

**FIFTH NATIONAL REPORT
OF THE RUSSIAN FEDERATION
ON THE FULFILLMENT OF
COMMITMENTS RESULTING FROM
THE CONVENTION ON NUCLEAR
SAFETY**

**Fifth Review Meeting
under the Convention on Nuclear Safety**

Moscow 2010

The Fifth National Report of the Russian Federation on the fulfillment of commitments resulting from the Convention on Nuclear Safety for the period from 2008 to July 2010 was prepared in compliance with Article 5 of the Convention on Nuclear Safety.

The Report was prepared taking into account the recommendations of the fourth Meeting of Contracting Parties to review the national reports held on 14-25 April 2008 at the International Atomic Energy Agency (IAEA), the recommendations given in the Convention on Nuclear Safety, in the IAEA guidelines on Report preparation, in the "Synopsis of the Relevant IAEA Safety Requirements Reflecting the Issues Addressed by Articles 6 to 19 of the Convention on Nuclear Safety" (IAEA Secretariat's Report to the Contracting Parties on the Convention on Nuclear Safety of 18 May, 2006), and in the "Guidelines Regarding National Reports under the Convention on Nuclear Safety" (INFCIRC/572/Rev.3) prepared by the Working Group on National Reports following the decision of the Fourth Review Meeting.

The Report does not address some aspects of the fulfillment of the Convention articles that were described in detail in the previous National Reports of the Russian Federation and have not undergone any changes in the period under review.

The Report was prepared by the State Corporation for Atomic Energy "Rosatom", Russian Federation Ministry of Natural Resources and Environment, and the Federal Environmental, Industrial and Nuclear Supervision Service with contributions from:

- Russian Concern for the Production of Electrical and Thermal Energy at Nuclear Plants (Rosenergoatom Concern);
- All-Russian Research Institute for Nuclear Power Plants Operation (VNIIAES);
- Scientific and Engineering Centre for Nuclear and Radiation Safety (SEC NRS).

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List of Acronyms

AEP	- Atomenergoproekt, open joint-stock company
AER	- Atomenergoremont, open joint-stock company
AMB	- pressure-tube thermal reactor (AMB stands for "large peaceful atom") – water-cooled graphite-moderated pressure-tube reactor
AMRDC FMBA	- Emergency Medical Radiation Dosimetry Centre of the Federal Medical and Biological Agency
APCS	- automated process control system
ASSET	- Analysis of Safety Significant Events Team
ATE	- Atomtechenergo, open joint-stock company
AZ	- emergency protection
BN	- sodium-cooled fast reactor
Bq	- Becquerel (activity measurement unit)
CCR	- central control room
FA	- fuel assembly
FEI	- National Scientific Centre "A.I. Leipunskiy Physics and Energy Institute", federal state-owned unitary enterprise
FGU	- federal state-owned institution
FGUP (FSUE)	- federal state-owned unitary enterprise
FNHPP	- floating nuclear heat-and-power plant
EGP	- loop-type graphite power reactor
EMERCOM of Russia	- Russian Federation Ministry for Civil Defence, Emergency Management and Response to Natural Disasters
ERC	- Emergency Response Centre (Rosenergoatom)
ETC	- Emergency Technical Centre
GOST	- Russian national standard
IAEA	- International Atomic Energy Agency
IBRAE RAN	- Institute for Safe Development of Nuclear Power of the Russian Academy of Sciences
INES	- International Nuclear Event Scale
INPO	- US Institute for Nuclear Power Operations
INSAG	- International Nuclear Safety Advisory Group (with the IAEA Director General)
IRS	- Incident Reporting System (IAEA/NEA)
ISA	- in-depth safety analysis
ISAR	- in-depth safety analysis report
ISO	- International Standardization Organisation
KOPUR	- programme for inspection, assessment, prediction and life management of nuclear plant components
LLN	- long-lived nuclides

List of Acronyms

LRW	- liquid radioactive waste
LRW SF	- liquid radioactive waste storage facility
Minprirody of Russia	- Russian Federation Ministry of Natural Resources and Environment
MOX fuel	- mixed uranium-plutonium oxide fuel
NIAEP	- Nizhniy Novgorod Engineering Company "Atomenergoproekt", open joint-stock company
NPO "Typhoon"	- Research and Production Association "Typhoon"
NPP	- nuclear power plant
NRB	- Radiation Safety Regulations
NRG	- noble radioactive gas
OE	- operating experience
OIS OE	- Industry-level Information and Analysis System for Operating Experience of Nuclear Power Plants
OJSC	- open joint-stock company
OKB GP	- Experimental Design Bureau "Gidropress", open joint- stock company (OKB Gidropress)
OKBM	- I.I. Afrikantov Experimental Mechanical Engineering Bureau, open joint-stock company (OKBM Afrikantov)
OKChS	- Rosatom's Commission for Management of Emergencies
OPAS	- Team for Emergency Assistance to Nuclear Plants
OPB	- Basic Safety Rules for Nuclear Plants
OSART	- Operational Safety Review Team
OSChS	- Industry-level (Rosatom) System for Prevention and Management of Emergencies
OSPORB	- Basic Health Rules for Radiological Safety Assurance
POKAS	- quality assurance program for a nuclear plant
PRIS	- Power Reactor Information System (IAEA)
PSA	- probabilistic safety analysis
PSAR	- Preliminary Safety Analysis Report
RBMK	- high-power channel-type reactor
RD EO	- guidance document (guidelines) of Operating Organisation
RF	- Russian Federation
Rosatom	- State Corporation for Atomic Energy "Rosatom"
Rosenergoatom Concern	- Russian Concern for the Production of Electrical and Thermal Energy at Nuclear Plants, open joint-stock company
Rostekhnadzor	- Federal Environmental, Industrial and Nuclear Supervision Service
RSChS	- National System for Prevention and Management of Emergencies
RW	- radioactive waste

List of Acronyms

SAI OE	- System for Analysis and Use of Information on Operating Experience of Nuclear Power Plants
SAR	- Safety Analysis Report
SChSK	- Utility-level (Rosenergoatom) System for Prevention and Management of Emergencies
SChSO	- Plant-level System for Prevention and Management of Emergencies at a Facility (including nuclear plants)
SEC NRS	- Scientific and Engineering Centre on Nuclear and Radiation Safety, federal state-owned institution (with Rostekhnadzor)
SFA	- spent fuel assembly
ERC	- Emergency Response Centre ("Situation and Crisis Centre" of Rosatom, "Crisis Centre" of Rosenergoatom)
SNF	- spent nuclear fuel
SNF SF	- spent nuclear fuel storage facility
SO-CDU EES	- System Operator – Central Dispatcher Office of the National Power System, open joint-stock company
SPbAEP	- St. Petersburg Scientific and Engineering Institute "Atomenergoproekt"
SRW SF	- solid radioactive waste storage facility
SS	- safety system
Sv	- Sievert (dose equivalent measurement unit)
SRW	- solid radioactive waste
TC	- Training Centre
TG	- turbine generator
TP	- Training Point
TSC	- Technical Support Centre
VNIIAES	- All-Russian Research Institute for Nuclear Power Plants Operation, open joint-stock company
WANO	- World Association of Nuclear Operators
WWER	- water-cooled water-moderated power reactor

Introduction

The Russian Federation signed the Convention on Nuclear Safety on 20 September 1994 (RF Government Ordinance No. 1069 of 20 September 1994) and approved it on 12 July 1996 (RF Government Ordinance No. 377 of 3 April 1996). The Convention on Nuclear Safety became effective in Russia on 24 October 1996.

The national policy of the Russian Federation in the area of the nuclear power safety is governed by Article 71 of the Russian Federation Constitution, according to which the Russian Federation has under its authority the federal power systems, the nuclear power sector and fissile materials, and is based on the federal laws "On the Use of Atomic Energy", "On the Radiological Safety of the Public", "On Environmental Protection", and others.

These laws are intended to guard human life and health and protect the environment in the course of activities associated with the use of nuclear energy; they are meant to encourage further development of science and technology, and help consolidate the international regime of safe uses of nuclear energy.

The Federal Law No. 317-FZ adopted on 1 December 2007 established the State Corporation for Atomic Energy "Rosatom" to implement state policy in the field of nuclear energy use, assure nuclear and radiation safety and pursue international cooperation in this area.

The RF Government Ordinance No. 404 of 29 May 2008 transferred to the Ministry of Natural Resources and Environment (Minprirody of Russia) some of the Regulator's functions associated with elaboration of the state policy on and regulation of the safe use of nuclear energy, including the issue of federal rules and regulations on the use of nuclear energy. Adherence to the federal rules and regulations while licensing the activities in the field of nuclear energy is checked and supervised by the Federal Environmental, Industrial and Nuclear Supervision Service (Rostekhnadzor).

The Federal Law No. 170-FZ of 21 November 1995 "On the Use of Atomic Energy" stipulates that the overall responsibility for the safety of nuclear installations as well as for the safe management of nuclear materials and radioactive substances rests with the Operating Organisation.

Russia has only one Nuclear Operator – open joint-stock company "Russian Concern for the Production of Electrical and Thermal Energy at Nuclear Plants" (Rosenergoatom Concern), which incorporates all 10 Russian nuclear power plants.

Nuclear power development in the Russian Federation is defined by the "Long-Term Programme of Rosatom Activities (2009-2015)" endorsed by the RF Government Ordinance No. 705 of 20 September 2008. The

same ordinance cancelled since 1 January 2009 the targeted federal programme "Development of Nuclear Power and Industry Complex of Russia in 2007-2010 and up to 2015".

The major objectives of the Programme include:

- energy security and guaranteed energy supply to the national economy and to the public with absolute fulfillment of nuclear and radiation safety rules established with regard to the use of nuclear energy;
- innovative expansion of the nuclear industry, including design of nuclear reactor facilities of a new generation and development of a closed fuel cycle technology.

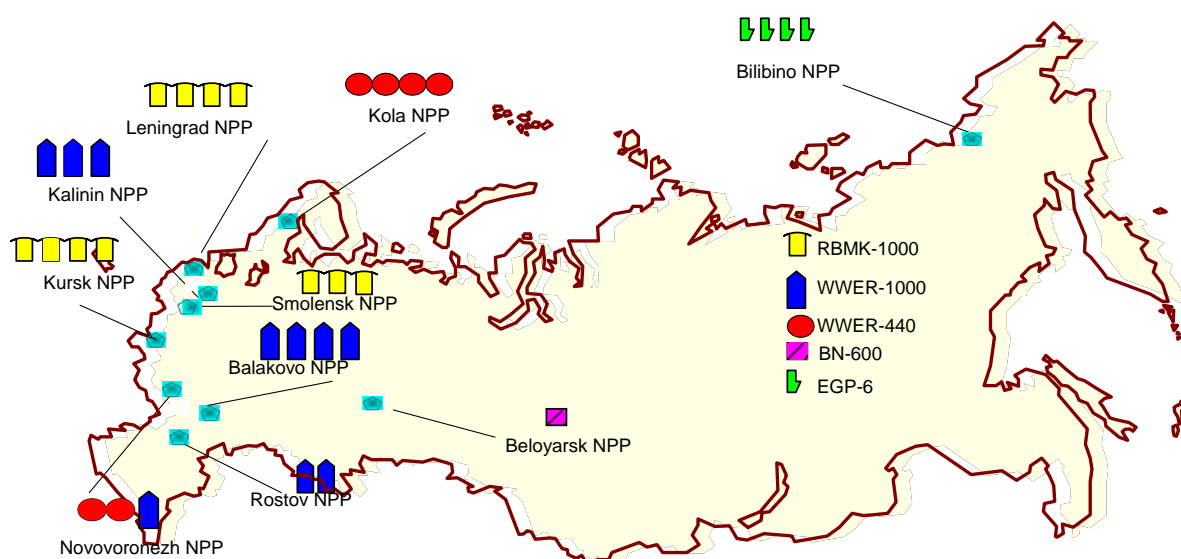
The list of the Russian nuclear plants holding site and construction licences is given in Appendix 1.

Fulfillment of the Russian Federation's commitments resulting from the Convention on Nuclear Safety is discussed below article-by-article, as prescribed by the Convention on Nuclear Safety and recommended by the Fourth Review Meeting held in April 2008.

Article 6. Existing Nuclear Installations

As of 31 July 2010 the Russian Federation had in operation 32 nuclear units at ten nuclear sites, including ten WWER-1000 units, six units of the WWER-440 type (WWER plants have water-cooled water-moderated reactors with a non-boiling coolant), eleven RBMK-1000 units (pressure-tube water-graphite reactors), one BN-600 plant with a sodium-cooled fast reactor, four EGP-6 units (loop-type graphite power reactor). During the time since the submittal of the Fourth National Report the number of operating nuclear units increased by one: the process of bringing Rostov-2 to first criticality was started in December 2009; the reactor became critical for the first time in January 2010, and the unit was connected to the grid in March 2010. Four nuclear units are in the stage of decommissioning. NPP list is given in Appendix 1, and the location of the operating plants is shown on the map below.

Location of Operating Russian Nuclear Plants



The key performance indicators of the operating Russian nuclear plants in 2007-2009 are given in Appendix 2.

As required by Article 6 of the Convention, safety assessment is performed for all Russian nuclear plants. Such assessments are performed annually in keeping with the Operator (Rosenergoatom Concern) standard STO 1.1.1.04.0143-2009 "Regulation on Annual Operational Safety Assessment Reports for Nuclear Plants" agreed with the Regulatory Body.

Apart from this, the Operator and the Regulator appraise safety:

- in the framework of the licensing procedure (when seeking an operation licence and amending licence terms and conditions, which is required, in particular, in case of any modifications to the safety-related systems and components of a nuclear plant, changes to the operating procedure and emergency procedures, and in some other cases);
- in the framework of the regular activity on revision of existing and development of new safety assessment regulations (in particular, on probabilistic safety analysis, periodic safety assessment);
- in case of changes in the regulatory safety requirements in the area of nuclear energy;
- in the course of investigation of NPP operational events.

The findings and conclusions of safety assessments and analyses serve as an input to develop and implement safety enhancement measures for the operating nuclear plants.

6.1. Life extension of nuclear plants

Life extension of the operating nuclear units on expiry of their design service life is of vital importance at the current stage of nuclear power development in Russia; it is the most cost-effective investment in NPP safety enhancement and in the preservation of generating capacities.

The life extension efforts for the operating nuclear plants were launched to implement the "Programme of Nuclear Power Development in Russia in 1998-2005 and up to 2010" approved by the RF Government Ordinance No. 815 of 21 July 1998.

Extension of the operating plant life is included in the "Long-Term Programme of Rosatom Activities (2009-2015)" endorsed by the RF Government Ordinance No. 705 of 20 September 2008.

According to the current Russian regulations, life extension activities for the nuclear plants include:

- comprehensive examination of the nuclear unit;
- evaluation of the technical feasibility of extending the life of unit components;
- safety assessment of the unit;
- cost-benefit analysis of unit life extension activity.

The outcome of this effort is the decision on the expediency of extending the service life of the unit in question.

Next, a plan is developed to prepare the unit for its extra lifetime, including:

- justification for extending the life of non-replaceable components;
- implementation of a comprehensive programme of unit upgrading;
- testing of unit systems and components;
- preparation of a safety case for the unit.

The outcome is submitted by the Operator to the Regulatory Body for an independent review and issue of a licence for unit operation beyond its original lifetime.

The economically sound extra time of nuclear unit operation ranges from 15 to 30 years; it is defined case-by-case proceeding from technical and economic considerations.

As of 01.01.2010, the life extension efforts were completed for 14 nuclear units with the total installed capacity of 6808 MWe: Novovoronezh 3 and 4 (WWER-440), Kola 1 and 2 (WWER-440), Leningrad 1, 2 and 3 (RBMK-1000), Kursk 1 and 2 (RBMK-1000), Bilibino 1, 2, 3 and 4 (EGP-6), and Beloyarsk 3 (BN-600).

The extensive upgrading work at these plants significantly enhanced their safety that currently meets the requirements of relevant Russian regulations and IAEA recommendations in respect of the nuclear plants built to earlier rules and regulations.

The activities proved that these 14 units could be safely operated beyond their original design service life (for another 15 years). Following the established procedure, licences have been obtained from the Federal Environmental, Industrial and Nuclear Supervision Service (Rostekhnadzor) for the operation of these units beyond their original design life (See Table 6.1).

Table 6.1 - Nuclear Units that Received Life Extension Licences from Rostekhnadzor in 2009-2010

NPP, Unit	Reactor type	Rated power, MWe	Year of commissioning	End of the original 30-year life (year)
Leningrad 3	RBMK-1000	1000	1979	2009
Kursk 2	RBMK-1000	1000	1979	2009
Beloyarsk 3	BN-600	600	1980	2010

6.2. Upgrading of operating plants

Starting from 2008, efforts have been under way to upgrade Rosenergoatom plants.

The units that were allowed by the beginning of 2010 to perform trials at an upgraded power level are listed in Table 6.2.

Table 6.2 - Nuclear Units Allowed to Perform the Upgrade Trials

Plant	Unit	Reactor type	Rated power, MWth	Licensed power level of the reactor facility (% of original rated power)
Balakovo	1	WWER-1000	3000	104
	2	WWER-1000	3000	104
	3	WWER-1000	3000	104
	4	WWER-1000	3000	104
Kola	4	WWER-440	1375	107
Kalinin	3	WWER-1000	3000	104
Kursk	1	RBMK-1000	3200	105
	2	RBMK-1000	3200	105
Leningrad	1	RBMK-1000	3200	105
	2	RBMK-1000	3200	105
Rostov	1	WWER-1000	3000	104

Each time a safety case was prepared prior to the upgrading to evaluate the impact of reactor upgrading on the performance of safety-related systems and components of the unit, on the normal operation and upsets in the unit operation, including accidents. The findings and conclusions of this analysis were used to draw up a list of modifications to be made in the unit systems and components (i.e. reactor facility, steam turbine facility, I&C systems, electrical and other equipment), and a list of amendments to be made in the operating documentation of the unit. The safety case was developed under general coordination of the Operator with contributions from appropriate design and engineering companies and manufacturers of unit components. Also, comprehensive programmes were developed for each unit to detail the procedure of unit start-up and power raising to the upgraded value (the programmes included tests and measurements intended to confirm that the upgraded unit was performing as designed. In particular, the steady-state and dynamic modes of unit operation were studied).

