design basis accidents and to mitigate the consequences thereof, is the basic regulatory requirement, without which NPP operation is not permitted.

Special attention is paid to protecting the leak-tight enclosure against degradation under beyond design basis accidents and maintaining its efficiency. Basic efforts to protect the leak-tight enclosures under beyond design basis accidents were to equip such systems of Russian NPPs with passive autocatalytic recombiners (PAR), which ensure hydrogen oxidation (recombination) beyond inflammability conditions to prevent impacts resulting from fire and explosion on leak-tight compartments of a NPP unit under severe beyond design basis accident.

New designs of Russian NPPs provide for the features that prevent degradation of the containment, for instance, the trap to retain molten fuel in the reactor cavity.

Following the requirements of item 5.1.4 of OPB-88/97 Code, in accordance with which personnel actions should be based on the signs of the events that occur and RI conditions and accident evolution prediction, the Operating Organization has developed symptom-based emergency operating procedures (SB EOP) for all VVER and RBMK units. These new emergency procedures are fully in compliance with personnel action concept for accident management as based on RI and physical protective barriers' conditions. Based on the prognosis, SB EOPs specify and direct actions of NPP unit operating personnel to terminate the accident and bring the unit to the controlled state when the chain reaction is terminated, fuel is cooled down in the reactor and radioactive substances are confined within the established boundaries. In doing so it is permitted to use normal operation systems.

19.6. Provision of Engineering and Scientific Support to NPPs

The Russian Operating Organization, using its own capabilities and with involvement of external organizations, provides the required engineering and scientific support to nuclear plants throughout their life cycle.

Types and forms of engineering support may vary at different stages of NPP construction, startup and operation depending on the tasks confronting the Operating Organization or specific NPP.

Usually, the Operating Organization as well as nuclear power plants invite specialized research, design, maintenance, commissioning and other organizations and NPP equipment manufacturers on a contractual basis to perform the needed work and render services.

Within the system of Federal Atomic Energy Agency there are large design, research institutes and architect-engineering bureaus, and also maintenance, commissioning, construction/assembly and other organizations which have extensive experience of working in the nuclear power sector and possess licenses of the Regulatory Body of Russia to

perform the appropriate activities. These organizations which render the required and effective support to NPPs include:

- Research and Development Institute of Power Engineering (NIKIET);
- "Gidropress" Design Bureau;
- Machine Building Experimental & Design Bureau (OKBM), Nizhny Novgorod;
- "Atomenergoproekt" Design Institute;
- "Atomenergoproekt" Institute in St. Petersburg;
- "Atomenergoproekt" Institute in Nizhny Novgorod;
- All-Russian Research and Design Institute of Energy Technology (VNIPIET);
- "Atomtekhenergo" Company;
- Research and Design Institute of Assembly Technology (NIKIMT);
- "Physics and Energy Institute" (PhEI).

All-Russian Research Institute for Nuclear Power Plant Operation (VNIIAES) provides continuous scientific and technical support to the Operating Organization on matters of NPP operation.

Russian Research Center "Kurchatov Institute" renders scientific support to the Operating Organization and NPPs over a wide range of safety issues.

19.7. Programs for Collection and Analysis of NPP Operating Experience Information. System of Russian and Foreign NPP Operating Experience Feedback

In Russia there exists a unified information system on nuclear plant operating experience.

This information system covers all NPPs in operation and under construction, the Operating Organization and also design, architect-engineering, research and other organizations, which provide support to NPP operation.

VNIIAES institute is the leading organization in the nuclear industry, which maintains the functioning of NPP operating experience information system.

The objectives of information exchange and generalization of NPP operating experience data are:

- information support to nuclear power plants of Russia as regards learning from good practices of Russian and foreign NPPs and implementation of innovations in the field of Russian NPP performance indicators improvement including the use of new administrative, technological and information solutions;

- information support at the national level to all the organizations that give services on NPP operational experience data generalization as well as undertake research, design, engineering and technological efforts for the Operating Organization or NPPs;
- information support to the Regulatory Body of Russia at the national level.

Based on the data coming from nuclear power plants VNIIAES maintains databases (DBs).

VNIIAES, while assuring Russia's participation in the IAEA information programs (IRS, PRIS, INES) and also as a member of WANO Moscow Center, receives and disseminates the following information on the foreign experience in the industry:

- NPP events;
- NPP performance indicators;
- NPP operating experience;
- experience with NPP peer reviews;
- good practices.

The feedback of the Russian and foreign NPP operating experience allows to prevent NPP operational events and to improve NPP safety.

Information on operational events and equipment failures received from NPPs is also used for dealing with the following tasks:

- obtaining statistical data for NPP probabilistic safety assessments;
- calculation of major indicators describing equipment reliability;
- identification of trends and comparative assessment of operation activities;
- identification of recurring events and causes of recurrence of NPP operational events;
- comparison of progression of actual transients with the algorithms used in the designs;
- analysis of safety system operation modes;
- development of recommendations for event prevention.

Based on the analysis of NPP operational events VNIIAES produces the following information materials that are disseminated among NPPs, the Operating Organization, the Regulatory Body of Russia, RI and NPP designers and all organizations concerned:

- quarterly reviews of NPP operational events;
- NPP safety-relevant operational event reports;
- INES event rating forms;
- annual analytical reports on NPP operational events, which contain event descriptions, event causes and impact on NPP

safety, assessment of personnel performance as well as planned corrective actions to preclude the occurrence of similar events at other NPPs;
- recommendations for equipment improvement.

19.8. Radwaste and Spent Fuel Management at NPP Sites and Measures Taken to Reduce Their Volumes

19.8.1. NPP Radwaste and Measures to Reduce Their Volumes

Radioactive waste (RW) produced during Russian NPPs operation is stored in special storage facilities at NPP sites.

At all NPPs there are guidance documents for RW accounting and control, which set forth the requirements to the organization and conduct of control and accounting of radioactive substances and RW during their storage and use at NPPs. In accordance with the above documents all NPPs maintain rigorous control of RW accumulation in the Liquid Waste Storages (LWS) and in Solid Waste Storages (SWS).

Additionally, to reduce the volumes of RW coming to NPP repositories Rosenergoatom Concern has put into effect provisional standards for annual receipt of liquid radioactive waste (LRW) and solid radioactive waste (SRW) by its Order of 1 January 2000.