The safety cases and reports on the uprate trials were reviewed by the Federal Environmental, Industrial and Nuclear Supervision Service.

6.3. Upgrading of nuclear plants

All operating nuclear plants undergo system/component modification activities every year. Modifications are planned, prepared and implemented in compliance with the Operator guides and guidelines.

In keeping with this guidance the following documents are prepared for each nuclear unit:

- a comprehensive long-term programme of modifications (for 5 years) to enable long-term planning of the activities;
- annual modification plans for the purpose of routine planning and organisation of work.

In addition to the annual routine modifications carried out at all units irrespective of their operation time so far, there are large-scale upgrading activities at the plants aimed at unit preparation for life extension. These include:

- technical modifications intended to ensure unit safety in the extra time of its operation (beyond the original design life);
- replacement of components on expiry of their lifetime;
- measures to increase unit efficiency and capacity factor;
- actions to increase generation at the operating units.

The above activities are included in the unit life extension investment project and are implemented before the end of the original design life of the unit (before obtaining a licence for unit operation beyond its original design life).

The key upgrading activities performed at Balakovo (Units 1-4), Beloyarsk (Unit 3), Bilibino (Units 1-4), Kalinin (Units 1-3), Kola (Units 1-4), Kursk (Units 1-4), Leningrad (Units 1-4), Rostov (Unit 1) and Smolensk (Units 1-3) plants are listed in Appendix 3.

In conclusion, it should be pointed out that the provisions of Article 6 of the Convention on Nuclear Safety are fulfilled for all operating nuclear units.

The technical and organisational measures that are being implemented at the plants allow maintaining acceptable safety level of existing Russian NPPs.

Article 7. Legislative and Regulatory Framework

Regulation of relations in the area of nuclear energy is performed on the basis of the Russian Federation Constitution as the Basic Russian Law that has the supreme legal effect and direct action in the Russian Federation.

Part 4 of Article 15 of the Russian Federation Constitution establishes the top priority of the international agreements concluded by the Russian Federation over other documents in the national legislative system (including the Convention on Nuclear Safety ratified by the Russian Federation, and Vienna Convention on Liability for Nuclear Damage, Joint Convention on Safe Management of Spent Fuel and Radioactive Waste, Convention on Early Notification of Nuclear Accidents, Convention on Physical Protection of Nuclear Materials, and other international agreements ratified by the Russian Federation and taking precedence over the federal laws).

Legal regulation of safety in the field of nuclear energy relies on the federal laws of the Russian Federation and by-laws – regulatory legal acts of the President of the Russian Federation and the Government of the Russian Federation, federal rules and regulations on nuclear energy, regulatory documents of nuclear safety authorities, as well as technical regulations, national standards and codes.

7.1. Federal laws

The following laws constitute the legal basis for nuclear energy regulation in the Russian Federation:

- Federal Law No. 170-FZ of 21 November 1995 "On the Use of Atomic Energy";
- Federal Law No. 3-FZ of 9 January 1996 "On the Radiological Safety of the Public".

It is worth mentioning the following laws regulating various aspects of nuclear energy use:

- Federal Law No. 7-FZ of 10 January 2002 "On the Environmental Protection";
- Federal Law No. 184-FZ of 27 December 2002 "On the Technical Regulation";
- Federal Law No. 13-FZ of 5 February 2007 "On the Specifics of Management and Handling of Assets and Shares of the Organisations Performing Activities in the Field of Nuclear Energy and on Making Amendments in Some Legal Acts of the Russian Federation";

- Federal Law No. 294-FZ of 26 December 2008 "On Protecting the Rights of Juridical Bodies and Individual Entrepreneurs in the Context of State Control (Supervision) and Municipal Control";
- Federal Law No. 317-FZ of 1 December 2007 "On the State Corporation for Atomic Energy "Rosatom";
- Federal Law No. 318-FZ of 1 December 2007 "On Amending Some Legal Acts of the Russian Federation in Connection with the Adoption of the Federal Law "On the State Corporation for Atomic Energy "Rosatom";
- Federal Law No. 52-FZ of 30 March 1999 "On the Sanitary and Epidemiological Well-Being of the Public";
- Federal Law No. 190-FZ of 29 December 2004 "City Development Code of the Russian Federation";
- The Penal Code of the Russian Federation, No. 63-FZ of 13 June 1996;
- The Russian Federation Code of Administrative Offences, No. 195-FZ of 30 December 2001;
- Water Code of the Russian Federation, No.74-FZ of 3 June 2006;
- The Russian Federation Law No. 2395-1 of 21 February 1992 "On Mineral Resources";
- Federal Law No. 174-FZ of 23 November 1995 "On Environmental Assessment".

The basic provisions of the federal laws "On the Use of Atomic Energy", "On the Radiological Safety of the Public", "On the Technical Regulation", "On the Environmental Protection" and of the RF Penal Code and the RF Code on Administrative Offences were discussed in the previous National Reports of the Russian Federation.

Some amendments have been made in the federal laws on nuclear energy use since the submittal of the Fourth National Report of the Russian Federation.

Russia adopted the Federal Law No. 317-FZ of 1 December 2007 "On the State Corporation for Atomic Energy "Rosatom" which gave the State Corporation for Atomic Energy "Rosatom" (State Corporation "Rosatom") the authority to carry out, in the name of the Russian Federation, state management of the use of nuclear energy in accordance with Chapter IV of the Federal Law "On the Use of Atomic Energy", and perform legal regulation in the field of nuclear energy. The Federal Law No. 317-FZ defines the purpose of establishing of the State Corporation "Rosatom", its legal status, organisational principles and goals, as well as the basic principles of managing Rosatom activities, its reorganisation and liquidation. The Law has set the following goals for Rosatom:

Article 7

- Rosatom is set up and shall operate to implement the state policy, perform legal regulation, render state services, and manage the state assets in the field of the use of nuclear energy, advancement and safe functioning of the organisations belonging to the nuclear power and industry complex of the Russian Federation, assurance of nuclear and radiation safety, non-proliferation of nuclear materials and technologies, further development of nuclear science, engineering and industry-specific education, and international cooperation in this area;
- Rosatom is meant to provide conditions and mechanisms ensuring safe use of nuclear energy and perform consolidated management of the organisations belonging to the nuclear power and industry complex of the Russian Federation and operating within the domains of nuclear and radiation safety, nuclear science and engineering, and training;
- Rosatom shall provide implementation of the state policy in nuclear industry development.

The Federal Law No. 318-FZ of 1 December 2007 "On Amending Some Legal Acts of the Russian Federation in Connection with the Adoption of the Federal Law "On the State Corporation for Atomic Energy "Rosatom" made several amendments in the Federal Law No. 170-FZ of 21 November 1995 "On the Use of Atomic Energy":

- Being an authority managing the nuclear energy use, the State Corporation for Atomic Energy "Rosatom" makes decisions on siting nuclear facilities, radioactive sources and storage facilities which belong to the federal property or have federal or cross-regional importance, in keeping with the procedure prescribed by the Russian law and in compliance with the Federal Law "On the State Corporation for Atomic Energy "Rosatom";
- The State Corporation for Atomic Energy "Rosatom" is authorized to manage the use of nuclear energy on behalf of the state. An appropriate amendment was made in Article 20 of the Federal Law "On the Use of Atomic Energy";
- Article 23 of the Federal Law "On the Use of Atomic Energy" was amended to say that the state regulation of the safe use of nuclear energy includes the activities of the State Corporation for Atomic Energy "Rosatom" in addition to relevant federal executive authorities stipulated previously;
- The State Corporation for Atomic Energy "Rosatom" is authorized to make decisions on early decommissioning of nuclear facilities, radioactive sources and storage facilities. Also, Rosatom is liable for the losses resulting from early decommissioning decisions and decisions to restrict operation of

nuclear installations, radioactive sources and storage facilities made for the reasons other than technical or environmental.

Also, the Federal Law No. 318-FZ of 1 December 2007 "On Amending Some Legal Acts of the Russian Federation in Connection with the Adoption of the Federal Law "On the State Corporation for Atomic Energy "Rosatom" put under the RF Government authority the decisions on:

- procedure for classing nuclear facilities, radioactive sources and storage facilities as facilities of federal or cross-regional significance;
- procedure for making decisions on siting and construction of nuclear facilities, radioactive sources and storage facilities which are not owned by the state or municipalities, or do not have federal or cross-regional significance, or are not sited and constructed at closed municipalities.

The Federal Law No. 318-FZ put the expenses associated with the management of the spent nuclear fuel under a dedicated fund set up by the Operator and relevant authorities managing the use of nuclear energy.

The Federal Law No. 160-FZ of 23 July 2008 "On Amending Some Laws of the Russian Federation in Connection with the Improvement of the Implementation of RF Government Authorities" introduced amendments in the federal laws "On the Use of Atomic Energy", "On the Radiological Safety of the Public", and "On the Technical Regulation". These amendments are related to the functions performed by the RF Government:

- the function to identify medical contra-indications to particular activities in the field of nuclear energy, job positions for which the contra-indications are relevant, and requirements for pertinent medical and psycho-physiologic examinations was transferred from the RF Government to a federal executive authority authorized by the RF Government;
- the function to endorse the procedure for preparing health physics certificates ("passports") of organisations and territories was transferred from the RF Government to a federal executive authority authorized by the RF Government.

The Federal Law No. 374-FZ of 27 December 2009 "On Amending Article 45 in Part 1 and Chapter 25.3 in Part 2 of the RF Tax Code and Some Russian Laws..." complemented Article 26 of the Federal Law "On the Use of Atomic Energy" with Part 7 which establishes that "a state due shall be paid as prescribed by the Russian law on taxes and dues for a permit (licence) issued by a state safety authority for performing activities related to the use of nuclear energy, and for permit/licence re-issue or renewal".

The Federal Law No. 377-FZ of 27 December 2009 "On Amending Some Russian Laws in Connection with the Enactment of the Provisions of the RF Penal Code and RF Penal Enforcement Code Concerning the Limitation-of-Freedom Punishment" amended Article 215 of the Penal Code of the Russian Federation to increase liability for safety violations at nuclear facilities that could, or did, lead to human death or contamination of the environment.

In 2008 the Federal Law No. 294-FZ of 26 December 2008 was adopted "On Protecting the Rights of Juridical Bodies and Individual Entrepreneurs in the Context of State Control (Supervision) and Municipal Control". The provisions of this law concerning restrictions related to the procedure, frequency and duration of supervision activities on nuclear and radiation safety in the field of nuclear energy are to be put in force on 1 January 2011. However, this law allows "other federal laws" to set special terms for supervision of nuclear and radiation safety in the field of nuclear energy, and it is intended to do so within the timeframe established by the law by making amendments in the Federal Law "On the Use of Atomic Energy".

The state nuclear safety authorities have drafted a bill meant to amend the above law to address the specifics of nuclear and radiation safety supervision at nuclear installations and remove the obstacles on the way to effective supervision over nuclear and radiation safety. The bill is currently under review in the State Duma of the Federal Assembly of Russia.

The changes that have been made in the Russian legislation after the submittal of the Fourth National Report are in line with Russia's commitments under the Convention on Nuclear Safety.

7.2. Regulatory legal acts of the President of the Russian Federation and of the Government of the Russian Federation

In the period after the submittal of the Fourth National Report, the President of the Russian Federation and the Government of the Russian Federation have endorsed several new legal acts on various aspects of the use of nuclear energy. Also, a number of changes have been made in the earlier regulatory documents of the RF President and the RF Government.

Following the Federal Law No. 317-FZ of 1 December 2007 "On the State Corporation for Atomic Energy Rosatom", the President of the Russian Federation signed on 20 March 2008 the Presidential Decree No. 369 "On the Actions to Set Up the State Corporation for Atomic Energy "Rosatom". This Decree abolished the Federal Agency for Atomic Energy

and identified the key actions that shall be undertaken to establish the State Corporation for Atomic Energy "Rosatom".

Acting upon the Federal Law No. 13-FZ of 5 February, 2007 "On the Specifics of Management and Handling of Assets and Shares of the Organisations Performing Activities in the Field of Nuclear Energy and on Making Amendments in Some Legal Acts of the Russian Federation" (this law was described in the Fourth National Report), the RF President signed on 13 March 2009 the Presidential Decree No. 274 "On Transferring the Shares of the open joint-stock company "Nuclear Power and Industry Complex" to the State Corporation for Atomic Energy "Rosatom".

This Decree accepts the RF Government proposal to transfer to the State Corporation for Atomic Energy "Rosatom" all shares of the open joint-stock company "Nuclear Power and Industry Complex", as a property contribution of the Russian Federation.

The RF President Decrees No. 1656 of 10 December 2007; No. 460 of 8 April 2008; No. 1251 of 25 August 2008; No. 1542 of 30 October 2008; No. 517 of 7 May 2009; No. 791 of 11 July 2009; No. 1079 of 27 September 2009 made amendments in the Presidential Decree No. 556 of 27 April 2007 "On the Reorganisation of the Nuclear Power and Industry Complex of the Russian Federation" because of the changes in the list of Russian juridical bodies that may have nuclear materials in their ownership (except for the nuclear materials that may be in federal ownership only), the list of Russian juridical bodies that may have nuclear facilities in their ownership, the list of nuclear materials that may be in federal ownership only, and the timeframe for putting the shares of the open joint-stock companies owned by the state (federal ownership) as RF contribution in the authorized capital of the open joint-stock company "Nuclear Power and Industry Complex".

The Russian Federation Government has issued several new ordinances which redistributed the regulatory functions between federal executive authorities:

- The RF Government issued Ordinance No. 404 on 29 May 2008 "On the Ministry of Natural Resources and Environment of the Russian Federation" which establishes this Ministry as a federal executive authority with the functions of elaborating the state policy on and regulating the safe use of nuclear energy (except for the activities related to the development, manufacture, testing, operation and decommissioning of nuclear weapons and military nuclear power facilities). In particular, the Ministry is authorized to issue federal rules and regulations on the use of nuclear energy. This ordinance establishes that the Ministry of Natural Resources and Environment of the Russian Federation shall organize and provide, within its authority, the fulfillment of commitments arising from the international agreements of the Russian Federation, as pertaining to the

Ministry domain. The Ministry shall coordinate and oversee the activities of the services within its jurisdiction, including the Federal Environmental, Industrial and Nuclear Supervision Service;

- The RF Government Ordinance No. 219 of 10 March 2009 made amendments in the RF Government Ordinance No. 412 of 3 July 2006 "On the Federal Executive Authorities and Authorized Organisations Performing State Management of the Use of Nuclear Energy and State Regulation of the Safe Use of Nuclear Energy" to include the Ministry of Natural Resources and Environment of the Russian Federation in the authorities performing state regulation of the safe use of nuclear power;

- On 20 September 2008 the RF Government issued Ordinance No. 705 "On the Long-Term Programme of Activities of the State Corporation for Atomic Energy "Rosatom" (2009-2015)", which cancelled since 1 January 2009 the implementation of the targeted federal programme "Development of the Nuclear Power and Industry Complex of Russia in 2007-2010 and to 2015" and endorsed the "Long-Term Programme of Activities of the State Corporation for Atomic Energy "Rosatom" (2009-2015)".

The new Programme includes:

- actions to upgrade the operating nuclear plants;
- actions to provide serial construction of nuclear units and completion of the projects already in the advanced stage of construction;
- actions to provide personnel for the programme of serial construction of nuclear plants etc.;
- actions to increase total nuclear capacity in Russia to 33 GWe by 2015;
- actions to raise the share of nuclear generation to 18.6 % of total electricity production in the country.

The Programme envisages completion of the projects already in the advanced stage of construction (Rostov 2, Kalinin 4, Beloyarsk 4); construction of new units at the sites of the operating nuclear plants, and construction of new nuclear plants both in the immediate vicinity to the existing NPP sites and at new sites (Novovoronezh NPP-2, Leningrad NPP-2, Seversk NPP, Tver NPP, Kola NPP-2, Baltic NPP).

The targets will be met owing to expansion of the nuclear industry capabilities through further development of the nuclear power and industry complex; advancement of nuclear science and technology; enhancement of the capabilities for ensuring nuclear and radiation safety, and by improving the state management of the use of nuclear energy;

- The RF Government Ordinance No. 239 of 7 April 2008 made amendments in the "Regulation on Development and Approval of Federal Rules and Regulations in the Field of Nuclear Energy" endorsed by the RF

Government Ordinance No. 1511 of 1 December 1997, because of the changes in the current list of nuclear rules and regulations;

- The RF Government Ordinance No. 351 of 22 April 2009 "On Amending Some Acts of the Russian Federation Government" introduced amendments in the RF Government Ordinance No. 865 of 14 July 1997 "On Endorsing the Regulation on Licensing Activities in the Field of Nuclear Energy" because of the transfer of some functions related to establishing the procedure of licensing activities in the field of nuclear energy from the Federal Environmental, Industrial and Nuclear Supervision Service to the RF Ministry of Natural Resources and Environment;

- The RF Government issued Ordinance No. 888 of 26 November 2008 "On Endorsing the Regulation on the State Corporation for Atomic Energy "Rosatom" which defined the way Rosatom should perform its functions;

- The RF Government Ordinance No. 404 of 29 May 2008 made some amendments in the "Regulation on the Federal Environmental, Industrial and Nuclear Supervision Service" endorsed by the RF Government Ordinance No. 401 of 30 July 2004, because of Rostekhnadzor transfer under the RF Ministry of Natural Resources and Environment and transfer of some of Rostekhnadzor functions to the Ministry (these changes are described in more details in the chapter discussing the fulfillment of Article 8 of the Convention);

- Several amendments have been made in the RF Government Ordinance No. 377 of 3 April 1996 "On Adopting the Convention on Nuclear Safety" by the RF Government Ordinance No. 351 of 22 April 2009: "to fulfill the provisions of the Convention, appoint the RF Ministry of Natural Resources and Environment as Regulator authorized to issue national requirements and regulatory provisions on the safety of nuclear facilities; the Federal Environmental, Industrial and Nuclear Supervision Service as Regulator authorized to license nuclear facilities and prohibit operation of unlicensed nuclear facilities, to oversee and appraise nuclear facilities to check adherence to current regulations and licence terms and conditions, to ensure fulfillment of current regulations and licence terms and conditions; appoint the State Corporation for Atomic Energy "Rosatom" as an authority for using the nuclear energy.

7.3. Federal rules and regulations on the use of nuclear energy

According to the Federal Law "On the Use of Atomic Energy", the RF Government Ordinances No. 1511 of 1 December 1997 and No. 404 of 29 May 2008, the Ministry of Natural Resources and Environment of the Russian Federation (Minprirody of Russia) issues, on its own, federal rules and regulations to establish mandatory requirements for the assurance of

nuclear and radiation safety (except for sanitary and hygiene requirements) and requirements for the national systems of accounting and control of nuclear materials, radioactive materials and radioactive waste. Federal rules and regulations also specify procedures for investigation and reporting of operational events at nuclear facilities and establish rules for early notification of state authorities of various levels, managing authorities and other stakeholders about operational events at nuclear facilities.

Several new federal rules and regulations have been developed since the submittal of the Fourth National Report to bring the regulatory requirements in line with the existing science and technology level considering both Russian and international experience in the area of nuclear energy.

Considering that before May 2008 the issue of federal rules and regulations in the area of nuclear energy had been a function of the Federal Environmental, Industrial and Nuclear Supervision Service and that after May 2008 this function was transferred to the RF Ministry of Natural Resources and Environment, some new federal rules and regulations were put into force by Rostekhnadzor while others were introduced by Minprirody of Russia.

The list of the new federal rules and regulations put into force after the submittal of the Fourth National Report is given in Appendix 4.

7.4. Documents approved by the Federal Environmental, Industrial and Nuclear Supervision Service

Before 2009 one of major types of legal acts issued by the Federal Environmental, Industrial and Nuclear Supervision Service was guidance documents which regulated its activities. At present, instead of the guidance documents the Service issues the so-called Regulations which give methodological directions on the implementation of the state functions of licensing and supervision under the Service's authority.

Another type of documents developed and approved by the Federal Environmental, Industrial and Nuclear Supervision Service is safety guides which describe ways and methods acceptable to the Regulator for fulfilling requirements of federal rules and regulations. In January 2010 an order was issued to endorse the Rules for Developing and Amending the Guides on Regulations Supervising the Safety of Facilities Using Nuclear Energy (safety guides) to replace the expired Gosatomnadzor of Russia Order No. 103 of 10 December 2001 "On Endorsing the Instructions on the Development and Revision of Safety Guides in the Area of Nuclear Energy".

The list of guidance documents and safety guides developed and enacted by the Federal Environmental, Industrial and Nuclear Supervision

Service in the period after the submittal of the Fourth National Report is given in Appendix 5.

Thus, the Russian Federation has an effective legislative and regulatory framework, which regulates the issues related to the provision and regulation of the safety of nuclear installations. The evolutionary changes in this framework are meant to strengthen the Regulator's role and enhance its efficiency, as well as to improve the existing rules and regulations establishing requirements for the safe use of nuclear energy taking into account the plans for further expansion of the nuclear power sector.

Article 8. Regulatory Body

8.1. Authorities and duties of the Regulatory Body

According to the Convention on Nuclear Safety, Regulatory Body is "any body or bodies given the legal authority by that Contracting Party to grant licences and to regulate the siting, design, construction, commissioning, operation or decommissioning of nuclear installations".

Before May 2008 the Regulatory Body in Russia was the Federal Environmental, Industrial and Nuclear Supervision Service (Rostekhnadzor). The RF Government Ordinance No. 404 of 29 May 2008 transferred some Regulator functions to the Ministry of Natural Resources and Environment of the Russian Federation (Minprirody of Russia).

In keeping with the RF Government Ordinance No. 404 of 29 May 2008 the Ministry of Natural Resources and Environment of the Russian Federation performs the following functions:

- elaborates the state policy and performs legal regulation on the safe use of nuclear energy (except for the activities related to development, manufacture, testing, operation and decommissioning of nuclear weapons and military nuclear power facilities);
- organises and provides, within its authorities, the fulfillment of commitments arising from the international agreements of the Russian Federation;
- coordinates and looks after the activities of the Federal Environmental, Industrial and Nuclear Supervision Service;
- brings in to the Russian Federation Government draft federal laws, draft legal acts of the RF President and the RF Government, and other documents subject to endorsement by the Russian Federation Government, as pertaining to its own domain and to the domain of the Federal Environmental, Industrial and Nuclear Supervision Service under its jurisdiction;
- acting upon and to execute the Russian Federation Constitution, federal constitutional laws, federal laws, acts of the Russian Federation President and the Russian Federation Government, establishes on its own the following types of legal regulatory documents in its area of activity:
 - federal rules and regulations in the field of nuclear energy, in compliance with the Russian legislation;
 - regulation on the procedure for giving work licences in nuclear power to nuclear facilities personnel in accordance with the list of job positions endorsed by the RF Government;

- requirements for the list and contents of documents demonstrating safety of nuclear installations, radioactive sources and storage facilities for nuclear and radioactive materials and for radioactive waste, and of nuclear energy activities subject to licensing;
- regulation on organisation and implementation of supervision over the national system of nuclear materials accounting and control;
- legal regulations on other aspects of its area of authority, except for the issues which, according to the Russian Federation Constitution, federal constitutional laws, federal laws, the acts of the RF President and RF Government, shall be regulated only by the federal constitutional laws, federal laws and legal acts issued by the RF President and the RF Government;
- As defined in the RF Government Ordinance No. 404 of 29 May 2008, when implementing legal regulation in its area of authority, the RF Ministry of Natural Resources and Environment:
 - brings in to the Russian Federation Government draft federal laws, draft legal acts of the RF President and the RF Government, and other documents subject to endorsement by the Russian Federation Government, on the issues pertaining to its own domain and the domains of the federal services and federal agencies under its jurisdiction;
 - following the prescribed procedure, submits to the RF Government proposals on establishing, reorganizing and abolishing organisations under its own authority and the authority of the federal services and federal agencies under its jurisdiction;
 - has the right to give mandatory directions to heads of the federal services and federal agencies under its jurisdiction;
 - has the right to suspend, if necessary, decisions of the federal services and federal agencies under its jurisdiction (of their heads) or cancel these decisions unless otherwise prescribed by a federal law;
 - issues orders that have regulatory status.

According to the RF Government Ordinance No. 404 of 29 May 2008, the RF Ministry of Natural Resources and Environment has no authority to perform functions of oversight and supervision.

According to the RF Government Ordinance No. 401 of 30 July 2004, the Federal Environmental, Industrial and Nuclear Supervision

Service has the following authorities in its area of activity, in compliance with the federal laws, acts of the RF President and the RF Government, and legal regulations of the RF Ministry of Natural Resources and Environment:

- provide oversight and supervision within the established authority over:
 - adherence to the rules and regulations in the area of nuclear energy; fulfilment of the terms and conditions of permits (licences) for carrying out activities in the field of nuclear energy;
 - nuclear, radiation, industrial and fire safety (at nuclear installations);
 - physical protection of nuclear installations, radioactive sources, storage facilities for nuclear and radioactive materials; national systems for accounting and control of nuclear and radioactive materials and radioactive waste;
 - fulfilment of international commitments of the Russian Federation in the area of safe use of nuclear energy;
 - within its area of authority, fulfilment of the requirements of the Russian legislation pertaining to the management of the radioactive waste;
 - timely return of spent fuel assemblies of nuclear reactors and relevant reprocessing products to the supplier country, with which the Russian Federation has an international agreement on importing to the Russian Federation spent fuel assemblies of nuclear reactors for the purpose of temporary technological storage and reprocessing with the condition of sending back the reprocessing products;
- license activities in the field of nuclear energy, in compliance with the Russian legislation;
- grant work licences to nuclear facilities personnel;
- check (by performing inspection) the fulfilment by the juridical and physical bodies of the requirements of the Russian legislation, legal regulations, rules and regulations in the field of nuclear energy;
- approve qualification reference books for managers and experts (employees), which describe requirements for the qualifications of personnel seeking licences for performing activities in the field of nuclear energy;
- approve lists of the radioisotope products whose import/export is not subject to licensing;
- organise and ensure the functioning of the system of nuclear facilities oversight in emergencies (emergency response);

- create, improve and maintain computerized information and analysis system, in particular, to be used to support the national automated system monitoring the radiation levels on the territory of the Russian Federation;
- being part to the national emergency prevention and management system, direct activities of the functional subsystems overseeing facilities presenting a nuclear and radiation hazard.

According to the Regulation, to implement its authorities in the established area, the Federal Environmental, Industrial and Nuclear Supervision Service has the right to:

- request and receive in the established manner the information necessary for making decisions on the issues included in the area of its authority;
- carry out, within its authority, necessary investigations; organise the performance of investigations, tests, reviews, analyses and assessments, as well as research related to various aspects of the oversight and supervision in the established area of authority;
- oversee the activities of regional bodies of the Federal Service and other organisations under its jurisdiction;
- following the prescribed procedure, engage scientific and other organisations, scientists and experts to deal with the issues within its domain;
- take lawful constraining and preventive measures to preclude and/or suppress violation, by legal entities and citizens, of mandatory requirements within its domain; take measures to mitigate the consequences of such violations.

The RF Government decision to transfer the Federal Environmental, Industrial and Nuclear Supervision Service under the RF Ministry of Natural Resources and Environment (the Minister is a member of the RF Government) and the legislative establishment (Article 24 of the Federal Law No. 170-FZ "On the Use of Atomic Energy") of the regulating authorities guarantee that the Russian Regulatory Body does not have assigned to it the responsibilities that could come in conflict with its safety regulation responsibilities in the field of nuclear energy.

In accordance with the current norms of the law, the decisions and actions of Rostekhnadzor management and officials (e.g., in the framework of the licensing procedure, administrative law enforcement, etc.) may be appealed, in particular, in court. Such a procedure is envisaged in the "Regulation on Licensing Activities in the Field of Nuclear Energy" (section 41) endorsed by the RF Government Ordinance No. 865 of 14 July 1997, in the "Russian Federation Code of Administrative Offences", in the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal

Environmental, Industrial and Nuclear Supervision Service", and in other regulatory acts.

The basic principles of organizing the activities of the RF Ministry of Natural Resources and Environment and of the Federal Environmental, Industrial and Nuclear Supervision Service are described in the appropriate regulations issued in compliance with the RF Government Ordinance No. 30 of 19 January 2005 "On the Standard Interface Regulation for Federal Executive Authorities".

The "Regulation on the Ministry of Natural Resources and Environment" endorsed by the Minister's Order No. 205 of 9 August 2007, describes the following provisions:

- approval procedure for the organisation and staff list of the Ministry and of its regional offices;
- powers of the Minister and Deputy Ministers;
- powers of directors of Ministry's departments;
- process for planning and organisation of the activities;
- process for preparing and formalizing decisions made by Minprirody of Russia;
- process of implementing directives in Minprirody of Russia;
- process of preparing and adopting legal regulations in the framework of the regulation in the established area of activity;
- procedure for preparing, reviewing and submitting draft acts to the Government;
- law drafting activities and procedure for participating in the law drafting activities of the Federal Assembly chambers;
- interface between the Ministry and its federal services and federal agencies; implementation of the Ministry's powers related to coordination and oversight of their activities;
- rules for arranging interface between the Ministry and the organisations under its jurisdiction;
- rules for interfacing with judicial bodies;
- procedure for handling various types of appeals;
- procedure for handling appeals of organisations and members of the public;
- procedure for providing access to information about the Ministry's activities.

The "Regulation on the Federal Environmental, Industrial and Nuclear Supervision Service" endorsed by the Chairman of the Federal Service in his Order No. 724 of 24 July 2006, stipulates, in particular, the following:

- approval procedure for the organisation and the staff list of the Federal Service and its regional offices;

- powers of the Chairman and Deputy Chairmen of the Federal Service; principles of dividing powers between Deputy Chairmen;
- powers of heads of the Federal Service departments;
- procedure for the Federal Service development of administrative regulations for implementing functions and rendering services on behalf of the state;
- process for planning and setting targets for the Federal Service activities;
- rules of the Federal Service participation in the preparation of documents used to develop a long-term financial plan of the Russian Federation and a draft federal law on the next-year federal budget;
- order of planning activities of the Federal Service management, of going on business trips and having vacations;
- procedure for preparation and formal documenting of Federal Service decisions;
- process of implementing directives in the Federal Service;
- procedure for preparation and review by the Federal Service of the draft acts to be submitted to the RF Government;
- process of interfacing with judicial bodies;
- procedure for handling appeals received by the Federal Service;
- procedure for providing access to information about the Federal Service activities.

The Federal Environmental, Industrial and Nuclear Supervision Service performs its activities employing a quality assurance system that meets the requirements of the "Quality Assurance Regulation..." currently in force in Rostekhnadzor.

8.2. Regulatory Body organisation

The Ministry of Natural Resources and Environment of the Russian Federation implements the legal regulation functions assigned to it in the field of nuclear energy through its headquarters and the federal executive bodies under its jurisdiction. The organisational chart of the Ministry of Natural Resources and Environment of the Russian Federation is presented in Figure 8.1.

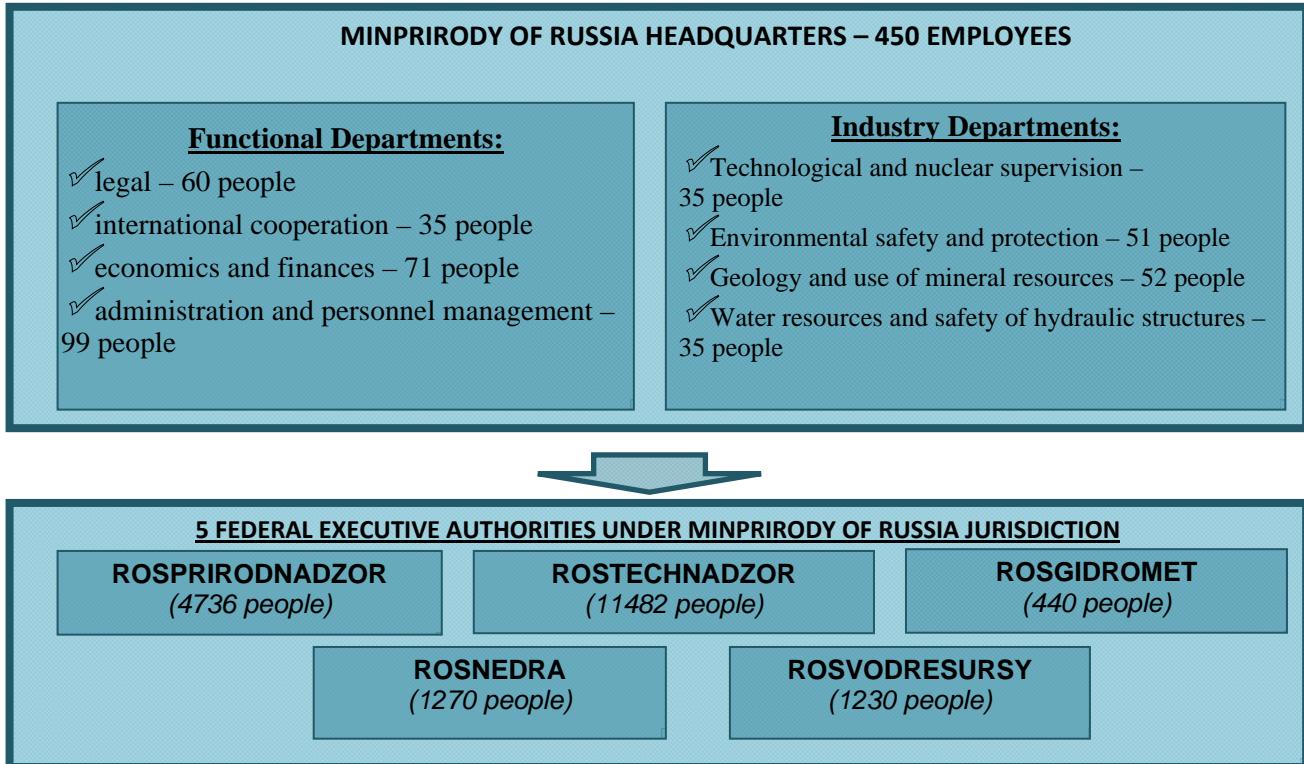


Figure 8.1 - Organisation of the RF Ministry of Natural Resources and Environment

Figure 8.2 shows the interface between Minprirody of Russia departments as regards the implementation of the functions and powers related to regulation of the safe use of nuclear energy.