In accordance with these standards schedules for administrative and technical measures reducing RW generation have been developed for all NPPs. Due to implementation of these measures the volumes of LRW and SRW have been reduced more than two-fold by the end of 2002 against 1999.

New, more stringent standards for all reactor types have been brought into effect on 1 January 2003, considering RW reduction achieved.

Summary data on the volumes of existing RW at specific NPPs as of 1 January 2004 are presented in Appendix 14.

The nuclear industry's strategy in the field of RW management according to the "Concept of Radioactive Waste Management" adopted in 2000 includes the following:

- application of new and effective RW processing technologies and establishment of an optimum system of unified complexes and facilities for RW processing and conditioning;
- establishment at NPPs of a system of long-term storage of conditioned waste using metal-concrete containers;
- improvement of operation regimes to minimize the waste produced.

In recent years the above solutions were implemented at the majority of NPPs.

All operating NPPs are equipped with standard installations for RW treatment and reprocessing, which allow reducing RW activity and volumes.

Installations for in-depth concentration by evaporation are operated at Balakovo NPP and Novovoronezh NPP; the equipment for melted salt packing into metal-concrete containers is close to commissioning.

Bituminization facilities are in operation at Kalinin NPP and Leningrad NPP.

Ion sorption technology for LRW treatment has been implemented at Beloyarsk NPP, and other NPPs are preparing to install such facilities.

Radwaste Management Center (RWMC) put into operation at Balakovo NPP is equipped with facilities for waste sorting, incinerating, compacting and cementation. Additionally, it is planned to put into operation an in-depth decontamination facility for spent ion-exchange resins.

Compacting facilities are in operation at Beloyarsk NPP, Kola NPP, Kursk NPP, Smolensk NPP and Novovoronezh NPP.

Plasma bed incineration facility will be put into operation at Novovoronezh NPP in 2006.

The Operating Organization performs regular monitoring of the status of RW storage at NPPs.

19.8.2. Spent Fuel Storage at NPPs

Spent nuclear fuel (SNF) storage at Russian NPP sites is carried out in accordance with NPP spent fuel management strategy stated in the Federal targeted program "Program of Nuclear Power Development in the Russian Federation for 1998-2005 and for the Period up to 2010".

Presently, depending on fuel cycle completion stage, SNF on-site storage is implemented as follows:

- SNF from NPPs with VVER-440 and BN-600 where the closed fuel cycle is implemented is under interim storage in the at-reactor spent fuel pools followed by shipment from NPP territory to the reprocessing plant;
- SNF from NPPs with VVER-1000, RBMK-1000, EGP-6 and AMB reactors, which is not subjected to reprocessing, is stored in the special on-site storage facilities or in the centralized storage facility of the Mining and Chemical Combine (MCC).

In the NPP sites SNF is placed in the at-reactor spent fuel pools as well as in the spent fuel pools of special separate-standing storage facilities (SSSF and SNFSF). Leaky spent fuel assemblies (SFAs) are stored in the spent fuel pools in individual casks.

Appendix 15 contains data on the extent, to which on-site storage facilities are filled as of late 2003.

Presently, NPPs with VVER-440 maintain storage facilities with ~1800 SFAs; which does not exceed 20-25% of spent fuel pool capacities. After cooling in the spent fuel pool during 3-5 years SNF is shipped to the reprocessing plant RT-1 depending on SNF generation rates.

VVER-1000 plants maintain under interim storage ~1880 SFAs, which after cooling for not less than 3 years are shipped to the centralized storage facility at Krasnoyarsk MCC. Currently accumulation rates are in agreement with the shipment rates.

The basic option for RBMK-1000 plants is to organize temporary storage in the at-reactor spent fuel pools, where each SFA is placed into an individual cask filled with water and is stored for not less than 3 years. Then SFAs are transported to SNFSF for temporary interim storage on NPP site.

Presently NPPs with RBMK-1000 reactors maintain ~16900 SFAs in the at-reactor spent fuel pools and ~64000 SFAs in the SNFSF.

The document "Spent Nuclear Fuel Management Concept of the Ministry of the Russian Federation for Atomic Energy" approved in 2003 provides for introducing SNF long-term storing on NPP sites using dual-purpose metal-concrete containers.

At Bilibino NPP SNF management technology is limited to on-site storage in the at-reactor spent fuel pools. Two pools are already full and storage is maintained as "dry" option with natural air cooling. SFAs discharged from the reactors are placed for "wet" storage into the third spent fuel pool. Today the third spent fuel pool houses 913 SFAs.

The document "Action Plan for Safe Management of Irradiated Nuclear Fuel of Bilibino NPP and Unit Preparation for Decommissioning in 2002-2006" provides for a set of measures to ensure SNF safe long-term storage in the on-site storage facilities in a situation where SNF is not shipped from NPP territory. Long-term dry storage on NPP site in the existing storage facilities remains the basic option for SNF management.

To decommission AMB units (shut down in 1981 and 1989) at Beloyarsk NPP 7198 SFAs were discharged from the core. Out of these 2202 SFAs were shipped away and the remaining 4996 SFAs were placed into special dry flasks to be stored in the on-site spent fuel pools. "The Program of AMB Reactor SNF Storage and Removal from Beloyarsk NPP" has been adopted to ensure safety in AMB reactor SNF management.

Summary data on the number of spent fuel assemblies stored on NPP sites are contained in Appendix 15.

Thus, the existing system which regulates nuclear installation operation, maintenance and repair, inspection and testing as well as NPP operational event reporting and assessment in Russia, enables to ensure nuclear plant safe operation.

Here the contributing factors are the continuous scientific-technical support rendered to the Operating Organization and nuclear power plants by a number of research, design and engineering institutes, the application of a unified NPP operating experience feedback system and the use of foreign NPP operating experience.

Major Conclusions

1. The signing of the Convention on Nuclear Safety by the Russian Federation and practical implementation of its requirements have contributed to more effective solution of a number of tasks related to safety assurance during operation of nuclear installations.
2. Today a legislative basis regulating the relations in the nuclear power sector has been established in Russia, and responsibilities of state bodies ensuring safety and safety regulation in the nuclear power have been defined.