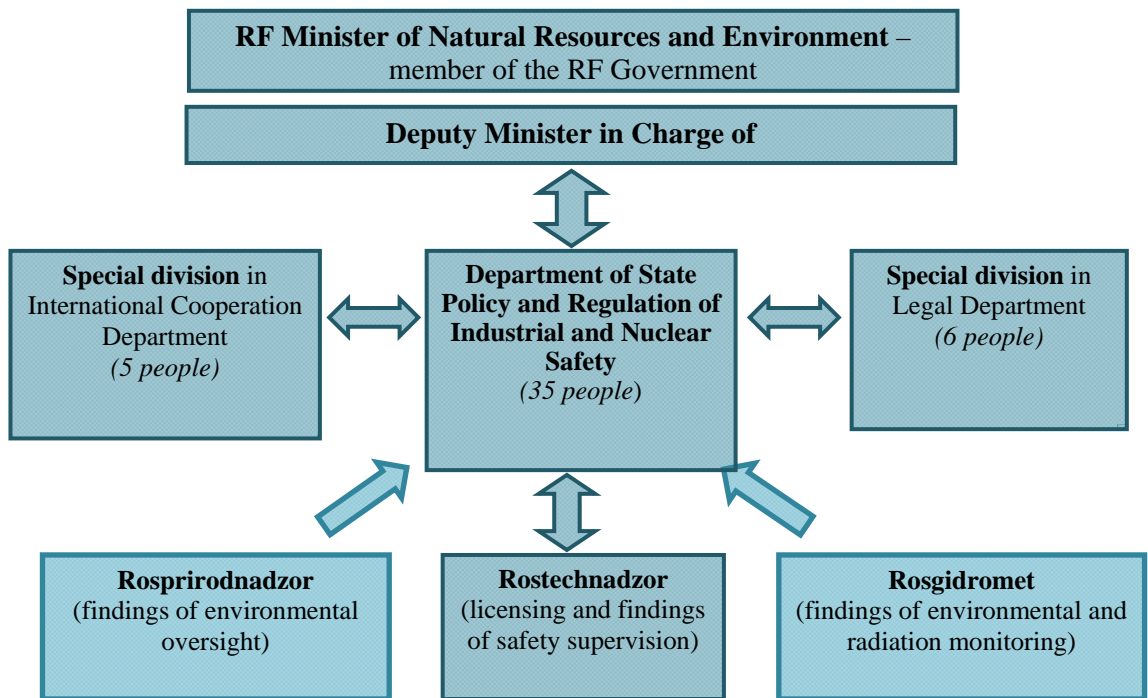


Figure 8.2 - Interface within Minprirody of Russia Pertaining to Elaboration of State Policy and Legal Regulation of the Safe Use of Nuclear Energy

The functions assigned to the Federal Environmental, Industrial and Nuclear Supervision Service on the oversight, supervision and licensing of activities in the field of nuclear energy are implemented by the headquarters (central office) and by the regional offices set up following an established procedure (in particular, by the regional offices performing supervision over nuclear and radiation safety). The organisational chart of the central and regional offices of the Federal Service (showing also staff number) is given in Figure 8.3.

Figure 8.4 shows Rostekhnadzor headquarters departments engaged in the regulation of nuclear and radiation safety, and regional offices supervising nuclear and radiation safety, including on-site inspection offices overseeing nuclear and radiation safety at NPP sites.

The Federal Service has two technical support organisations on nuclear and radiation safety – the federal state-owned institution (FGU) "Scientific and Engineering Centre for Nuclear and Radiation Safety" (SEC NRS) and the federal state-owned unitary enterprise (FGUP) "Foreign Trade Organisation Safety" (VO "Safety").

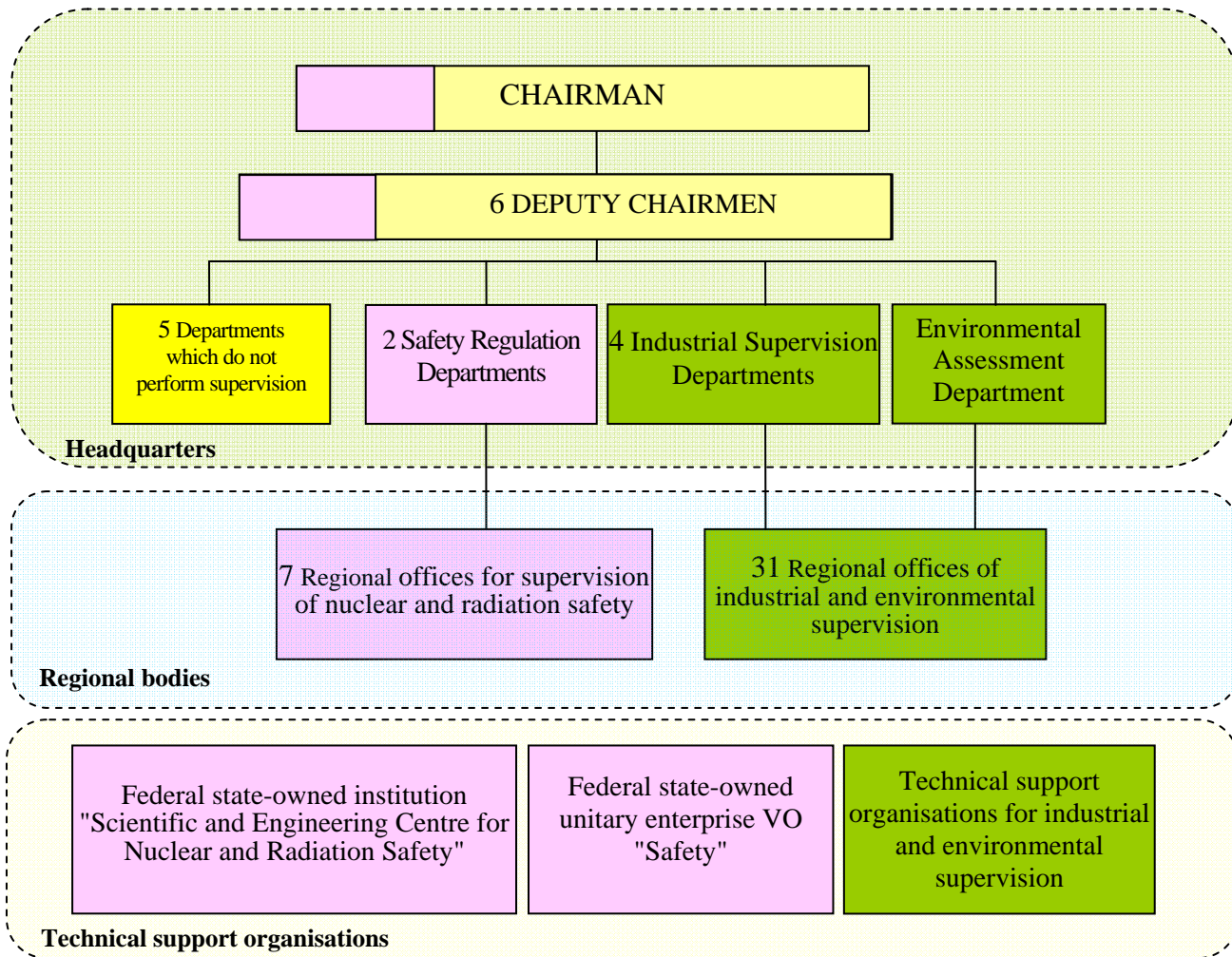


Figure 8.3 - Organisational Chart of the Federal Environmental, Industrial and Nuclear Supervision Service

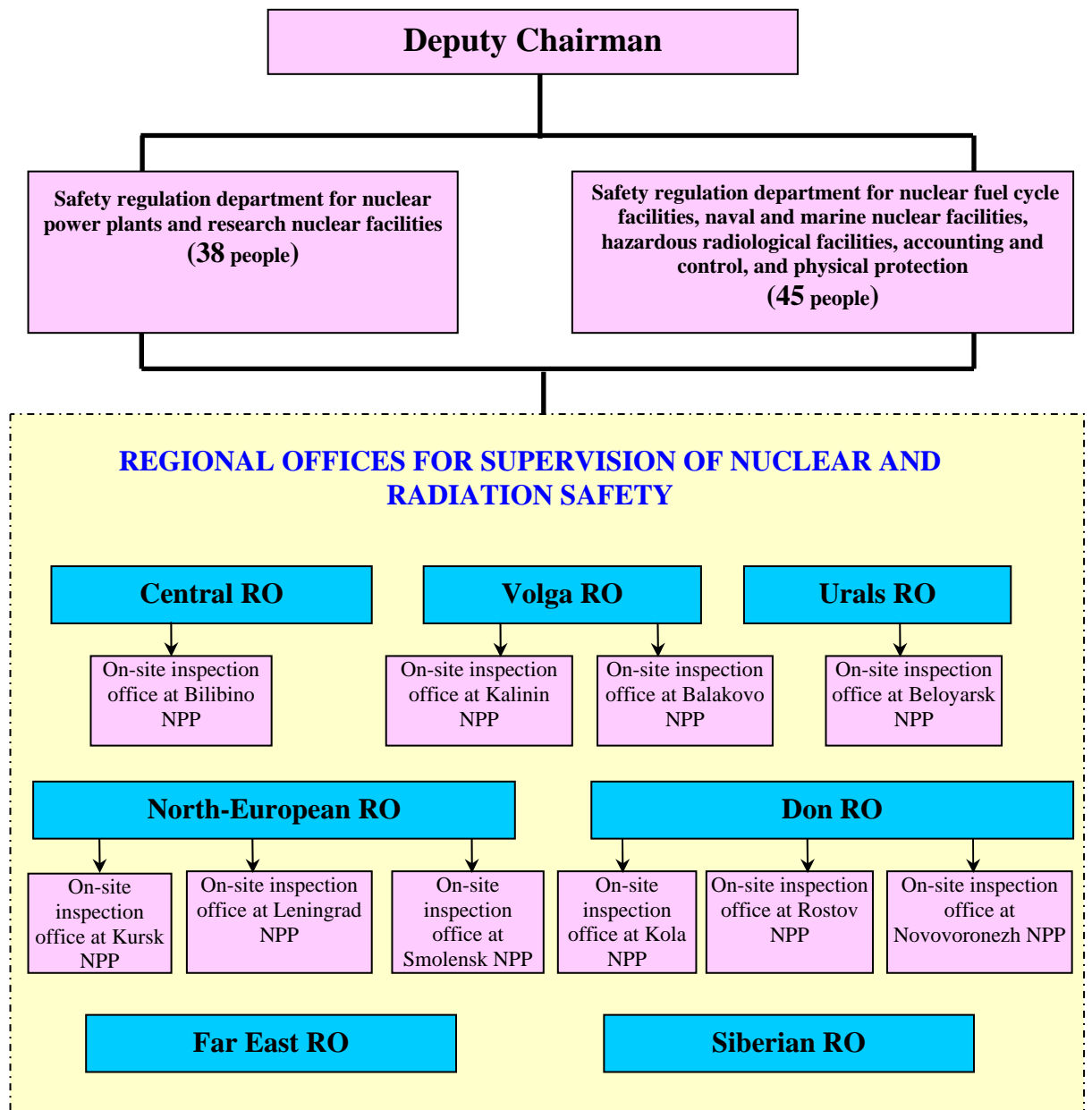


Figure 8.4 - Divisions of the Federal Environmental, Industrial and Nuclear Supervision Service Involved in the Regulation of Nuclear and Radiation Safety

The headquarters of Minprirody of Russia and of Rostekhnadzor, as well as the regional offices for supervision over nuclear and radiation safety, have the staff possessing appropriate qualifications, the requirements for which are set out in the Federal Law No. 79-FZ of 27 July 2004 "On the State Public Service", in the RF President Decree No. 1131 of 27 September 2005 "On Qualification Requirements for State Public

Service Experience (or Other State Service) or Professional Experience for Federal State Public Employees", and in other legal regulations.

The qualifications of Minprirody of Russia and Rostekhnadzor employees are maintained on a regular planned basis, in the framework of a proficiency enhancement system in place in the Ministry and in the Federal Service, which includes:

- the IT hardware and software tools which support functioning of the national computerized system monitoring the radiation levels on the territory of the Russian Federation;
- additional professional training programmes, proficiency enhancement courses;
- educational institutions providing appropriate content and quality of the additional professional training of state employees;
- Minprirody of Russia and Rostekhnadzor divisions managing the proficiency enhancement system.

The data on the actual numbers of staff in the regional offices for nuclear and radiation safety supervision with the Federal Environmental, Industrial and Nuclear Supervision Service in 2009 is given in Appendix 6.

The information about the funding provided for the nuclear supervision activities of the Federal Environmental, Industrial and Nuclear Supervision Service from the federal budget of the Russian Federation in 2008-2010 is given in Appendix 7.

Following the RF Government request, an international review team on nuclear and radiation safety and on the safe management and shipment of radioactive waste visited the RF Ministry of Natural Resources and Environment on 16-27 November 2009 to render an Integrated Regulatory Review Service (IRRS). The IRRS reviewers looked into the regulation of the nuclear plants, research reactors, radioactive waste management systems, fuel cycle facilities, radioactive sources used in industry and medicine, and other research facilities and activities. The mission reviewed the results of the self-assessment performed by the Russian safety regulation bodies; highlighted good practices and pointed out areas for improvement.

8.3. Licensing procedure and organisation of the technical reviews of safety documentation for nuclear facilities

Being a regulatory authority on licensing nuclear facilities, the Federal Environmental, Industrial and Nuclear Supervision Service takes guidance in the Federal Law No. 170-FZ "On the Use of Atomic Energy" and in the "Regulation on Licensing Activities in the Field of Nuclear Energy" endorsed by the RF Government Ordinance No. 865 of 14 July 1997. In keeping with these legal documents, Rostekhnadzor issues

licences to organisations operating nuclear facilities (for siting, construction, operation and decommissioning), handling radioactive and nuclear materials and radioactive waste, and to organisations performing activities and rendering services in the field of nuclear energy (in particular, design, engineering and manufacture services for equipment) and also to the organisations performing reviews.

As a follow up to the "Regulation on Licensing" and in keeping with the RF Government Ordinance No. 679 of 11 November 2005 "On the Procedure for Developing and Endorsing Administrative Regulation on Implementation of State Functions and Administrative Regulation on Rendering State Services", the RF Ministry of Natural Resources and Environment endorsed the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal Environmental, Industrial and Nuclear Supervision Service" by its Order No. 262 of 16 October 2008.

This document contains the following chapters:

- General provisions;
- Requirements for implementing the state function of licensing activities in the field of nuclear energy;
- Administrative procedures;
- Procedure and ways of checking implementation of the state function;
- Procedure for appealing against actions (lack of actions) of officials and decisions made while implementing the state function of licensing activities in the field of nuclear energy;
- 19 appendices.

To arrange and carry out a safety review on a nuclear facility in the framework of licensing procedure, the Federal Environmental, Industrial and Nuclear Supervision Service enlists the services of two expert organisations – FGU "Scientific and Engineering Centre for Nuclear and Radiation Safety" (SEC NRS) and FGUP "Foreign Trade Organisation Safety" (VO "Safety").

In 2007 SEC NRS performed 172 reviews on the safety of nuclear facilities and of their modifications; in 2008 – 145 reviews, and in 2009 – 188 reviews.

Currently, 72 people in SEC NRS are dealing with the organisation and conduct of NPP safety reviews in the framework of licensing procedure (including 11 managers, 55 experts and 6 technical staff members).

Experts from other organisations take part in the safety reviews in addition to the SEC NRS staff. They work under personal contracts (SEC NRS data base currently includes over 330 external experts).

The funding of the safety review services of the SEC NRS amounted to RUR 146.6 mln. in 2007; RUR 153.9 mln. in 2008, and RUR 228.5 mln. in 2009.

The actual number of VO "Safety" staff dealing with NPP safety reviews is currently 37 people.

VO "Safety" invites external experts to review the documentation (199 experts were invited in 2008 and 183 in 2009).

NPP safety review funding was RUR 38.77 mln. in 2007, RUR 76.07 mln. in 2008, and RUR 18.93 mln. in 2009 coming from extra-budgetary funds (contracts and international activity).

8.4. Technical support organisations for the Regulatory Body

FGU "Scientific and Engineering Centre for Nuclear and Radiation Safety" (SEC NRS) and FGUP "Foreign Trade Organisation "Safety" (VO "Safety") provide technical support to the RF Ministry of Natural Resources and Environment and to the Federal Environmental, Industrial and Nuclear Supervision Service on the issues related to nuclear and radiation safety.

SEC NRS provides scientific and technical support to the national nuclear safety regulation authorities in the following areas:

- development of legal regulatory documents on nuclear energy;
- development and revision of federal rules and regulations on nuclear energy;
- organisation and performance of safety reviews in the area of nuclear energy;
- scientific studies to justify nuclear and radiation safety principles and criteria;
- organisation of and actual certification of software;
- routine activities requested by Minprirody of Russia and Rostekhnadzor headquarters.

In 2007-2009 SEC NRS reviewed 5 federal rules and regulations that were then approved by Minprirody of Russia (and prior to the reorganisation, by Rostekhnadzor), 5 safety guides, and 16 guidance documents. In 2007 the Centre prepared and issued an updated version of the list of regulations used by Rostekhnadzor in safety regulation. At present SEC NRS is preparing a new version of the list of regulations.

Also SEC NRS has been reviewing draft documents of the IAEA. In 2007-2009 the Centre reviewed 16 draft IAEA safety standards, made comments and remarks and sent them to the authors.

In the reported period SEC NRS has performed some activities to harmonise safety requirements for the nuclear plants with the reference

levels proposed by the West-European Nuclear Regulators Association (WENRA).

By today SEC NRS has produced reports on the findings of this comparison and made proposals for further improving the safety requirements for Russian nuclear plants.

SEC NRS developed for the state authorities regulating nuclear and radiation safety and has been maintaining a full-text electronic data base on the nuclear regulatory documents currently in force in the Russian Federation.

On request from the Federal Environmental, Industrial and Nuclear Supervision Service, SEC NRS analyses operational events at NPPs and issues annual summary assessment reports on the operational safety of the plants based on the analysis of the data submitted to the Regulatory Body by the Operating Organisation. The Centre maintains an electronic data base on the operational events at the plants ("ISI-Nadzor"), which is used by Rostechnadzor in its regulatory activities.