   A new structure of the federal bodies of executive power has been established, namely: Federal Atomic Energy Agency and Federal Ecological, Technological and Nuclear Authority.
3. Operating NPP unit lifetime extension beyond the design life is one of the major trends at the present stage of nuclear power development in Russia.
4. An up-to-date system of federal standards and regulations has been set up, which defines the requirements for designing, equipment manufacturing, nuclear plant construction, operation and decommissioning with due account of world practices.
5. Priority of nuclear installation safety issues has been legislatively supported and is being implemented in practice. A system of updating safe operation limits and conditions has been adopted.
6. Regulatory documents formulate and establish the requirements for NPP quality assurance programs.
7. Safety level of all NPP units is regularly reviewed and assessed throughout nuclear plant life cycle. The Regulatory Body of Russia takes into account the findings of these assessments and safety justifications when granting licenses to continue nuclear installation operation.
8. Legislative and regulatory framework has been established enabling to assure radiation protection of human life and the environment.
9. The analysis of nuclear plant operating experience over the recent years has shown stable downward trends in the number of Russian NPP operational events, amounts of radioactive substance releases and discharges into the environment and personnel exposures hence proving the effectiveness of NPP unit operational safety improvement measures taken by the Operating Organization.

10. Necessary actions have been taken on the governmental level to ensure emergency preparedness of nuclear plants and measures to assure safety of personnel, public and environment in NPP locations.
11. Inspections conducted by the Regulatory Body of Russia and missions of the international organizations have confirmed positive trends in the nuclear operations activity and plant personnel commitment to further enhancement of NPP safety.

Conclusion

It follows from the article-by-article review of the progress with the fulfillment of the Convention on Nuclear Safety that the Russian Federation complies with all her commitments resulting from the Convention on Nuclear Safety.

Head
Federal Atomic
Energy Agency

A.Yu. Rumyantsev

Acting Chairman
of the Federal Ecological,
Technological and Nuclear
Authority

A.B. Malyshev

Appendices

Appendix 1.
List of Russian Federation NPPs

Nuclear Units in Operation

NPP name, Unit No	Reactor type	Power, MWe		End of design lifetime	Unit operation license issued by Russian Regulatory Body	
		Net	Gross		License No	License expiry date
Balakovo-1	VVER	950	1000	2015	GN-03-101-0991	25.12.2007
Balakovo-2	VVER	950	1000	2017	GN-03-101-0990	31.03.2005
Balakovo-3	VVER	950	1000	2018	GN-03-101-1245	15.03.2009
Balakovo-4	VVER	950	1000	2023	GN-03-101-0989	30.06.2005
Beloyarsk-3	BN	560	600	2010	GN-03-101-1078	08.04.2010
Bilibino-1	EGP-6	11	12	2004	GN-03-101-0957	01.02.2005
Bilibino-2	EGP-6	11	12	2005	GN-03-101-0973	01.03.2005
Bilibino-3	EGP-6	11	12	2006	GN-03-101-0974	01.04.2005
Bilibino-4	EGP-6	11	12	2006	GN-03-101-0975	01.05.2005
Kalinin-1	VVER	950	1000	2014	GN-03-101-1132	01.07.2008
Kalinin-2	VVER	950	1000	2016	GN-03-101-1010	30.09.2004
Kola-1	VVER	411	440	2003	GN-03-101-1130	06.07.2008
Kola-2	VVER	411	440	2004	GN-03-101-1314	30.07.2009
Kola-3	VVER	411	440	2011	GN-03-101-1081	03.04.2011
Kola-4	VVER	411	440	2014	GN-03-101-1230	07.10.2009
Kursk-1	RBMK	925	1000	2007	GN-03-101-1168	19.12.2006
Kursk-2	RBMK	925	1000	2009	GN-03-101-1248	28.01.2009
Kursk-3	RBMK	925	1000	2013	GN-03-101-1180	15.11.2008
Kursk-4	RBMK	925	1000	2015	GN-03-101-1181	30.11.2008
Leningrad-1	RBMK	925	1000	2003	GN-03-101-1204	21.12.2006
Leningrad-2	RBMK	925	1000	2005	GN-03-101-1153	12.07.2005
Leningrad-3	RBMK	925	1000	2010	GN-03-101-1079	25.02.2006
Leningrad-4	RBMK	925	1000	2011	GN-03-101-1035	22.01.2006
Novovoronezh-3	VVER	385	417	2001	GN-03-101-1029	31.12.2006
Novovoronezh-4	VVER	385	417	2002	GN-03-101-1215	31.12.2008
Novovoronezh-5	VVER	950	1000	2010	GN-03-101-1217	31.12.2008
Rostov-1	VVER	950	1000	2031	GN-03-101-0979	01.01.2005
Smolensk-1	RBMK	925	1000	2012	GN-03-101-1200	30.12.2008
Smolensk-2	RBMK	925	1000	2015	GN-03-101-1227	30.01.2009
Smolensk-3	RBMK	925	1000	2020	GN-03-101-0938	15.04.2007

Appendix 1 continued

Units Planned to be Commissioned before 2010

NPP name, Unit No	Reactor type	Power, MWe		Utility	Start of construction	Commissioning
		Net	Gross			
Kalinin-3	VVER	950	1000	REA	01-Oct-85	2004
Kursk-5	RBMK	925	1000	REA	01-Dec-85	2006
Rostov-2	VVER	950	1000	REA	01-May-83	2007
Balakovo-5	VVER	950	1000	REA	01-Apr-84	2009

Note: REA - Rosenergoatom Concern

Units in the Stage of Decommissioning

NPP name, Unit No	Reactor type	Power, MWe		Utility	Start of construction	Start of commercial operation	Date of removal from operation
		Net	Gross				
Beloyarsk-1	AMB	102	108	REA	01-Jun-58	26-Apr-64	01-Jan-83
Beloyarsk-2	AMB	146	160	REA	01-Jan-62	01-Dec-69	01-Jan-90
Novovoronezh-1	VVER	197	210	REA	01-Jul-57	31-Dec-64	16-Feb-88
Novovoronezh-2	VVER	336	365	REA	01-Jul-64	14-Apr-70	29-Aug-90

Note: REA - Rosenergoatom Concern

Appendix 2.
Major Performance Indicators of Russian NPPs in 2001-2003

VVER-440 Plants

Indicator	NPP	Kola				Novovoronezh		All VVER-440 plants
	Unit	1	2	3	4	3	4	
1. Operation Time Factor OTF, %	2001	81.26	75.05	80.56	81.61	40.29	81.88	73.44
	2002	65.10	63.50	90.30	83.12	73.24	66.86	73.69
	2003	73.56	62.31	83.74	79.25	71.32	79.34	74.92
2. Load Factor LF, %	2001	63.27	49.07	70.64	67.99	38.38	79.45	61.51
	2002	51.76	48.99	76.10	72.08	72.36	64.42	64.21
	2003	60.75	52.11	75.79	68.69	69.45	77.13	67.21
3. Availability Factor AF, %	2001	81.96	84.74	85.28	87.07	38.69	80.95	76.74
	2002	69.02	83.53	91.38	80.27	72.97	65.81	77.30
	2003	75.85	66.48	83.87	90.88	70.18	79.18	77.80
4. Number of automatic scrams per 7000 hours of operation	2001	2.95	0	0	0	0	0	0.54
	2002	0	1.26	0	0	1.09	0	0.36
	2003	1.09	1.28	0	0	1.12	0	0.53

Note: Major performance indicators of Russian NPPs in 1990-2000 are presented in the previous National Reports on the Fulfillment of the Convention on Nuclear Safety.

Appendix 2 continued

VVER-1000 Plants

Indicator	NPP	Balakovo				Volgo-donsk	Kalinin		Novo-voro-nezh NPP	All VVER-1000 plants
	Unit	1	2	3		4	1	2	5	
1. Operation Time Factor OTF, %	2001	91.80	84.68	79.08	83.94	-	80.15	80.71	85.75	83.73
	2002	85.63	84.56	85.36	76.74	86.12	86.40	86.25	84.82	79.01
	2003	85.23	73.83	85.29	86.12	81.70	84.57	86.09	85.70	83.57
2. Load Factor LF, %	2001	88.82	80.22	72.64	78.89	-	79.48	80.54	72.53	79.01
	2002	81.70	81.24	82.87	74.13	85.77	86.91	84.00	81.20	82.23
	2003	84.20	74.02	83.89	86.31	83.32	85.64	87.55	83.55	83.55
3. Availability Factor AF, %	2001	90.70	82.75	77.73	82.69	-	79.67	80.76	73.12	81.06
	2002	87.74	85.27	86.23	78.60	87.22	88.35	87.10	83.65	85.52
	2003	85.80	75.31	85.75	87.52	84.55	86.29	88.10	84.92	84.78
4. Number of automatic scrams per 7000 hours of operation	2001	1.74	0	0	0.95	-	0	0	0.93	0.55
	2002	0	0.94	0	0	0.93	0	0	0.94	0.40
	2003	0.94	0	0	0	0	0	0	0	0.12

Appendix 2 continued

RBMK-1000 Plants

Indicator	NPP	Kursk				Leningrad				Smolensk			All RBMK-1000 plants
	Unit	1	2	3	4	1	2	3	4	1	2	3	
1. Operation Time Factor OTF %	2001	23.31	87.53	45.06	83.11	90.45	90.23	79.99	50.30	67.81	86.04	89.30	72.10
	2002	39.27	61.88	88.90	69.59	81.10	90.89	38.05	100.0	86.71	44.40	89.39	71.83
	2003	83.65	66.60	62.43	77.65	96.97	94.73	92.47	27.39	86.17	88.51	87.87	78.59
2. Load Factor LF, %	2001	16.39	60.09	43.90	82.44	87.74	87.13	77.04	44.81	63.78	79.59	86.42	66.30
	2002	30.89	38.07	85.45	68.51	70.66	86.91	31.89	94.15	84.55	42.24	89.19	65.68
	2003	79.63	46.36	62.95	76.93	92.46	88.53	84.54	24.75	83.49	79.48	87.43	73.32
3. Availability Factor AF, %	2001	16.62	61.11	45.05	83.13	89.47	88.99	79.38	45.78	67.98	81.65	88.33	67.95
	2002	32.58	38.25	88.61	69.22	71.92	89.04	33.61	97.78	85.96	44.16	90.23	67.40
	2003	80.91	47.10	63.33	78.34	95.22	91.49	86.65	26.10	84.97	81.77	88.26	74.92
4. Number of automatic scrams per 7000 hours of operation	2001	0	0	0	0	1.77	0	0	3.18	2.36	0.93	0	0.71
	2002	0	0	0	1.15	2.96	0	0	0	0.92	3.60	0	0.71
	2003	2.87	1.2	0	0	0	0	0	0	0	1.80	0	0.55

Appendix 2 continued

BN-600 and EGP-6 Plants

Indicator	NPP	Beloyarsk	Bilibino				EGP-6 plants
	Unit	3	1	2	3	4	
1. Operation Time Factor OTF, %	2001	82.35	72.42	84.92	84.85	67.71	77.47
	2002	80.92	84.19	65.57	71.35	73.28	73.60
	2003	78.04	54.89	81.76	81.02	66.78	71.11
2. Load Factor LF, %	2001	79.89	53.61	64.57	61.89	41.68	55.44
	2002	77.35	58.51	36.23	37.70	44.55	44.25
	2003	75.74	32.15	42.22	44.58	31.71	37.66
3. Availability Factor AF, %	2001	80.71	72.43	84.91	84.85	67.70	77.47
	2002	79.39	84.19	65.57	71.34	73.28	73.59
	2003	76.81	54.89	81.75	81.02	66.77	71.11
4. Number of automatic scrams per 7000 hours of operation	2001	0	0	0	0	0	0
	2002	0	0	1.22	0	0	0.27
	2003	0	0	0	0	0	0

Appendix 3.
Codes and Standards which Regulate NPP Units Lifetime Extension

The following documents regulate NPP units lifetime extension:

- Federal act on the "Use of Atomic Energy".

Article 9 empowers RF Government to take decisions in the area of atomic energy use relating to design, construction, operation, decommissioning of nuclear installations owned by the Federal Government.