SEC NRS has a Software Certification Council which incorporates several sections. Both, the SEC NRS staff, prominent scientists from Russian research, academic and educational institutions, and experts from the front-edge nuclear companies participate in the Council's activities. As of December 2009, there existed valid certificates for 157 software products in various areas (neutronics, thermal hydraulics, strength analysis, radiation safety, PSA, etc.). Of these, 47 computer codes were certified in 2007-2009. According to the federal rules and regulations, certification is mandatory for software used to perform the safety analysis of the plants.

SEC NRS has a quality management system for scientific research, development of regulatory documents, and review of safety case documents, which has been certified within the ISO 9001:2000 system.

SEC NRS publishes an official journal of Minprirody of Russia and Rostechnadzor – "Nuclear and Radiation Safety" which contains draft and official texts of regulations and articles written by people working in Minprirody of Russia, Rostechnadzor, its technical support organisations and other companies, on the vital issues of nuclear and radiation safety regulation.

VO "Safety" assists Rostechnadzor in:

- reviewing the upgrades undertaken at Russian NPPs in the framework of licensing procedure;
- supervising over accounting, control and physical protection of nuclear materials; training inspectors and developing regulations in this area;
- developing a methodology for licensing enterprises reprocessing weapons-grade plutonium and producing MOX fuel.

In conclusion, it should be pointed out that the Russian Federation has independent Regulatory Bodies – the Ministry of Natural Resources and Environment of the Russian Federation and the Federal Environmental, Industrial and Nuclear Supervision Service.

The Ministry of Natural Resources and Environment of the Russian Federation and the Federal Environmental, Industrial and Nuclear Supervision Service have human, financial and technical resources that allow them to perform the assigned functions while maintaining their independence.

Article 9. Responsibility of Licence Holder

In accordance with Article 26 of the Federal Law No. 170-FZ "On the Use of Atomic Energy", any activity in the area of nuclear energy subject to licensing by the state safety regulation authorities is not allowed if there is no permission (licence) for this activity.

The Federal Law "On the Use of Atomic Energy" (Article 34) sets out that the full responsibility for the safety of a nuclear facility as well as for the proper management of nuclear materials and radioactive substances rests with the Operating Organisation, i.e. licence holder.

The open joint-stock company "Rosenergoatom Concern" shall perform the function of the Operator of the Russian nuclear plants in compliance with the Russian legislation and its own Charter.

The open joint-stock company "Rosenergoatom Concern" has full responsibility for the safety of Russian NPPs and for the proper management of nuclear materials and radioactive substances in its possession. This responsibility is not removed from the Operator because of the activities of other enterprises and organisations performing works or giving services to the Operator.

According to the Operating Organisation's Charter, the Deputies of the Director General of Rosenergoatom – directors (managers) of Rosenergoatom subsidiaries – operating nuclear power plants manage the production and financial-economic activity of their subsidiaries (nuclear plants) and are responsible for NPP safety in compliance with the approved Subsidiary Regulations and their labour contracts. The plant managers act within the authorities described in the authority certificates issued by Rosenergoatom Director General.

While performing the functions and responsibilities set out by the Russian legislation and in the Charter, the Operating Organisation fulfils the requirements set by the Regulatory Body to implement the authorities given to the Regulator.

The Operating Organisation must inform the Regulatory Body of all cases of violations of safe operation limits and conditions; submit systematized data on all upsets in NPP operation, and submit periodic reports on the level of NPP safety and on the state of nuclear and radiation safety as requested by the Regulatory Body (within its authority).

Operator's ability to be responsible for the safety of nuclear facilities is verified by the Regulatory Body in the framework of the licensing procedure, and also when conducting inspections and reviewing the information presented by the applicant. Regulatory Body performs systematic checks of the fulfillment of the terms of the issued licences.

The detailed description of the Operating Organisation and of its mission was given in the previous National Reports of the Russian Federation.

The 1963 Vienna "Convention on Liability for Nuclear Damage" ("Vienna Convention") entered into force in the Russian Federation on 13 August 2005. This Convention proclaims essentially that:

- plant Operator has full (absolute and exceptional) liability for a potential nuclear damage to a third party in case of a radiation accident (nuclear incident) at this plant;

- Operator liability for a nuclear damage shall not be less than US\$ 5 mln. in its gold parity as of 29 April 1963;

- when seeking an operation licence for a nuclear plant the Operator shall present documented financial guarantee of its ability to cover the nuclear damage. The financial guarantee may have the form of liability insurance.

Rosenergoatom Concern is subject to the Vienna Convention. Consequently, it insures its nuclear damage liability in the Russian nuclear insurance pool to the sum that guarantees the fulfillment of the Vienna Convention. Hence, the Operator fully fulfills the international commitments of the Russian Federation regarding nuclear damage liability.

In the Russian Federation the principle of the overall responsibility of the Operating Organisation for NPP safety is established by the legislation, defined in the regulatory requirements, and is an essential organisational principle of safety assurance, which meets the requirements of Article 9 of the Convention on Nuclear Safety.

Article 10. Priority to Safety

10.1. Safety policy

One of the basic principles of legal regulation in the field of nuclear energy in the Russian Federation set out by the Federal Law No. 170-FZ of 21 November 1995 "On the Use of Atomic Energy" is safety assurance. Taking guidance in the Russian legislation, legal and other acts on nuclear energy, the Operator (Rosenergoatom) has declared in its "Policy Statement", in particular, the following principles of its activities related to the centralised management of the nuclear plants and provision of their safety:

"...Provision of NPP safety at all stages of nuclear plant life cycle is the top-priority mission of Rosenergoatom.

Rosenergoatom has given and will continue spending every effort and resources to ensure due fulfillment of the requirements of the Russian legislation concerning the use of nuclear energy. This will also include continued diligent fulfillment of the commitments resulting from the Convention on Nuclear Safety, recommendations of the codes and safety guides of the International Atomic Energy Agency (IAEA), principles and provisions of the International Nuclear Safety Advisory Group (INSAG) documents described in the "Basic Safety Principles of NPPs" and "Safety Culture".

The centralised management of the nuclear power plants has rested upon and will rely in future on the following fundamental principles:

- implement scientific, technical and economic policy giving priority to safety assurance;
- ensure due qualification, self-discipline, neatness and diligence of personnel;
- encourage commitment of personnel and organisations involved in the NPP life cycle to safety culture principles;
- recognise that Rosenergoatom's responsibility as Operator is in no way diminished because of the independent activities of designers, manufacturers and suppliers of equipment, construction companies, other enterprises and organisations, authorities managing the use of nuclear energy and safety regulation authorities..."

10.2. Safety culture and assessment of its effectiveness

Safety culture effectiveness is assessed in accordance with the IAEA recommendations given in INSAG-4 ("Safety Culture"), in Report No. 11 of the Safety Series ("Development of Safety Culture and Nuclear Safety") and INSAG-15 ("Key Practical Issues in Strengthening Safety Culture"),

and recommendations stated in the Operating Organisation's standard "Regulation on Annual Operational Safety Assessment Reports for Nuclear Plants" (STO 1.1.1.04.001.0143-2009), Section 3.6 State of Safety Culture.

The status of the plant's safety culture is reviewed and assessed based on a "Regulation on Annual Self-assessment of Safety Culture" developed by the plant.

Assessment of safety culture effectiveness is focused on three principal areas:

- safety indicators of the plant;
- analysis of the causes of events or potential errors to learn lessons;
- personnel commitment to safety enhancement in general, including the high-level management of this process.

Russian nuclear plants attach great attention to the organisation of activities encouraging safety culture awareness among personnel. The effort relies on the rules and regulations specifying requirements for the safe and reliable operation of the plants.

Special emphasis is placed on activities addressing the human factor as well as on measures aimed at prevention and correction of human errors.

Safety culture is evaluated against the safety culture indicators identified in the "Regulation on the Safety Culture Awareness Day in Rosenergoatom Concern" put into force by Rosenergoatom Order No. 1117 of 10 December 2004.

Evaluation of safety culture helped identify areas for improvement to further enhance safe and reliable operation of the plants, in particular:

- improvement of operating and maintenance procedures;
- improvements in the training of operating and maintenance personnel;
- development of additional procedures and training aids to enhance staff awareness of safety importance;
- broader use of internal and external operating experience of the nuclear plants;
- improvement of guidelines addressing the self-assessment of operational safety;
- introduction of new technologies and materials;
- introduction of symptom-based procedures.

Some plant activities are mentioned below to illustrate this point.

For example, the Novovoronezh NPP has conducted training of division managers on safety culture and its human performance (psychological) aspects. Workshops and inquiries on safety culture were undertaken in the framework of a TACIS project on human factor. The data collected at the workshops and through inquiries were then analysed to propose corrective actions.

The top management of the Kola NPP expressed its safety culture commitment in the "Policy Statement of the Kola NPP Management on the Safe Operation of the Plant".

The Smolensk NPP has the practice of appraising the factors affecting the safety culture during plant operation at the regular meetings held by the Chief Engineer.

Rosenergoatom regularly identifies the best-performing plants from the viewpoint of safety culture.

Safety culture effectiveness is also analysed during preparation of an annual summary report on unit safety. The report discusses, in particular, the level of safety culture and suggests main areas for improvement.

Thus, the 2008 summary report on the operational safety of Russian nuclear plants contains the findings of the analysis of the key performance indicators (load factor, availability factor, fuel assembly failure rates, unavailability of control and protection systems, annual collective dose). The analysis has revealed an improvement trend in the key plant performance indicators and a downtrend in the plant downtime caused by events in plant operation and equipment failures.

Investigation of operational events helps identify indicators describing the dominating causes of the events and highlight the areas of personnel activities that should be improved by developing additional safety enhancement measures.

The measures developed at the plants to enhance safety culture are also meant to improve plant performance indicators and eliminate weaknesses revealed by the analysis of direct and root causes of operational events.

10.3. Role and importance of the Regulatory Body

While performing the functions assigned to them by the Federal Law No. 170-FZ "On the Use of Atomic Energy" and by other acts and by-laws (described in Article 8 of this National Report), the Ministry of Natural Resources and Environment of the Russian Federation and the Federal Environmental, Industrial and Nuclear Supervision Service, as independent authorities, pursue the state policy on the safety regulation of nuclear facilities.

The Federal Environmental, Industrial and Nuclear Supervision Service clearly declared the goals of the nuclear and radiation safety regulation in its "Policy Statement on the State Regulation of Nuclear and Radiation Safety in the Territory of the Russian Federation". This Statement says that all activities of the state Regulatory Body are meant to provide conditions ensuring the protection of personnel, the public and the environment against unacceptable radiation impacts, and preventing

uncontrolled proliferation and use of nuclear materials. To achieve this goal the Regulatory Body:

- sets out the safety criteria, rules and regulations in the area of nuclear energy;
- organises issue of licences (permits) for activities in the area of nuclear energy;
- develops and implements NPP inspection programmes;
- applies sanctions in case of a violation of nuclear and radiation safety requirements;
- supports and conducts independent research into nuclear and radiation safety;
- advises state authorities and the public on the changes in the situation with nuclear and radiation safety.

Hence, in the Russian Federation, the authorities managing the use of nuclear energy, the nuclear plant Operator and the Regulatory Body implement the national policy which gives highest priority to safety assurance.

Article 11. Financial and Human Resources

11.1. Financial resources of the Operating Organisation

According to the RF Government Ordinance No. 731 of 30 June 1999 "On Amending the RF Government Ordinance No. 1455 of 7 December 1996 "On Including NPP Safety Expenses in the Prime Cost of the Utility Services", the activities carried out at the nuclear plants to ensure nuclear, radiation, fire and industrial safety are financed from the dedicated funds covered by the prime cost of the services rendered by the Operating Organisation using the rates endorsed by the Federal Antimonopoly Service (previously, RF Ministry for Antimonopoly Policy and Support of Entrepreneurs).

The Operating Organisation – Rosenergoatom Concern – accumulates funds necessary for ensuring safe operation of the nuclear plants.

It should be mentioned that the financial resources of the Operator have increased substantially in the last three years, which allowed expediting implementation of the safety enhancement activities at the operating plants.

For example, in 2008-2009 the Operator spent:

- RUR 4553.7 mln. to enhance nuclear, radiation, environmental, industrial and fire safety at the nuclear plants;
- RUR 55430 mln. to upgrade and backfit the operating units;
- RUR 1208.8 mln. for NPP decommissioning programmes;
- RUR 339.9 mln. for training personnel and maintaining their qualifications.

In 2010 the Operator plans to spend:

- RUR 6238.3 mln. for enhancement of nuclear, radiation, environmental, industrial and fire safety of the nuclear plants;
- RUR 29280 mln. for upgrading and backfitting of the units in operation;
- RUR 2351.3 mln. for NPP decommissioning programmes;
- RUR 277.5 mln. for training personnel and maintaining their qualifications.

11.2. Human resources of the Operating Organisation

In accordance with Article 35 of the Federal Law "On the Use of Atomic Energy" the Operating Organisation shall provide recruitment, training and maintenance of the skills of nuclear plant personnel.

In nuclear power the system of staff recruitment and training is based on relevant regulations, in particular, on the document of the Federal Agency for Atomic Energy "Organisation of Personnel Management at

Nuclear Plants" (attachment to Rosatom Order No. 60 of 15 February 2006).

This document establishes requirements for the following key aspects of personnel management at the nuclear plants:

- personnel selection and hiring procedure;
- pre-job training;
- training to maintain proficiency;
- vocational and skills improvement training.

This document is applicable also to the staff of the organisations rendering design, engineering, maintenance, commissioning and testing services for power equipment.

At present all Russian nuclear plants and support organisations are fully staffed with skilled personnel necessary for the operation, maintenance and repair of major and auxiliary equipment of nuclear plants, and for implementation of the managerial, economic and other functions.

The average payroll staff of the plants and support organisations is about 38000 people. The number and mix of NPP personnel involved in the generation is compliant with the existing regulatory documents.

As required by relevant regulations, each NPP has on its staff personnel possessing necessary professional skills and authorised, as prescribed, for doing the work on their own.

The list of job positions, requirements for personnel skills, procedure for selection, training and admission for unaided work were discussed in detail in the Third National Report of the Russian Federation.

Personnel of nuclear plants and maintenance organisations is regularly trained at the plant Training Points and dedicated Training Centres, taking periodic training courses, having individual training and periodic drills using technical aids (simulators, imitators, mock-ups).

In 2009, 25818 people from the nuclear plants were trained at the plant Training Points.

In addition, 9192 people from the plants received training at external educational institutions in 2009, in particular, 565 people in "Moscow Competence Development Institute" (MIPK "Atomenergo"); 1093 people in a non-governmental educational institution "Central Competence Development Institute" (NOU TsIPK), and 388 people in the Obninsk "State Nuclear Energy University" (IATE).

Russian system of higher education provides training of different engineers for nuclear power.

11.3. Training, education and maintenance of personnel qualifications

Rosenergoatom's system of selection, training, maintenance and enhancement of personnel qualifications plays a very important role in the provision of safe and reliable operation of the nuclear plants.

NPP Operator takes care of the selection, training, admission for unaided work and maintenance of the qualifications of operating personnel. Personnel selection and training system is aimed at attaining, checking and maintaining personnel competencies essential for ensuring safe operation of a nuclear plant in any condition, and for taking accident management actions in case of an accident.

Each NPP has a training division which incorporates a human performance ("psycho-physiological") laboratory or department. Training division has appropriate training aids as well as materials and instructors.

Personnel management activities are performed in compliance with the Russian legislation, rules and regulations on nuclear energy, and Operator documents.

Personnel management pursues the following goals:

- ascertain that the qualifications of people hired for the jobs meet work requirements, characteristics and conditions;
- provide necessary competencies before the person is admitted to working on his/her own;
- maintain the necessary competencies and enhance them in the course of the work;
- improve competences in case of changes in work conditions;
- continuously and systematically check employee competences in the course of their work.

Each NPP develops plant-specific "Annual Personnel Management Schedule" approved by the Plant Manager. The "Schedule..." is the basic document for organising personnel management activities. It contains the sections on:

- staff selection and recruitment;
- management of next-in-succession personnel;
- management of young specialists;
- training, maintenance and enhancement of personnel qualifications;
- provision of technical aids and training materials, in particular, at the plant Training Point;
- activities of the methodological council on professional training of personnel;
- organisation of the work of occupational safety section;
- organisation of the work of technical library;
- occupational forms of personnel management:

- working meetings attended by plant management;
- safety awareness days;
- occupational safety days;
- plant management rounds of the work places;
- examinations to check personnel knowledge;
- accident management, fire-fighting and emergency preparedness drills and exercises;
- evaluation of managers and specialists suitability for their job positions;
- periodic medical examinations and psycho-physiological testing;
- comprehensive and targeted inspections.

The discussion below covers some aspects of personnel management activities.

Personnel recruitment

Personnel recruitment is carried out in compliance with the qualification requirements described in the regulations. Qualification requirements for employees requiring nuclear work permits (licences) are established, in accordance with the Federal Law "On the Use of Atomic Energy", in the qualification handbook on the job positions of managers and specialists of nuclear plants.

The list of NPP job positions requiring Rostekhnadzor work permits (licences) has been approved by the RF Government.

Pre-job training

Employees possessing qualifications required by the regulations and having no medical and psycho-physiologic contra-indications for taking particular jobs are admitted for a pre-job training.

All new employees receive within a month initial training on the specifics of the plant process and occupational safety, by way of lead-in briefings in the framework of the hiring procedure, and initial briefing at a work place.

An individual training programme is developed for each employee being hired for a job or transferred to another job at a plant. The programme includes:

- theoretical instruction;
- drills using technical aids (if required for the job);
- in-situ probation (if required for the job);
- initial examination;
- shadowing (if required for the job);
- obtaining a nuclear work licence (if required for the job);
- admission for working on his/her own.

Fulfillment of individual stages and of the pre-job training programme on the whole is checked by the immediate superior of the employee being trained for the job.