- Federal Codes and Standards in the Area of Atomic Energy Use:
  - "General Guidelines for Assuring Nuclear Plant Safety" (OPB-88/97), NP-001-97 (PNAE G-1-011-97);
  - "Rules for Design and Safe Operation of Nuclear Power Installation Components and Piping", PNAE G-7-008-89 in principle allow for the possibility to extend NPP unit lifetime as a whole;
  - State Standard "NPPs and their Equipment Reliability" (GOST 26291-84) defines the specified NPP lifetime as NPP calendar operation time specified in the design, on expiration of which NPP further operation might be continued once the decision was taken based on investigations of NPP safety and economic efficiency.

To expand the existing regulatory and methodological framework relating to NPP unit lifetime extension in Russia the following documents defining technical requirements to the conduct of activities associated with NPP unit preparation for lifetime extension and criteria for successful activities completion were developed and introduced during 1999-2001:

- Federal Standards "Main Requirements to NPP Unit Lifetime Extension", NP-017-2000;
- Guiding Document of the Russian Regulatory Body "Requirements to the Structure and Content of the Documents that Justify Safety of NPP Unit Extended Operation Period", RD-04-31-2001.

Rosenergoatom Concern developed and put into effect in the established order the following guiding and methodological documents as a follow-up development of federal codes and standards:

- "Manual on the Organization and Conduct of NPP Systems and Equipment Upgrading";
- "Typical Program of NPP Unit Comprehensive Examination for Lifetime Extension", RD EO 0283-01;
- "Manual on the Management of Service Life Characteristics of NPP Unit Elements", RD EO 0281-01;

- "Program of Ensuring the Quality of the First Generation NPP Unit Lifetime Extension Activities", RD EO 0291-01;
- "Basic Guidelines for Extending the Lifetime of NPP Units of the Second Generation", RD EO 0327-01;
- Methodologies for Justifying Equipment Residual Lifetime.

Appendix 4.
Measures for NPP Safety Improvement and Upgrading

4.1. Major Safety Improvement Measures Implemented at Kola NPP Unit 1 in 2002-2004

No	Measure
1.	Upgrading of reliable power supply system for essential loads
2.	Upgrading of essential service water system
3.	Upgrading of the safety injection system and spray system
4.	Upgrading of controlling safety systems
5.	Upgrading of multifunctional simulator for NPP Training Point
6.	Installation of primary circuit collector leak arresters of 1SG-2,4, 2SG-3,4,5
7.	Upgrading of valves and blowdown pipelines and blowdown return lines of the main circulation circuit loops
8.	Upgrading of protective grids of the water receivers of the safety injection system (Tank B-8)
9.	Installation of check valves on feed water pipelines to the steam generator
10.	Upgrading of pressure lines from emergency motor-driven feed water pump
11.	Replacement of diesel generator control and monitoring systems
12.	Upgrading of relay protections and automatics (RP&A) of 6/0.4 kV 51.52T transformers
13.	Upgrading of RP&A of the bus leads of 6 kV in-house switchgear (completion of activities on the circuits of breakers interlocks)
14.	Replacement of process (temperature) control system of TGs-1,2,3,4
15.	Improvement of configuration for connecting impulse lines of level governor sensors in high pressure heaters to avoid the effects of level fluctuations on the quality of control
16.	Upgrading of automatic chemical control system
17.	Upgrading of steam generators blowdown system
18.	Installation of independent modular fire extinguishing systems in cable rooms

4.2. Major Safety Improvement Measures Implemented at Leningrad NPP Unit 1 in 2002-2004

No	Measure
1.	Upgrading of Emergency Core Cooling System (ECCS). Installation of a new three-train fast-acting ECCS subsystem (with hydro-accumulators) and a two-train ECCS system of long-term cooldown
2.	Installation of shutdown reactor power system (SRPS) consisting of three trains of emergency power supply
3.	Upgrading of essential service water system designed to ensure operability of safety systems involved in emergency core cooling
4.	Installation of an integrated system for the control of emergency cooling
5.	Upgrading of primary circuit associated with the commissioning of modified ECCS
6.	Putting into service back-up control room
7.	Installation of the second reactor scram system
8.	Reactor transfer to uranium-erbium fuel
9.	Installation of the third leak detection system in the primary circuit rooms based on metal status monitoring in the primary circuit

4.3. Major Upgrading Measures for Smolensk NPP Units 2 and 3 Implemented in 2001-2004

No	Upgraded facility, Unit	Name of activities
1.	№ 2	Modification of reactor protection system (RPS). Arrangement of independent train to measure and monitor reactor neutron power in the back-up control room (BCR)
2.	№ 3	RPS modification. Retrofitting of RPS automatic regulators' logic
3.	№ 3	RPS modification. Elimination of interlocks to activate RPS on the signal of "reduced water flowrate" in RPS channels
4.	№ 3	Modification of reactor protection system (RPS). Upgrading of an amplifier in the start-up range protection

No	Upgraded facility, Unit	Name of activities
5.	№ 2 and № 3	Installation of modified equipment for neutron flux monitoring system in line with regulatory documentation
6.	№ 2 and № 3	Installation of modified heat exchange equipment for reactor building intermediate circuit aiming to improve water chemistry. Replacement of existing heat exchangers by he plate and tube type heat exchanger
7.	№ 2	Instrumentation modification in turbine generators 3 and 4. Introduction of up to 200 signals into the KVINT system (A-701). "Pilot" project. Metrological qualification of KVINT system (calibration methodology)
8.	№ 2	Replacement of storage batteries of ECCS-6 emergency core cooling system with expired life by seismically resistant VARTA batteries (V_B-2312)
9.	№ 2	Reactor building Instrumentation modification. Monitoring scope expansion. Information display on the pressure in the bottom water lines' (BWL) rooms and in leak-tight rooms to RPS panel with alarms introduced on the activity suppression facility board
10.	№ 2	Reactor building instrumentation modification. Monitoring scope expansion. Information display on pressure in BWL rooms, leak-tight rooms, reactor cavity to the UCR-O, BCR
11.	№ 3	Segregation of SKALA measuring current circuits from the measuring current circuits having control logic devices
12.	№ 2 and № 3	Modification of exhaust devices of diesel generators in standby diesel power plants. Installation of spark arresters
13.	№ 2	Modification of the central part of automatic radiation safety monitoring system (ARSM-6) of the first stage of the plant
14.	SWTS, LSWS	Modification of special water treatment system (SWTS) instrumentation and liquid and solid waste storage (LSWS). Installation of acoustic level meters on the tanks for solutions preparation