To practice the plant operation skills, the training system involves the use of appropriate technical aids, such as various simulators properly authorized for use as NPP personnel training tools. Special attention is given to practicing actions in case of potential upsets in NPP operation (including accidents) and to the operational feedback to learn the lessons from past events.

Examinations

Examinations are carried out to ascertain that employees have the knowledge necessary for doing their jobs.

Plant personnel examinations include an initial check (before an employee is admitted for doing unaided job), planned and unplanned exams.

Personnel are checked for knowing:

- rules and regulations on the use of nuclear energy;
- rules and regulations on industrial safety;
- rules, regulations and instructions on occupational safety;
- rules, regulations and instructions on health physics;
- rules, regulations and instructions on fire safety;
- basic rules of NPP operation, job and process regulations.

Examination frequency has been set as follows:

- managers and specialists belonging to operating personnel have exams once every two years;
- workers belonging to operating personnel have exams once every two years;
- other categories of plant personnel undergo examinations once every three years.

Frequency of examining plant personnel authorized to handle radioactive sources, for knowing relevant health physics rules and regulations:

- managers and specialists belonging to operating personnel, and workers belonging to operating personnel: once a year;
- other plant managers and specialists: once every three years.

Examination commission is appointed by an order issued by the plant manager. The order appoints commission members and lists job positions subject to examination.

The chairperson and deputy chairpersons of the headquarters and plant examination commissions, and members of the headquarters commission take examinations for knowing occupational and industrial safety rules, regulations and instructions in the training organisations of the

federal executive authorities and executive authorities of the Russian Federation subjects.

Shadowing

Shadowing is a form of personnel management undertaken to develop appropriate work competences, including handling of operating systems and equipment under supervision and on permission of another employee in charge of the shadowing.

Shadow employee and person responsible for the shadow equally share responsibility for all actions of the shadow employee at the work place.

When doing a shadow work the employee shall have at least two individual accident management drills, including at least one fire-fighting drill.

Admission for working on one's own

Employees who have successfully completed training for the job are admitted for working on their own by a plant directive.

Employees who shall have a nuclear work permit (licence) are admitted for working on their own by a plant manager order after obtaining the licence.

Maintenance of personnel qualifications

Maintenance of personnel qualifications is an activity aimed at maintaining professional competences essential for performing the job functions. It is carried out at the plant's Training Point, in plant divisions and at dedicated training institutions.

Plant personnel qualifications are maintained based on the competence maintaining (refresher training) programmes. Annual scope of refresher training has been set at:

- main control room personnel: at least 80 hrs, including 36 hrs of simulator drills;

- other categories of NPP personnel: no less than 20 hrs.

Topical plans of refresher training programmes cover:

- study of difficult and safety important issues included in the pre-job training programme (in particular, management of design-basis and beyond-design-basis accidents, process fundamentals, safety culture principles);

- study of topics seldom encountered in practical activities;

- study of operating experience (including operational feedback and event reports; discussion of industrial accidents, process upsets, etc.);

- study of occupational safety and industrial safety issues;

- drills to practice the most important skills (including first aiding, use of protective and fire-fighting means, actions in accidents and emergencies);
- study of modifications in the attended circuits and equipment, and changes to the existing operational documentation.

Enhancement of personnel qualifications

Enhancement of plant management and specialist qualifications has the purpose of updating their professional theoretical knowledge. It comes in various forms, has the frequency of no less than once every five years, and takes place in external professional training institutions.

Other plant employees are trained in plant divisions or at the plant's Training Point to enhance their qualifications.

The Operating Organisation has the necessary financial resources to enable training of NPP personnel and maintenance of their qualifications. All nuclear plants are staffed with personnel having appropriate qualifications.

The qualifications of NPP personnel are maintained employing up-to-date technical training tools, including full-scope and analytical simulators.

Article 12. Human Factor

12.1. Ways to prevent human errors

A continued effort is made to prevent human errors and hence ensure safe operation of nuclear plants. The ways and techniques of this work depend on several factors, such as the findings of analyses of the human errors made in the course of professional activities, review of the man-machine interface, and assessment of the system of operating experience feedback.

To ensure better identification and analysis of the causes of NPP operational events and provide effective development of adequate corrective actions the Operating Organisation developed and put into force on 01.04.2005 the "Guidelines for Analysing the Causes of Operational Events at Nuclear Plants, Fires, Industrial Accidents and Damage to Buildings and Structures" (RD EO 0095-2004). This document is currently in the final stage of revision to take into account the experience of its application and the new regulations.

The Guidelines that were developed taking into account the IAEA ASSET methodology (IAEA-TECDOC-632) and methodology of the Institute of Nuclear Power Operations (INPO), USA (INPO 90-004) recommend to use the following techniques for the analysis:

- adapted ASSET methodology (IAEA);
- Task Analysis (INPO);
- Change Analysis (INPO);
- Barrier Analysis (INPO);
- Event and Causal Factor Chart (INPO);
- Fault Tree Analysis (INPO);
- Psychological Analysis of the Causes of Erroneous Actions of Personnel (developed in Russia).

The methodology developed for investigation and analysis of the causes of nuclear plant events is meant, in particular, to help establish a working atmosphere that requires:

- responsible attitude of personnel towards the problems that may upset normal operation of the plant and compromise reliable performance of plant systems and components;
- voluntary reporting of operational weaknesses and errors;
- detection of changes in personnel behaviours that may cause similar abnormal events;
- personnel training in using the cause analysis methodology for investigation of abnormal events to ensure that the entire sequence is properly described and detected, with identification of the safety significance of the event;

- availability of procedures describing personnel actions and responsibilities in the course of plant operation.

Operational events at the nuclear plants caused by human errors are investigated by a commission which always includes human performance professionals (psychologists).

During event investigation the psychologist analyses the causes of erroneous actions of personnel from the viewpoint of human performance. This helps identify the causes that have led to the human errors and factors (organisational, psychological) that triggered them, and develop appropriate measures to eliminate these causes.

The man-machine interface is reviewed as well. In particular, the work places in the main control room, central control room, other control rooms and desks at the plant have been investigated from the human factor engineering perspective. The findings were used to make recommendations to enhance lighting, improve the main control room mimic panels, ventilation and the general arrangement of the work places.

The nuclear plants have an operating experience feedback system in place. All significant upsets in the operation of plant systems and components are investigated by a commission. The investigation reveals the causes of the event, in particular, those associated with work organisation and human factor. The cause analysis findings serve to develop corrective and preventive actions to preclude the recurrence of such events.

The production divisions of the plant have monthly meetings of personnel to discuss the events that have occurred at the plant. During plant personnel examinations special emphasis is placed on ascertaining that the staff knows the symptoms of the initiation and progression of abnormal performance of the attended equipment and knows how to cope with abnormalities, including those caused by human errors.

Rosenergoatom set up and has been maintaining an Industry-level Information and Analysis System for Operating Experience of Nuclear Power Plants (OIS OE) to ensure effective use of operating experience feedback.

The system provides collection, processing, storage, analysis and dissemination of information on the operation of nuclear plants in Russia and other countries. The information serves to analyse operational events and define the actions to prevent their recurrence.

The following arrangements have been made at all Russian nuclear plants to prevent, reveal and correct human errors:

- high-quality training of operating and maintenance personnel for specific jobs (professions) using state-of-the-art technical aids and efficient educational techniques;

- periodic training courses for operating and maintenance personnel to keep their skills and competence at a level essential for the safe operation of the plant;
- psychological support to operators making critical decisions, in particular, through lectures, drills and role playing on relevant topics;
- analysis of the operating experience of Russian and other plants using the information received from various sources;
- mandatory debriefing sessions with the operating personnel to discuss abnormal performance of plant systems and components.

Implementation of these arrangements helps ensure and maintain the required knowledge and skills of the operating personnel.

12.2. Administrative, managerial and organisational decisions related to human factor

The work to prevent, reveal and correct human errors is carried out on the basis of appropriate administrative, managerial and organisational decisions. The effort is meant to organise and implement personnel training and skill maintenance activities; update and develop, considering operating experience feedback, the missing operational documentation describing professional activities of personnel providing operation and maintenance of systems and components.

Of particular importance are emergency preparedness exercises with the participation of personnel of the main plant divisions ("shops") and with the involvement of human performance specialists. The purpose of the exercises is to give personnel a chance to practice self-control techniques, have the experience of working in a team and learn how to avoid erroneous actions.

12.3. Role of the Regulatory Body with regard to human performance

The Federal Environmental, Industrial and Nuclear Supervision Service pays great attention to supervising the effort to take into account the impact of qualification, organisational and ergonomic causes of personnel errors on NPP safety assurance.

In accordance with Article 23 of the Federal Law "On the Use of Atomic Energy", some categories of plant employees (management, operating personnel and personnel overseeing nuclear and radiation safety) may perform their functions only if having appropriate permits (licences) of the Federal Environmental, Industrial and Nuclear Supervision Service.

The Russian Federation Government endorsed a list of plant job positions, for which the staff shall have a work licence in the area of nuclear energy.

One of the mandatory conditions for getting a licence is the absence of medical, in particular, psycho-physiologic contra-indications. The RF Government endorsed a list of medical contra-indications, a list of job positions, for which the contra-indications are relevant, and requirements for pertinent medical and psycho-physiologic examinations.

The RF Ministry of Natural Resources and Environment issued Order No. 13 on 29 January 2009 to endorse "The Rules for Issuing Work Licences to Nuclear Plant Personnel".

According to this document, personnel licensing procedure consists of the following steps:

- the Operating Organisation applies to the Federal Environmental, Industrial and Nuclear Supervision Service to grant a licence to a candidate licensee;
- the Federal Service reviews the application documentation;
- an ad-hoc commission checks (examines) the candidate knowledge and skills;
- the Federal Service makes a decision to grant or not to grant the licence;
- the licence is issued.

The introduction of personnel licensing system enabled a proper quality control of NPP personnel knowledge.

Supervision over personnel proficiency is regulated by the "Guidelines for Arranging Supervision over Provision of Competence of the Operating Personnel of Nuclear Plants and the Staff Overseeing Nuclear and Radiation Safety of Nuclear Plants" (RD-04-28-97) described in the Fourth National Report.

The regulatory activity incorporates the review of the outcome of the actual safety activities of plant personnel. One of the information sources for this effort is event investigation reports and annual operational safety assessment reports of the plants. The Regulatory Body is maintaining a data base on plant events.

The findings of the above reviews are presented in the annual reports containing human error statistics, information about the managerial weaknesses; description of poor safety culture examples; analysis of the direct and root causes of errors and weaknesses; overview of the corrective actions developed to prevent human error recurrence; trends in human error indicators; proposals for improving competences of managerial, operations and maintenance personnel.

Regulatory activity includes plant inspections to check the process of providing plant personnel proficiency (including checks of personnel

training at the plant Training Points, Training Centres, and on simulators), and checks of the fulfilment of the terms of the licences issued to the plant personnel.

The results of the effort made by the Federal Environmental, Industrial and Nuclear Supervision Service to address human factor in the regulatory activities, have been reported at the meetings of various IAEA working groups in the framework of experience sharing.

Analysis of plant personnel performance in recent years shows that the number of cases pointing to deficiencies in personnel training has decreased to stabilise at a certain level. For example, in 2005-2009 NPP personnel made annually, on average, 7-9 errors recorded in the event investigation reports while in 2000 the number of such errors was 19.

Hence, prevention of human errors, identification of training weaknesses and maintenance of high professional skills are of vital importance in NPP safety improvement activities.

The Russian Federation has established, at a governmental level, procedures and requirements for organizing supervision over the professional skills of the managerial, operating and other personnel of nuclear plants.

Article 13. Quality Assurance

Quality assurance (QA) is of prime importance in Russia at all stages of development, construction and operation of nuclear facilities.

The QA requirements for nuclear plants are included in the key regulatory documents in force in Russia.

The national QA policy, QA programmes for the operating plants, plants under construction and support organisations were described in detail in the Second National Report.

The QA management system functions in compliance with the QA administration structure described in the "QA Programme for Nuclear Plant Operation" – POKAS(E).

POKAS(E) consists of a set of documents describing a combination of organisational, engineering and other QA actions intended to implement safety principles established in relevant regulations and achieve the operation quality targets.

Planning and actual evaluation of the achievements are undertaken at all levels of the QA management system.

POKAS(E) programmes were revised in 2007-2010 at all NPPs to take into account the new nuclear regulations.

Rosenergoatom performs internal and external audits at each plant to evaluate POKAS(E) effectiveness in order to support the functioning of the "QA Programme for Nuclear Plant Operation" and assess its effectiveness. Corrective actions are developed based on the audit findings; they are implemented under close control of the Operating Organisation.

In 2009 the implementation of POKAS(E) was checked at Kursk, Kalinin, Novovoronezh and Rostov NPPs. In 2010 such audits will be performed at other Rosenergoatom plants.

Rosenergoatom's commissions use the following basic criteria to evaluate POKAS(E) effectiveness:

- certainty that requirements of the current rules and regulations on nuclear power safety are fulfilled;
- meeting customer's requirements as regards the quality of electricity and heat supply;
- provision and monitoring of conditions conducive to attaining optimum performance indicators of the plant;
- use of NPP operating experience.

To further develop the QA systems at nuclear plants and meet current requirements for such systems the Operator has been implementing an "Action Plan for Obtaining Certificates of Compliance with GOST R ISO 9000-2001 and GOST R ISO 14001-98 Requirements" that was developed in 2002.

The Plan prescribes the following organisational actions for all Rosenergoatom plants and enterprises:

- develop work plans to prepare for and undertake certification of the QA management and environmental surveillance systems;
- organise activities to standardise the work processes as prescribed by the current corporate standards;
- develop a QA and certification training programme for personnel of Rosenergoatom headquarters, nuclear plants and support organisations;
- improve the organisation of Rosenergoatom's headquarters and subsidiaries aimed at improving the QA management system;
- arrange regular workshops to share experience on the QA management and certification of the QA systems.

Balakovo NPP was the first Russian nuclear plant to get in 2005 a certificate of its QA management system compliance with GOST R ISO 9001-2001 and with the nuclear regulations. Experience of Balakovo plant in the preparation for certification has been extended to other plants. Smolensk and Rostov NPPs got such certificates in 2007 and 2009 respectively.

The open joint-stock company "All-Russian Research Institute for Nuclear Power Plants Operation" (VNIIAES) received in 2005 a certificate of compliance with ISO 9001:2000 in the area of scientific and technical products, engineering and consulting services. A re-certification audit of the QA management system was performed in May 2008. Another audit took place in 2010, as a result of which the institute received a certificate of compliance with ISO 9001:2008.

Proactive attitude in respect of the environmental problems and commitment to transparent environmental policy, goals, objectives and results called for certifying Rosenergoatom's Environmental Management System for compliance with GOST R ISO 14001-2007. By now, such certificates have been obtained by Rosenergoatom, Balakovo, Rostov and Smolensk NPPs. Kola, Leningrad, Novovoronezh and Kursk plants are expected to get the certificates in 2010.

The Federal Environmental, Industrial and Nuclear Supervision Service pays utmost attention to quality assurance in all stages of NPP design, construction and operation. The Russian Federation has in force "Requirements for a Quality Assurance Programme at a Nuclear Plant" (NP-011-99), which specify plant activities subject to quality assurance; types of QA programmes; requirements for developing and updating the QA programmes. Rostekhnadzor looks at the plant's QA programme when making a decision to grant (or not to grant) it a licence for operation and for other activities in the area of nuclear energy. To revise the programme, a licensee shall submit an application to the Federal Environmental,

Industrial and Nuclear Supervision Service asking to change the terms of the existing licence. The Federal Environmental, Industrial and Nuclear Supervision Service performs audits and inspections to ascertain that the plant is operated in compliance with the QA programme.

Thus, Russia attaches prime importance to quality assurance at all stages of nuclear plant design, construction and operation.

Article 14. Assessment and Review of Safety

It has become a practice in Russia to perform systematic safety assessments and reviews throughout the entire life cycle of a plant, as stipulated in the Convention on Nuclear Safety.

Safety assessments and reviews are performed by:

- the Operating Organisation with involvement of scientific, research, design and architect-engineering organisations – NSSS and plant designers, and other independent organisations;
- the Regulatory Body (Federal Environmental, Industrial and Nuclear Supervision Service) with involvement of independent scientific-technical support organisations and high-skilled experts.

International organisations (IAEA, WANO, etc.) play a prominent role in safety assessments and reviews by conducting missions such as OSART, arranging technical visits, technical support missions and peer reviews of nuclear plants.

14.1. Safety review during licensing

According to the current legislation, the Operating Organisation shall obtain licences for siting, construction, operation and decommissioning of a nuclear plant.

To obtain a licence for a certain type of activity, the Operating Organisation (applicant) submits to Rostekhnadzor documents demonstrating nuclear and radiation safety of the plant. The list of safety documentation has been defined in Appendix 4 to the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal Environmental, Industrial and Nuclear Supervision Service".

The documentation submitted by an applicant is checked for completeness and then thoroughly reviewed. Based on the findings of the review, the Federal Environmental, Industrial and Nuclear Supervision Service makes a decision to grant or not to grant the licence. The licence is granted to nuclear plant Operator only in case of positive conclusions of the safety review. The Federal Service defines the licence terms and conditions which become an integral part of the licence.

14.1.1. Safety review during construction licensing of nuclear plants

According to Article 28 of the Federal Law No. 170-FZ "On the Use of Atomic Energy", decision to construct a nuclear facility is made by the Government of the Russian Federation. These decisions are made in compliance with the land management legislation, urban development legislation, environmental protection legislation, and taking into account conclusions of public inquiries.

In accordance with Article 26 of the Federal Law No. 170-FZ "On the Use of Atomic Energy", to obtain a nuclear plant construction licence the Operating Organisation shall submit to the Federal Environmental, Industrial and Nuclear Supervision Service the following set of documentation specified in Appendix 4 to the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal Environmental, Industrial and Nuclear Supervision Service":

- Preliminary Safety Analysis Report for nuclear plant (PSAR) prepared as required by pertinent federal rules and regulations;
- overall quality assurance programme;
- QA programme for construction – POKAS(C);
- design documentation (including design documentation on reactor installation, safety-related systems and physical protection), R&D and test reports referenced in the PSAR (shall be presented on Rostechnadzor request after the submittal of construction licence application);
- probabilistic safety analysis (PSA Level 1) for the nuclear unit.

The safety documentation is reviewed and the conclusions of the review serve as a basis for the decision to grant or not to grant the licence.

Hence, the principal assessment of design features and solutions meant to ensure the safety of the nuclear plant to be constructed is made at the construction licensing stage.

14.1.2. Safety review during operation licensing of nuclear plants

All operating Russian nuclear plants have operating licences issued by the Federal Environmental, Industrial and Nuclear Supervision Service. The operating licences are granted only after the assessment of nuclear plant safety based on the study and review of the safety documentation submitted by the applicant and following the inspections performed to check the provisions made to ensure safe operation of the plant.

According to the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy

by the Federal Environmental, Industrial and Nuclear Supervision Service", to obtain an operation licence for a nuclear plant, the applicant shall submit a set of documentation demonstrating nuclear and radiation safety of the plant (the required list of documentation is given in Appendix 8).

The inspections carried out in the course of the licence documentation review pursue the following goals:

- assess safety assurance directly at the site;
- check the information presented;
- evaluate (by the Regulatory Body) the applicant's capabilities and conditions for conducting the intended activity.

Similar procedure exists if licence holder applies for changing licence terms and conditions (the licensee shall make similar application to the Regulatory Body, in particular, before making modifications in the safety-related systems and in the operational documentation, for instance, in the "Technical Specifications for the Safe Operation of the Plant" ("Operating Procedure"), and in some other cases).

At present, the Federal Environmental, Industrial and Nuclear Supervision Service issues operation licences for nuclear plants for up to 10 years.

An effort is under way to introduce the practice of periodic safety reviews at Russian NPPs. The relevant regulatory framework is under development. It is expected that such reviews will be performed at least once in 10 years.

Information about the existing operation licences is given in Appendix 1.

14.2. NPP operational audits and inspections

Pursuant to the requirements of Article 35 of the Federal Law No. 170-FZ "On the Use of Atomic Energy", the Operating Organisation provides continued monitoring of the safe operation of nuclear plants.

The audits and inspections performed by the Operating Organisation are aimed at early detection and prevention of weaknesses in NPP operation.

Availability of the safety and safety-related systems is checked periodically, as prescribed by relevant regulations.

The Operating Organisation conducts global and specific (targeted) audits of the safe operation of nuclear plants; checks NPP preparedness for the fall-winter loads; checks adherence to the terms and conditions of the licences granted by the Regulatory Body, and audits the QA programmes.

The Operator's commissions use quantitative safety assessment methodologies to perform safety inspections, which allow revealing weaknesses, negative and positive trends, to enable better planning of

safety enhancement actions and more accurate assessment of their effectiveness.

Work was started in 2009 to introduce at the plants a system for reporting low-level events, which allows early detection and correction of potentially safety-significant deviations. In 2009 such system was put into trial operation at five NPPs, and it is planned to be put in practice at all other Russian NPPs in 2010.

The Operating Organisation also looks after and inspects plant equipment by performing technical examination of piping and components, and implementing in-service inspection programmes for metallic components and pipelines. The findings of such inspections serve to assess equipment condition and predict its safe residual lifetime.

An ad-hoc commission checks nuclear safety assurance at each operating plant every year. Every three months (quarterly) all plants have a "Safety Awareness Day" which is preceded by a targeted safety audit (i.e. of nuclear, radiation, environmental or fire safety).

Information about the findings of the audits and inspections performed by the Operating Organisation is documented in the form of reports and duly submitted to the Regulatory Body.

Safe operation of Russian NPPs is also reviewed by experts from international organisations.

For example, WANO arranged 22 technical support missions in Russia in 2008-2009. Ten such missions are planned for 2010.

WANO and IAEA perform peer reviews at Rosenergoatom plants.

According to WANO rules, peer reviews are voluntary for nuclear plants; they are carried once every six years at operating plants and during initial start-up at new plants (pre-start-up peer reviews).

WANO Moscow Centre performed five peer reviews at Russian NPPs in 2008-2009, and is planning to have another four in 2010.

For example, a follow-up peer review took place at Beloyarsk plant in November 2008.

This review identified nine examples of good practices:

- in the turbine building metallic valve designation tags are being replaced with the colour paper tags laminated on both sides. The use of laminated paper ensures higher quality of the tags and allows putting additional information on them. Tags of different colour are used for the valves belonging to different systems (steam, water, oil, gas, etc.);
- during the turbine generator overhaul the work area is fenced off by a metallic fence. A representative from the turbine division of Atomenergoremont (AER) is present all the time during the assembly of the flow part of the turbine. AER personnel carrying

out maintenance of the turbines wears special clothes – overalls of special colour without buttons and pockets;

- the plant has introduced an "Electronic Defects Log" which allows viewing the defects archive of each piece of equipment over the entire period of its operation;
- the plant conducts professional and "best specialist" competitions. There is a health physics competition between the plant divisions routinely dealing with hazardous radiological activities;
- the plant has updated the automatic chemistry measurement instruments. The new instruments, manufactured in Russia, provide more accurate measurements and more reliable automatic chemical monitoring; they are easy to operate and did not have any failures during one year of their operation;
- in the framework of TACIS Soft OSA programme (non-equipment on-site assistance) Beloyarsk operators made two visits in 2008 to Phoenix plant to have a two-week training at the Fast Reactor Operation Safety School (FROS) and to the sodium facilities at the Research Centre in Cadarache.

On 15-26 March 2010 WANO Moscow Centre performed a pre-start-up peer review at Rostov NPP, Unit 2.

During two weeks experts from Armenia, Belgium, Bulgaria, India, Iran, Russia, the USA, Czech Republic and Ukraine reviewed the technical condition of Unit 2 against safety and reliability requirements. It was pointed out that Rostov NPP had many good practices in various areas.

The experts also reviewed the performance of Unit 2 personnel in such basic areas as administration efficiency, operation, maintenance, engineering support, radiation protection, training and qualifications. They specially mentioned the very open atmosphere at the plant and the close fruitful collaboration with the Rostov personnel which helped the team to attain the mission goals.

The WANO experts gave a high mark to the technical condition of Rostov Unit 2.

An IAEA OSART mission visited Balakovo NPP on 19 May - 5 June 2008 to perform an independent peer review of safe operation issues.

The OSART team made one recommendation and nine suggestions as a result of this mission and highlighted 11 good practices.

The latter include in particular:

- comprehensive motivation programmes of professional competition are implemented both at the corporate and the plant levels. There are formalized criteria and indicators for competition;
- extension of the full-scope simulator configuration with the replica back-up control room is based on the necessity to achieve

skills and psychological preparedness of the main control room personnel;

- there exists psychological training of managers, operation and maintenance staff;
- hand held non-contact pyrometers and vibration measuring devices are used by field operators to monitor and take readings on specific equipment during their rounds;
- the plant has been using a computer-aided test bench to diagnose defects on electronic cards used for the controls of all systems in the plant.

A Follow-up OSART mission conducted at Balakovo NPP on 17-22 January 2010 has shown that the plant had fully fulfilled the nine suggestions made in 2008 and was in the process of implementing the recommendation.

Another, and the most important part of the mission, is that communication and experience sharing between the high-skilled specialists (the Balakovo review team included experts from Bulgaria, Hungary, Germany, Italy, China, Slovakia, the USA, France, Czech Republic and Japan) helps identify clever solutions used at Balakovo NPP to improve operation and enhance safety.

There are all grounds to say that Russia has developed a practice of having OSART missions at its plants once every three years. Next missions are planned to Smolensk NPP in 2011 and to Kola NPP in 2014, through which Russian OSART programme will be expanded to cover also RBMK and WWER-440 reactors.

Hence, the successful IAEA programme of OSART missions now extends to Russia as well to ensure unbiased competent peer review of NPP operational safety against the IAEA safety standards and the best international practices.

14.3. Assessment of in-service ageing of components

As required by the "Basic Safety Rules for Nuclear Plants" (OPB-88/97), the Operating Organisation develops programmes for checking the operability of systems and components, evaluating their ageing processes and replacing equipment with expired lifetime. There exists a KOPUR Programme (inspection, assessment, prediction and life management of components) for assessment and management of component life.

The Programme covers collection, accumulation and analysis of operational data on component defects, damages and failures, essential for the assessment and prediction of ageing parameters. It is used to judge whether equipment performance meets the requirements of regulatory and design documentation.

The KOPUR Programme envisages:

- monitoring of lifetime characteristics: periodically assess whether the current life characteristics of a component meet the requirements established in the regulatory and design documentation;
- assessment of lifetime characteristics: quantify the parameters;
- prediction: assess the residual life of components and equipment;
- management of lifetime characteristics: ensure the design life characteristics and design time of equipment operation and/or its possible use beyond the design lifetime.

14.4. Operational safety assessment of nuclear plants

Since 1991 all operating Russian NPPs have been carrying on annual operational safety assessments of each unit.

Such assessments are conducted in accordance with the "Regulation on Annual Operational Safety Assessment Reports for Nuclear Plants" (STO 1.1.1.04.001.0143-2009) and under control of the Operating Organisation. The findings and conclusions are documented in a special report.

The safety assessments of the plants are performed to:

- check actual condition of safety and safety-related systems and components;
- examine condition of physical safety barriers and accident localization systems;
- assess radiation levels at the site and in the environment;
- check implementation of the system/component upgrading programmes and assess the impact of these activities on plant safety;
- check the level of nuclear, radiation, industrial and fire safety at the plant;
- review and assess the operational events and human errors that have occurred at the plant;
- identify actions to further improve safety and reliability of plant operation.

Annual NPP safety assessment reports approved by the Operating Organisation are submitted to Rostekhnadzor for review and to be taken into account in the supervisory activities.

Summarising the annual safety assessment reports of the plants, the All-Russian Research Institute for Nuclear Power Plants Operation (VNIIAES) issues a summary annual report on the operational safety, which analyses and assesses the safety of all NPPs. The report is sent to the Operating Organisation, to Rostekhnadzor and to nuclear power plants.

Using as input the findings of the review of operational events at the plants and the annual assessment reports on the operational safety of the plants, Rostechnadzor's SEC NRS also issues an annual report which discusses the trends in the key safety indicators of plant performance, the situation with the most significant safety issues, and makes proposals for using the operating experience feedback in regulatory activities. The report is sent to the regional offices of Rostechnadzor and to the Operating Organisation.

The safety assessments of the plants performed in 2007-2010 have shown that the safety of all plants is maintained at an acceptable level and measures are in place to further improve plant safety and reliability. During this period, there has been a sustained trend towards improvement of operational safety indicators, such as reduction of the number of operational events at the plants and of the number of scrams on demand; of an overall number of equipment failures and safety system failures; of human errors etc. The radiation levels at the operating plants are acceptable. The gaseous and aerosol releases to the atmosphere and radionuclide discharge with effluents did not exceed the prescribed levels. The radionuclide content in soil, vegetation, agricultural products, water reservoirs was at a "zero" background level. Personnel exposure did not exceed the prescribed levels.

14.5. In-depth safety analysis of nuclear plants units

The work on the in-depth safety analysis was continued in 2007-2010 in compliance with the "Recommendations on the Content of the In-depth Safety Analysis Report for Operating Nuclear Units (ISAR)" (RB-001-05).

Table 14.1 contains the findings of the probabilistic safety analyses Level 1 performed for the operating plants.

Table 14.1 - Findings of the Probabilistic Safety Analyses (PSA Level 1)
for the Operating Plants

Plant (unit)	Reactor type	Integral frequency of severe core damage, 1/reactor-year
Balakovo-1	WWER	4.36·E-5
Balakovo-2	WWER	4.4·E-5
Balakovo-3	WWER	4.4·E-5
Balakovo-4	WWER	4.45·E-5
Beloyarsk-3	BN	3.5·E-5
Bilibino-1	EGP-6	6.141·E-7
Bilibino-2	EGP-6	6.141·E-7
Bilibino-3	EGP-6	6.141·E-7
Bilibino-4	EGP-6	6.141·E-7
Kalinin-1	WWER	8.06·E-5
Kalinin-2	WWER	8.59·E-5
Kalinin-3	WWER	4.44·E-5
Kola-1	WWER	3.09·E-5
Kola-2	WWER	2.52·E-5
Kola-3	WWER	6.56·E-6
Kola-4	WWER	1.28·E-4
Kursk-1	RBMK	9.85·E-6
Kursk-2	RBMK	7.47·E-6
Kursk-3	RBMK	8.53·E-6
Kursk-4	RBMK	preliminary estimate – 8.5·E-6 (PSA-1 to be completed in 2010)
Leningrad-1	RBMK	1.15·E-5
Leningrad-2	RBMK	8.8·E-6
Leningrad-3	RBMK	1.35·E-5
Leningrad-4	RBMK	preliminary estimate – 1.35·E-5 (PSA-1 to be completed in 2010)
Novovoronezh-3	WWER	3.44·E-5
Novovoronezh-4	WWER	5.12·E-5
Novovoronezh-5	WWER	4.3·E-5
Rostov-1	WWER	5.52·E-5
Smolensk-1	RBMK	9.19·E-5
Smolensk-2	RBMK	1.73·E-4
Smolensk-3	RBMK	3.83·E-5

Note: Integral frequency of severe core damage value to be updated taking into account implementation of additional safety improvement measures.

For the majority of the Russian nuclear plants the estimated values of severe core damage frequency given in Table 14.1 are in accordance with the target value for the operating NPPs stated in INSAG-12 ($<10^{-4}$ per reactor-year for severe core damage frequency). Efforts are in progress to update some of the obtained values.

14.6. NPP safety inspections performed by Rostechnadzor

To check Operators (and its contractors) adherence to safety regulations and to assess Operator's activities with regard to safety enhancement, elimination of non-compliances with safety regulations and fulfillment of licence terms and conditions, the Federal Environmental, Industrial and Nuclear Supervision Service conducts regulatory activities, including inspections to evaluate nuclear and radiation safety of the plants at all stages of their life cycle.

There are three types of inspections conducted at Russian plants: comprehensive (global), specific (targeted) and operational.

Comprehensive inspection of a plant covers all (or nearly all) safety issues under the authority of the Federal Environmental, Industrial and Nuclear Supervision Service. Usually, such inspections are carried out by a commission including Rostechnadzor inspectors and experts from the headquarters and regional offices. Representatives of other state nuclear safety authorities and independent experts may participate in the inspections.

Specific (targeted) inspection consists in a detailed check of one or several safety aspects. The inspection may be performed by a headquarters or regional office commission or by Rostechnadzor inspector alone.

Operational inspection includes a detailed check of adherence to safety requirements by individual workers, plant divisions and the plant on the whole, with a view to taking immediate measures to remedy the possible weaknesses. Such inspection is organized and performed by an inspector (or a team of inspectors) from a regional office of the Federal Environmental, Industrial and Nuclear Supervision Service.

In 2007-2009 the commissions set up by Rostechnadzor headquarters performed comprehensive nuclear and radiation safety inspections at Kola, Balakovo, Bilibino, Novovoronezh, Beloyarsk, Kursk and Rostov NPPs, and at Rosenergoatom. In addition, the commissions set by Rostechnadzor headquarters performed, together with experts from the Nuclear and Radiation Safety Centre of Finland, an extra inspection to check the operational safety of Leningrad NPP, and targeted inspections to check Rostov 2 preparedness for the first criticality and power operation.

The regional offices of Rostechnadzor have performed regular inspections at the plants in accordance with their work plans.

In total, the regional offices carried out 9503 inspections at nuclear plants in 2007-2009.

The inspections performed in 2007-2009 enabled a due check of safety level of the plants and a timely response to the weaknesses and violations revealed.

Also, the Federal Environmental, Industrial and Nuclear Supervision Service performs the following activities with regard to the nuclear and radiation safety evaluation:

- reviews annual reports of the Operating Organisation on the operational safety of the plants (including information about radioactive releases and discharges with effluents, accumulation of radioactive waste and spent nuclear fuel, and analysis of this information);
- continuously studies operational events at nuclear plants;
- assesses annual review reports on nuclear safety of the plants.

It is evident from the above that the safety reviews including international assessments, and systematic comprehensive and targeted inspections are meant to prevent operational events and further enhance NPP safety, which is in line with the requirements of the Convention on Nuclear Safety.

Article 15. Radiological Protection

15.1. Radiological protection legislation, rules and regulations

The following laws and regulatory documents regulate the radiological protection of NPP personnel, the public and the environment in the Russian Federation:

- Federal Law No. 170-FZ of 21 November 1995 "On the Use of Atomic Energy";
- Federal Law No. 3-FZ of 9 January 1995 "On the Radiological Safety of the Public";
- Federal Law No. 7-FZ of 10 January 2002 "On the Environmental Protection";
- "Radiation Safety Regulations" (NRB-99/2009) No. 47 of 7 July 2009;
- "Basic Health Rules for Radiological Safety Assurance" (OSPORB-99) No. 57 of 25 September 2000;
- "Basic Safety Rules for Nuclear Plants" (OPB-88/97) No. 9 of 14 November 1997;
- "Health Rules for Design and Operation of Nuclear Plants" (SP AS-03) No. 69 of 28 February 2003;
- "Radiation Safety Rules for NPP Operation" (PRB AS-99) No. 210 of 18 April 2001;
- other rules and regulations in the field of nuclear energy.

The Federal Law No. 170-FZ "On the Use of Atomic Energy" establishes a legal framework and regulation principles for relations arising during the use of nuclear energy and is aimed at safeguarding the life and health of humans and protecting the environment.