No	Upgraded facility, Unit	Name of activities
15.	SWTS, LSWS	Modification of SWTS and LSWS instrumentation. Installation of automatic concentrate meters on tanks for solutions preparation and solutions tanks
16.	LRW	Modification of liquid radioactive waste storage facility. Installation of sampling device for tanks containing liquid radioactive waste (LRW)

Appendix 5.
List of the Major Federal Codes and Standards Regulating Nuclear Plants Safety

I. Relating to all types of atomic energy utilization facilities:

- Requirements to Design and Safe Operation of Load-Lifting Cranes for Atomic Energy Utilization Facilities (NP-043-03*);
- Rules for Design and Safe Operation of Pressure Vessels for Atomic Energy Utilization Facilities (NP-044-03);
- Rules for Design and Safe Operation of Steam and Hot Water Pipelines for Atomic Energy Utilization Facilities (NP-045-03);
- Rules for Design and Safe Operation of Steam and Water Boilers for Atomic Energy Utilization Facilities (NP-046-03).

II. Relating to nuclear plants:

- Typical Content of the Action Plan for Personnel Protection in Case of Nuclear Plant Accidents (NP-015-2000);
- Basic Requirements to Nuclear Plant Unit Lifetime Extension (NP-017-2000);
- Requirements to the Content of the Safety Analysis Report for Fast Breeder Reactor of a Nuclear Plant (NP-018-2000);
- Requirements to Nuclear Plants Controlling Safety-Related Systems (NP-026-01);
- Standards for Designing Seismically Resistant Nuclear Plants (NP-031-01);
- Siting of Nuclear Plants. Basic Criteria and Requirements to Safety Assurance (NP-032-01);
- Rules for Design and Operation of Nuclear Plants' Safety-Related Ventilation Systems (NP-036-02);
- Rules for Ensuring Hydrogen Explosion Protection at a Nuclear Plant (NP-040-02).

III. Relating to radioactive waste and spent nuclear fuel:

- Collection, Reprocessing, Storage and Conditioning of Liquid Radioactive Waste. Safety Requirements (NP-019-2000);
- Collection, Reprocessing, Storage and Conditioning of Solid Radioactive Waste. Safety Requirements (NP-020-2000);
- Gaseous Radioactive Waste Management. Safety Requirements (NP-021-2000);

* Letter and digital symbols of documents according to the codes accepted in RF Regulatory Body are indicated here and further in brackets.

- Facilities for Dry Storage of Spent Nuclear Fuel. Safety Requirements (NP-035-02).

IV. Relating to accounting and control of nuclear materials:

- Basic Rules for Nuclear Materials Accounting and Control (NP-030-01).

Appendix 6.
Russian Regulatory Body Financing from the Resources of the Russian Federation Federal Budget in 2003

Name of sections and subsections of the functional classification of the federal budget	Allocated for 2003, thousand rubles	Actually funded in 2003, thousand rubles	% from allocated for 2003,	Funding backlog, thousand rubles
TOTAL EXPENDITURE	224447.5	224447.5	100%	0.0
For: State management and local management bodies *Functioning of executive bodies of state power*	196309.3	196309.3	100%	0.0
Including: Russian Regulatory Body Headquarters staff	32749.0	32749.0	100%	0.0
Russian Regulatory Body regional offices	163560.3	163560.3	100%	0.0
International activity *International, cultural, scientific and information relations*	3395.6	3395.6	100%	0.0
Fundamental research and assistance to scientific and technical progress *Development of advanced technologies and priority areas of scientific and technical progress*	18382.6	18382.6	100%	0.0
Industry, power engineering and construction *Construction, architecture*	5000.0	5000.0	100%	0.0
Education *Retraining and proficiency improvement*	1360.0	1360.0	100%	0.0

Appendix 7.
Russian Regulatory Body Financing from the Resources of the Russian Federation Federal Budget in 2004

Name of sections and subsections of the functional classification of the federal budget	Limits for 2004, thousand rubles
TOTAL EXPENDITURE	251134.6
For: State management and local authorities *Functioning of executive bodies of state power*	212635.2
Including: Russian Regulatory Body Headquarters staff	34895.1
Russian Regulatory Body regional offices	177740.1
International activity *International cultural, scientific and information relations*	3591.5
Fundamental research and assistance to scientific and technical progress *Development of advanced technologies and priority areas of scientific and technical progress*	21547.9
Industry, power industry and construction. *Construction, architecture*	12000.0
Education *Retraining and proficiency improvement*	1360.0

Appendix 8.
Data on the actual numbers of Russian Regulatory Body Regional Office Staff Members and Expenditures for Inspection Missions in 2002

Indicators	Total	CR	NER	UR	DR	SR	VR	DR
Number of regional staff members	1008	198	153	133	49	134	192	149
Number of Inspection Division staff members	739	172	118	94	23	70	178	84
Number of supervised enterprises and organizations	3526	1053	497	526	148	414	521	367
Number of inspection missions held in 2002	14542	3051	2098	5021	248	1507	993	1624
Actual expenditures for the Region, thousand rubles total:	121583.7	21215.0	23780.0	16485.6	10055.4	16764.0	18370.6	14913.1
including: running costs:	119547.9	20615.0	23334.2	15985.6	9905.4	16764.0	18370.6	14573.1
out of them for inspection missions	83168.9	19123.6	17996.3	9297.3	3767.4	8757.3	17242.0	6985.0
Running costs for 1 inspector, thousand rubles	112.54*	111.18	152.51	98.91	163.80	125.10	96.87	83.15
Running costs for 1 inspection mission, thousand rubles	5.72*	6.27	8.58	1.85	15.19	5.81	17.36	4.30

Legend:
CR - Central Region;
NER - North-European Region;
UR - Urals Region;
FER - Far East Region;
SR - Siberian Region;
VR - Volga Region;
DR - Don Region.

Symbol * shows average indicator values

Appendix 9.
Data of the Actual Numbers of Russian Regulatory Body Regional Office Staff Members and Expenditures for Inspection Missions in 2003

Indicators	Total	CR	NER	UR	FER	SR	VR	DR
Number of regional staff members	1009	198	149	130	52	132	196	152
Number of Inspection Division staff members	744	170	117	95	23	70	182	87
Number of supervised enterprises and organizations	3754	1099	540	563	150	450	577	375
Number of inspection missions held in 2003	12884	2740	1905	3787	207	1521	974	1750
Actual expenditures for the Region, thousand rubles Total:	153382.5	27702.0	27587.0	20615.8	12601.9	22978.0	23126.8	18771.0
including: running costs:	151255.6	27604.8	27475.7	18915.2	12571.9	22908.0	23079.0	18701.0
out of them for inspection missions	106028.1	25278.3	21574.9	12038.2	5029.7	11966.9	21563.7	8576.4
Running costs for 1 inspector, thousand rubles	142.51*	148.70	184.40	126.72	218.68	170.96	118.48	98.58
Running costs for 1 inspection mission, thousand rubles	8.23*	9.23	11.33	3.18	24.30	7.87	22.14	4.90

Legend:
CR - Central Region;
NER - North-European Region;
UR - Urals Region;
FER - Far East Region;
SR - Siberian Region;
VR - Volga Region;
DR - Don Region.

Symbol * shows average indicator values

Appendix 10.
Categories and Symptoms of NPP Operational Events

Category	Event symptoms and consequences
Accidents	
A01	Release of radioactive substances into environment during beyond design basis accident resulting in potential acute radiation effects on NPP personnel members (employees) and members of the public, health effects, radioactive contamination of a large territory. Trans-boundary transfer of radioactive substances is possible. Prolonged impact on the environment.
A02	Release of radioactive substances into environment resulting in the achieving or exceeding, beyond NPP exclusion zone boundary, of the "B" level of criteria for taking urgent decisions at the initial phase of the accident: predicted exposure dose during the first 10 days of 500 mGy for whole body or 5000 mGy for thyroid, lungs and skin.
A03	Release of radioactive substances into environment resulting in the exceeding, beyond NPP exclusion zone, of the "A" level of criteria for taking urgent decisions at the initial phase of the accident: predicted exposure dose during the first 10 days of 50 mGy for whole body or 500 mGy for thyroid, lungs and skin. Notes: 1. The accidents of A01, A02, A03 categories are characterised by the exceeding of the maximum design-basis limit for fuel rod damage. 2. Levels "A" and "B" of the criteria for taking urgent decisions at the initial phase of the accident are in accordance with NRB-99 radiation safety standards.
A04	Release of radioactive substances into environment resulting in the exceeding, within the exclusion zone, of the basic limit of exposure to members of the public of 5 mSv/year. Single external and/or internal exposure of personnel members to a dose, which exceeds the potentially detrimental exposure (200 mSv). Fuel rod damage exceeding safe operation limits for the number and extent of fuel rod defects while the maximum design basis limit has not been exceeded.

Appendix 10 continued

Category	Event symptoms and consequences
Incidents	
P01	Release of radioactive substances into the habitable room (rooms), on-site or into environment that occurred due to system (component) failures, operating procedure deficiencies, personnel errors resulting in: - contamination of habitable room (rooms) with beta nuclides of 10000 particles/(min·cm^2) and/or with alpha nuclides of 200 particles/(min·cm^2); - contamination of the exclusion zone leading to a dose which does not exceed 5 mSv/year. Single external and/or internal exposure of personnel members to a dose exceeding the basic dose limit but not more than the potentially detrimental exposure (200 mSv).
P02	Breach of safe operation limits (except the radiation limits).
P03	Breach of safe operation conditions.
P04	Unavailability of one or several safety system trains detected during the routine test or NPP unit in-service examination.
P05	Safety system actuation associated with the need to perform safety function during NPP unit operation and involving additional, as compared to design basis, failures of safety system components in excess of single failure and/or due to personnel errors.
P06	Safety system actuation associated with the need to perform safety function during NPP unit operation and not involving additional, as compared to design basis, failures of safety system components in excess of single failure and/or due to personnel errors.
P07	Actuation of a safety system or safety system train not associated with performing safety function including that part of fire extinguishing system, which provides the conditions for safety system functioning.

Appendix 10 continued

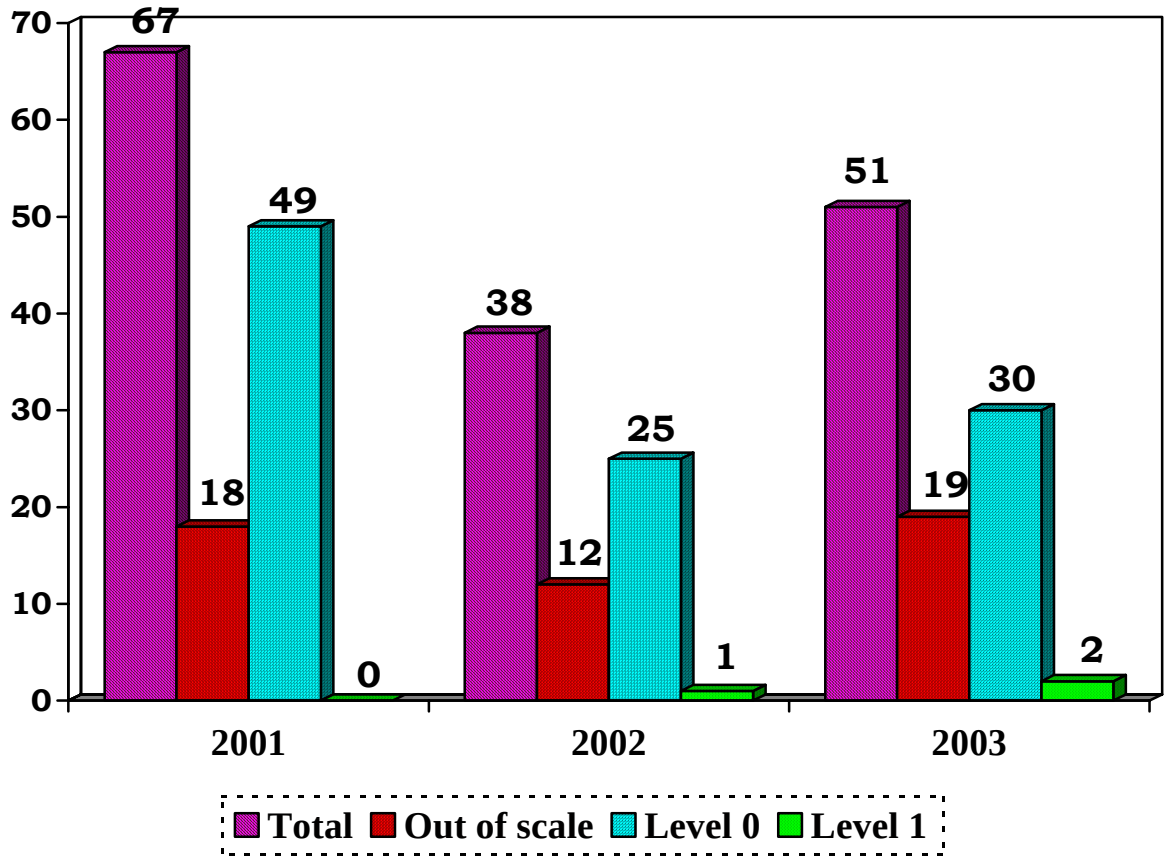
Category	Event symptoms and consequences
Incidents	
P08	Reactor installation shutdown or unit disconnection from the grid without scram actuation during NPP unit operation caused by system (component) failures and/or personnel errors or external impact.
P09	NPP unit power reduction by 25% and more of the power level immediately preceding this reduction caused by system (component) failure and/or personnel errors or external impact (excluding events stated in item 2.2 of the "Code on the Procedure for NPP Operational Event Investigating and Accounting" PNAE G-12-005-97).
P10	Drop and/or damage to fuel assembly, fuel rod during new or spent nuclear fuel handling operations caused by the failure of systems, components (including NPP lifting equipment used during nuclear fuel handling) and/or personnel errors.
P11	Damage or defects of NPP components of Safety Categories 1 and 2 that occurred or were detected during NPP unit operation but did not lead to an initiating event.

Appendix 11.
Distribution of Russian NPP Operational Events Rated by INES in 2001–2003

NPP name	Number of NPP operational events (INES level)								
	Out	0	1	Out	0	1	Out	0	1
	2001			2002			2003		
Kola	1	6		1	2		1	4	
Novovoronezh	5	2		1	2		1	9	1
Balakovo	2	7		3	1		5	1	
Kalinin	1			3			2	4	
Volgodonsk*	2	7			2				1
Kursk	2	8			5	1	1	8	
Leningrad		7		2	6		1	1	
Smolensk	6	8		1	4		7	2	
Beloyarsk	1			1				1	
Bilibino		1			3		1		
Total	20	47		12	25	1	19	30	2
	67			38			51		

* In 2001 Volgodonsk NPP was in the stage of power ascension

Appendix 12.
Trends in Russian NPP Operational Events Rated by INES in 2001–2003



Appendix 13.
List of NPP Safe Operation Regime Violations to be Immediately Reported by NPP Administration

Name of violation of NPP safe operation regime	Organizations and persons to be notified at all kinds of violations of NPP safe operation regime
Declaring the state of "Emergency Preparedness"	Rosenergoatom Concern's dispatcher on-duty. Situation & Crisis Center of the Federal Atomic Energy Agency. Territorial bodies for civil defense and emergency management of a city and region (autonomous district).
Declaring the state of "Emergency Situation"	Head of resident NPP Inspection Office. Environmental Protection Committee of the district.
Fire with a potential for radiological accident	Engineer on-duty of the State Mining and Technical Inspectorate of the respective district (in case of damage to NPP component(s) registered in the bodies of the Russian State Mining and Technical Inspectorate).
Natural disasters (earthquakes, tornadoes, floods etc.) that may cause a radiological accident	Heads of administration of a city and region (autonomous district). Dispatcher of corresponding department of the RAO Power System "United Power System of Russia" (in cases envisaged by the existing Manual on the Relations between NPP and Power System). NPP Health Center.
Attempts by criminals to commit criminal actions that may result in a radiological accident	NPP fire protection service security division and regional fire protection office. Military unit of the RF Ministry of Interior in charge of NPP physical protection (military unit duty officer, commander of the guard). Russian Ministry of Interior and Federal Security Service units responsible for a NPP. Territorial division of the Russian Hydrometeorological Service responsible for a NPP. Organizations of other ministries and agencies in the territory of NPP and exclusion zone. Local administration in the 5-km zone around a NPP. Emergency Management Commission of the Federal Atomic Energy Agency (to be notified by NPP management).

Appendix 14.
Status with Radwaste Storage Facility Fill-up at Operating NPPs
as of 01.01.2004

Nuclear plant	Liquid waste storage			Solid waste storage		
	Volume of storage containers, m^3	Container fill-up		Volume of storage containers, m^3	Container fill-up	
		m^3	%		m^3	%
Bilibino	1000	734	73.4	6330	3724	58.8
Balakovo	3600	1445	40.1	18750	12903	68.8
Beloyarsk (Unit 3)	6400	4649	72.64	6000	827.3	13.8
Kalinin	2940	2006	68.2	6615	2062	31.2
Kola	8576	6880	80.2	16361	7788	47.6
Kursk	63000	41297	65.5	31560	30098	95.4
Novovoronezh (Units 3,4,5)	4384	3385	77.2	36235	28182	77.8
Volgodonsk	800	262	32.7	5910	75.6	1.3
Smolensk	19400	15059	77.6	15150	12651	83.5
Leningrad	13820	12919	93.5	16600	8881	53.5

Appendix 15.
Spent Nuclear Fuel Presence at NPP Sites as of 01.01.2004

Nuclear plant	Reactor type	Number of spent fuel assemblies in storage facilities			
		Spent fuel pool	Spent fuel storage facility	Separate-standing spent fuel storage facility	Total
Balakovo	VVER-1000	877			877
Beloyarsk	AMB BN-600	4996 1151			4996 1151
Bilibino	EGP	5124			5124
Kalinin	VVER-1000	374			374
Kola	VVER-440	1198			1198
Kursk	RBMK-1000	4337	26207		30544
Leningrad	RBMK-1000	7831	26765		34596
Novovoronezh	VVER-440 VVER-1000	635 97		 358	635 455
Volgodonsk	VVER-1000	103			103
Smolensk	RBMK-1000	4861	12921		17782