The Federal Law No. 3-FZ "On the Radiological Safety of the Public" establishes legal framework for the radiological protection of the public and personnel with the purpose of health protection. The law sets out the main notions, standards, and regulation principles in the area of radiological protection; identifies measures essential for the provision of radiological safety, powers of the Russian Federation authorities and authorities of the RF subjects in radiological protection area. This law and the NRB-99/2009 were written taking into account the recommendations of the International Commission on Radiological Protection (ICRP).

The following key principles have been established for radiological protection:

- the principle of application of dose limits: the total dose to any individual from all ionizing sources should not exceed the specified individual dose limits;

- the principle of justification: any activity involving the use of ionizing source, in which the benefit for individuals and society does not exceed the risk of potential harm due to the exposure in excess of the natural background levels, should be prohibited;
- the principle of optimization: the likelihood of incurring exposure, the number of people exposed and the magnitude of their individual exposure should all be kept as low as reasonably achievable taking into account economic and societal factors.

The Federal Law No. 3-FZ "On the Radiological Safety of the Public" establishes the following principal hygienic limits (permissible dose limits) for human exposure on the RF territory resulting from the use of ionizing sources:

- average annual effective dose to the public 0.001 Sv, or lifetime effective dose (70 years) 0.07 Sv. Effective dose may be greater in some years provided that average annual effective dose in five consecutive years does not exceed 0.001 Sv;
- average annual effective dose to personnel 0.02 Sv, or effective dose over the working period (50 years) 1 Sv. Annual effective dose may reach 0.05 Sv provided that average annual effective dose in five consecutive years does not exceed 0.02 Sv.

This Federal Law says that the values specified for the main dose limits do not include the doses due to the background natural and human-induced radiation, and the doses received by people (patients) as a result of medical X-ray procedures and treatment. The above dose limits are reference for establishing exposure limits for human body and individual organs. In the event of a radiological accident, exposure may for a certain time exceed the specified dose limits within the limits established in appropriate health rules and regulations.

OPB-88/97 is the principal regulatory document which sets out principles and basic criteria of safety assurance, formulates main requirements for technical and organisational measures meant to ensure safety including the safety issues resulting from NPP specifics as a source of a radiological impact on personnel, public and environment.

NRB-99/2009 document specifies requirements and limits for the impact of ionising radiation. In particular, the document regulates the following:

- personnel and public exposure due to the human-made sources of ionising radiation in normal operation;
- personnel and public exposure in case of a radiological accident;
- exposure of personnel of industrial enterprises and the public caused by the natural sources of ionising radiation;
- medical exposure of the public.

In the normal operation of ionizing sources, annual dose limits are set proceeding from the following values of the lifetime individual risk: $1.0 \cdot 10^{-3}$ for personnel and $5.0 \cdot 10^{-5}$ for members of the public. The following overall risk limits (product of probability of event leading to exposure and probability of lethality caused by exposure) are taken to justify the protection against the sources of potential yearly exposure: $2.0 \cdot 10^{-4}$ 1/year for personnel and $1.0 \cdot 10^{-5}$ 1/year for the public.

NRB-99/2009 also updates the environmental limits of some radionuclides, clarifies some terms (in particular, "exclusion zone"), and has some other amendments.

OSPORB-99 specifies requirements for the protection of humans against the harmful impact of radiation.

The SP AS-03 Rules were developed based on and to expand the "Basic Health Rules for Radiological Safety Assurance" (OSPORB-99).

Considering the existing engineered safety level of the plants in normal operation (when the radiation doses to the public due to the actual plant releases and discharges with effluents are below $10 \mu\text{Sv}/\text{year}$ from each radiation hazard), the radiation risk to the public resulting from NPP operation is certainly acceptable ($<10^{-6}$ per year). Therefore, the release and discharge limits specified in SP AS-03 are calculated based on the public exposure of $10 \mu\text{Sv}/\text{year}$.

15.2. Radiological impact on NPP personnel

The annual operational safety assessments at Russian NPPs have shown that the radiological situation at all plants meets the requirements of the regulatory documents and the requirements of Article 15 of the Convention on Nuclear Safety.

The Operating Organisation - "Rosenergoatom Concern" - consistently pursues a policy of dose reduction.

New fundamental regulations were developed and adopted in the Russian Federation in the late 1990s on the radiological safety taking into account ICRP Publication 60 and IAEA Basic Safety Standards. Adoption of lower personnel exposure limits (100 mSv in five consecutive years rather than 50 mSv per year) is just one of many amendments introduced in the new rules and regulations (NRB-99/2009).

Owing to the adoption of new dose limits for personnel exposure, collective doses at all Russian NPPs decreased by more than 2 times; at the RBMK plants they decreased about 3 times. Doses at the RBMK plants (single-circuit configuration, numerous equipment, etc.) were reduced owing to the implementation in 2008 of a programme of technical and

administrative actions which allowed improving the radiological situation at these plants and reducing the collective doses to personnel.

The principal dose limits are respected at all NPPs. There have been no cases of exposure above the reference dose limits of 100 mSv over five consecutive years and 50 mSv per year.

The measures that helped reduce the occupational doses at all Russian plants included introduction at Rosenergoatom plants of model programmes and plant-specific programmes for minimizing personnel exposure:

- Model programme for optimizing doses to personnel when planning and preparing outages at RBMK plants;
- Model programme for provision of radiological safety in the course of very hazardous radiological activities;
- Regulation on documenting annual dose budget of a nuclear plant;
- Model content of the report "Evaluation of occupational doses to NPP personnel resulting from planned outage".

To keep doses to personnel as low as reasonably achievable at a level not greater than the prescribed limits, a "Programme for optimizing radiological protection of NPP personnel" was developed in 2009 and has been implemented.

The data on actual personnel exposures at Russian NPPs with different reactors in 2007-2009 is given in Tables 15.1–15.2.

Table 15.1 - Average Individual Doses to Plant and External Personnel in 2007-2009

Plant, units, reactor type	2007		2008		2009	
	Average dose, mSv/year	% of 20 mSv	Average dose, mSv/year	% of 20 mSv	Average dose, mSv/year	% of 20 mSv
WWER plants						
Balakovo 1-4, WWER-1000	0.62	3.1	0.62	3.1	0.57	2.9
Kalinin 1-3, WWER-1000	0.46	2.3	0.49	2.5	0.48	2.4
Kola 1-4, WWER-440	1.38	6.9	1.13	5.7	0.98	4.9
Novovoronezh 3,4, WWER-440; 5, WWER-1000	2.13	10.7	1.24	6.2	2.11	10.6
Rostov 1, WWER-1000	0.11	0.55	0.04	0.20	0.024	0.12
Weight average for WWER plants	0.96	4.8	0.75	3.8	0.86	4.3
RBMK plants						
Kursk 1-4, RBMK-1000	2.22	11.1	2.49	12.5	2.4	12.0
Leningrad 1-4, RBMK-1000	2.09	10.5	1.46	7.3	1.70	8.5
Smolensk 1-3, RBMK-1000	2.48	12.4	2.14	10.7	2.16	10.8
Weight average for RBMK plants	2.25	11.2	2.01	10.0	2.07	10.4
One-of-the-kind plants						
Beloyarsk 3, BN-600	0.33	1.7	0.26	1.3	0.30	1.5
Bilibino 1-4, EGP-6	3.78	18.9	4.69	23.5	4.11	20.5
Weight average for operating one-of- the-kind plants	1.54	7.7	1.72	8.6	1.50	7.5
Weight average for all operating plants	1.64	8.2	1.47	7.4	1.51	7.5

Table 15.2 - Annual Collective Doses to Plant and External Personnel (S) per Nuclear Unit in 2007-2009

Plant	S, man·Sv/unit		
	2007	2008	2009
WWER plants			
Balakovo	0.56	0.57	0.51
Kalinin	0.56	0.55	0.54
Kola	0.84	0.71	0.61
Novovoronezh (three units in operation)	2.04	1.20	2.00
Rostov	0.18	0.055	0.06
Weight average for all operating WWER plants	0.91	0.69	0.80
RBMK plants			
Kursk	3.28	4.00	3.90
Leningrad	3.15	2.36	2.72
Smolensk	3.86	3.34	3.32
Weight average for RBMK plants	3.39	3.23	3.31
One-of-the-kind plants			
Beloyarsk (Unit 3)	0.47	0.36	0.46
Bilibino	0.68	0.88	0.74
Weight average for all operating one-of-the-kind plants	0.63	0.77	0.69
Weight average for all operating plants	1.75	1.60	1.67

It can be seen in Tables 15.1–15.2 that the dose limits set for personnel of Russian NPPs have not been exceeded.

15.3. Monitoring of environmental contamination

All Russian NPPs are equipped with systems for entrapment of gaseous and airborne radionuclides in plant releases.

Owing to the improved fuel fabrication techniques (reduction of the number of leaky fuel rods in the core), introduction of advanced gas and aerosol cleaning techniques and enhancement of safety culture, releases in the environment from Russian NPPs have decreased dramatically (by 1-2 orders of magnitude) in the last 10-15 years.

Considering NPP safety level attained in normal operating conditions, the limits for radioactive releases and effluent discharges into the environment were set at a level, at which dose to a critical group of the public in the area of NPP site is negligible, i.e. below the minimum meaningful dose of 10 μ Sv per year.

Similar to the past, the actual gas and airborne releases and effluent discharge from the nuclear plants in the reported period stayed well below the relevant limits. Given such radionuclide release in the environment, the radiological risk to the public associated with the planned radionuclide release outside NPP site in normal operating conditions is certainly acceptable (less than 10^{-6} 1/year). This means that the releases and discharges associated with the normal operation of NPPs, if not above the prescribed limits (and this is what they really are), are in fact optimised.

Tables 15.3 and 15.4, respectively, show the absolute and relative (as a percentage of the release limit) daily and annual averages of gas and aerosol releases at Russian NPPs in 2009.

The releases given in the Tables produce negligible doses of public exposure in the vicinity of NPP sites – less than 0.01 mSv/year, which is less than 1 % of the annual external exposure caused by natural (background) radiation.

Similar to the previous years, in 2009 the gaseous and airborne releases from the plants stayed well below the prescribed limits. The noble gas (NRG) releases at the pressure-tube plants did not exceed 19 % of permissible limit. At WWER plants the noble gas releases were less than 14 % of permissible limit. Iodine compound releases ranged from 0.003 to 11.0 % of permissible limit.

Table 15.3 - Daily Average Gaseous and Airborne Releases at Russian NPPs in 2009

Plant	NRG		¹³¹ I	
	GBq	% of the target*	MBq	% of the target*
Balakovo	**	-	0.0011	0.002
Kalinin	99.0	5.2	2.37	4.8
Kola	**	-	0.025	0.05
Novovoronezh	260.0	13.8	5.4	10.9
Rostov	**	-	**	-
Kursk	810.0	8.0	3.6	1.42
Leningrad	670.0	6.7	2.24	0.88
Smolensk	175.0	1.73	0.16	0.06
Beloyarsk	12.1	0.64	no releases	-
Bilibino	990.0	18.1	**	-

Note: * Target - reference level;

** Releases are below the radionuclide activity detection limit.

Table 15.4 - Annual Gaseous and Airborne Releases at Russian NPPs in 2009

Plant	NRG		¹³¹ I		¹³⁴ Cs		¹³⁷ Cs		⁶⁰ Co	
	TBq/y	% of the limit	MBq/y	% of the limit	MBq/y	% of the limit	MBq/y	% of the limit	MBq/y	% of the limit
Balakovo	*	-	0.46	0.003	0.34	0.04	2.5	0.12	2.7	0.04
Kalinin	36.05	5.2	866.1	4.8	1.12	0.12	3.38	0.17	2.77	0.04
Kola	*	-	8.98	0.05	*	-	4.2	0.2	24.1	0.33
Novovoronezh	95.0	13.8	2000.0	10.9	140.0	15.0	180.0	8.9	650.0	8.8
Rostov	*	-	*	-	0.72	0.08	1.82	0.09	3.1	0.04
Kursk	297.3	8.0	1319.6	1.4	7.84	0.56	50.7	1.3	332.9	13.3
Leningrad	252.0	6.8	818.9	0.88	35.0	2.5	132.0	3.3	83.8	3.4
Smolensk	133.1	3.6	135.1	0.15	*	-	9.8	0.25	80.3	3.2
Beloyarsk	4.4	0.64	-	-	*	-	7.3	0.4	0.21	0.003
Bilibino	361.1	18.1	*	-	*	-	*	-	*	-

Note: * Releases are below the radionuclide activity detection limit.

Hence, the above data confirm that Russian NPPs provide adequate protection of the public and the environment against the radiological impact of NPPs.

15.4. Supervision over radiological protection of nuclear plant personnel, the public and the environment

Supervision over the radiological protection of NPP personnel, the public and the environment in the areas of NPP sites is carried out by the Department of Sanitary and Epidemiological Supervision of the Federal Medical and Biological Agency under the RF Ministry of Health and Social Development, and by the regional offices of this Department.

The Federal Environmental, Industrial and Nuclear Supervision Service supervises, on behalf of the state, adherence to the regulatory requirements established in respect of radiological safety and compliance with the terms of plant operation licences.

The health physics divisions at the plants monitor radiological protection of personnel and activity releases to the environment. The findings of the monitoring activity are presented to the regulatory authorities and to the Operating Organisation in the form of monthly, quarterly and annual reports.

The Federal Environmental, Industrial and Nuclear Supervision Service and health authorities systematically perform comprehensive and targeted inspections to evaluate the safety of individual plants. The findings of these inspections serve to make relevant recommendations and prescriptions.

It follows from the above that the Russian Federation has assured the radiological protection of NPP personnel, the public and the environment in the course of nuclear plant operation.

Personnel exposure doses stay at low level and do not exceed the prescribed limits. Radiological impact of NPPs on the public and the environment (in normal operation) due to the gas and aerosol releases and effluent discharge creates some additional radiation risk, which is certainly acceptable (less than 10^{-6} per year).

Article 16. Emergency Preparedness

16.1. Regulation of emergency preparedness on NPP site and beyond

The issues of personnel and public protection in case of an accident at a nuclear plant are regulated in Russia by various regulatory requirements. These regulatory requirements have been developed relying on domestic and international experience and take into account the recommendations of 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 Organisation (Licensee) for Emergencies at Nuclear Power Plants", No. 50-SG-06, Vienna, 1982.

The Russian Federation is a party to the international agreements relating to the issues of emergency preparedness including the cases of accidents with trans-boundary consequences:

- Convention on Environmental Impact Assessment in a Trans-boundary Context, 1991;
- Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency, 1987;
- Convention on Early Notification of a Nuclear Accident, 1986.

The current Russian regulatory documents that deal with the issues of emergency preparedness on and outside NPP sites include:

- Federal Law No. 170-FZ "On the Use of Atomic Energy";
- Federal Law No. 68-FZ "On the Protection of the Public and Territories against Natural and Human-Induced Emergencies";
- Federal Law No. 3-FZ "On the Radiological Safety of the Public";
- "Regulation on the National System for Prevention and Management of Emergencies" (approved by the RF Government Ordinance No. 794 of 30 December 2003, in the revision of the RF Government Ordinances No. 335 of 27 May 2005; No. 600 of 3 October 2006);
- "Basic Safety Rules for Nuclear Plants" (OPB-88/97);
- "Regulation on Announcement of Emergencies, Early Notification and Organisation of Urgent Assistance to Nuclear Plants in the Event of Radiation Hazards" (NP-005-98);
- "Typical Content of an Action Plan for Personnel Protection in Case of a Nuclear Plant Accident" (NP-015-2000) with Amendment No. 1 of 30 August 2002.

As mentioned in the previous National Reports of the Russian Federation, the above regulatory documents are aimed at preventing the

occurrence and progression of emergencies and at minimising the ensuing damage.

These documents define the norms for protecting the Russian and foreign citizens as well as the environment against natural and human-induced emergencies; the organisation principles, the required resources, and the interaction in managing potential emergencies at nuclear plants; the mission and functions of an interdepartmental Team for Emergency Assistance to Nuclear Plants (OPAS).

16.2. Implementation of emergency preparedness measures; emergency preparedness plans of nuclear plants

In accordance with the current laws and regulations, a National System has been instituted in the Russian Federation for Prevention and Management of Emergencies (RSCoS). The system is managed by the RF Ministry for Civil Defence, Emergency Management and Response to Natural Disasters (EMERCOM of Russia).

The System covers all the territories (regions) of Russia. In keeping with the Federal Law "On the Protection of the Public and Territories against Natural and Human-Induced Emergencies", the RF Government issued Ordinance No. 304 on 21 May 2007 to approve a classification of natural and human-induced emergencies. This classification is outlined in Table 16.1.

Table 16.1 - Classification of Natural and Human-induced Emergencies

Type of emergency	Number of people affected	Material damage (thousand roubles)	Location of emergency
Local	up to 10	up to 100	Facility
Municipal	up to 50	100-5000	Settlement or in-city territory of a federal-level city
Inter-municipal	up to 50	100-5000	Two or more settlements or in-city territories of a federal-level city
Regional	51-500	5000-500000	Does not exceed the territory of one RF entity
Inter-regional	51-500	5000-500000	Does not exceed the territory of two RF entities
Federal	above 500	above 500000	As decided by the RF Government

The classification of emergencies serves as a basis for early preparation of appropriate forces and resources at various administrative levels to manage emergencies and to remedy the damage caused.

EMERCOM of Russia provides interfaces and coordinates the activities of all ministries, agencies and organisations involved in the post-accident remedial actions also outside the exclusion zone of the affected nuclear plant. EMERCOM of Russia organizes training and employment of emergency response and rescue teams for early confinement of emergencies and limitation of the damage caused by them.

An Industry-level System for Prevention and Management of Emergencies (OSChS) at nuclear plants and other facilities of the nuclear power industry is functioning in the framework of the State Corporation for Atomic Energy "Rosatom".

The current Russian system of preventing and managing emergencies is shown schematically in Figure 16.1.

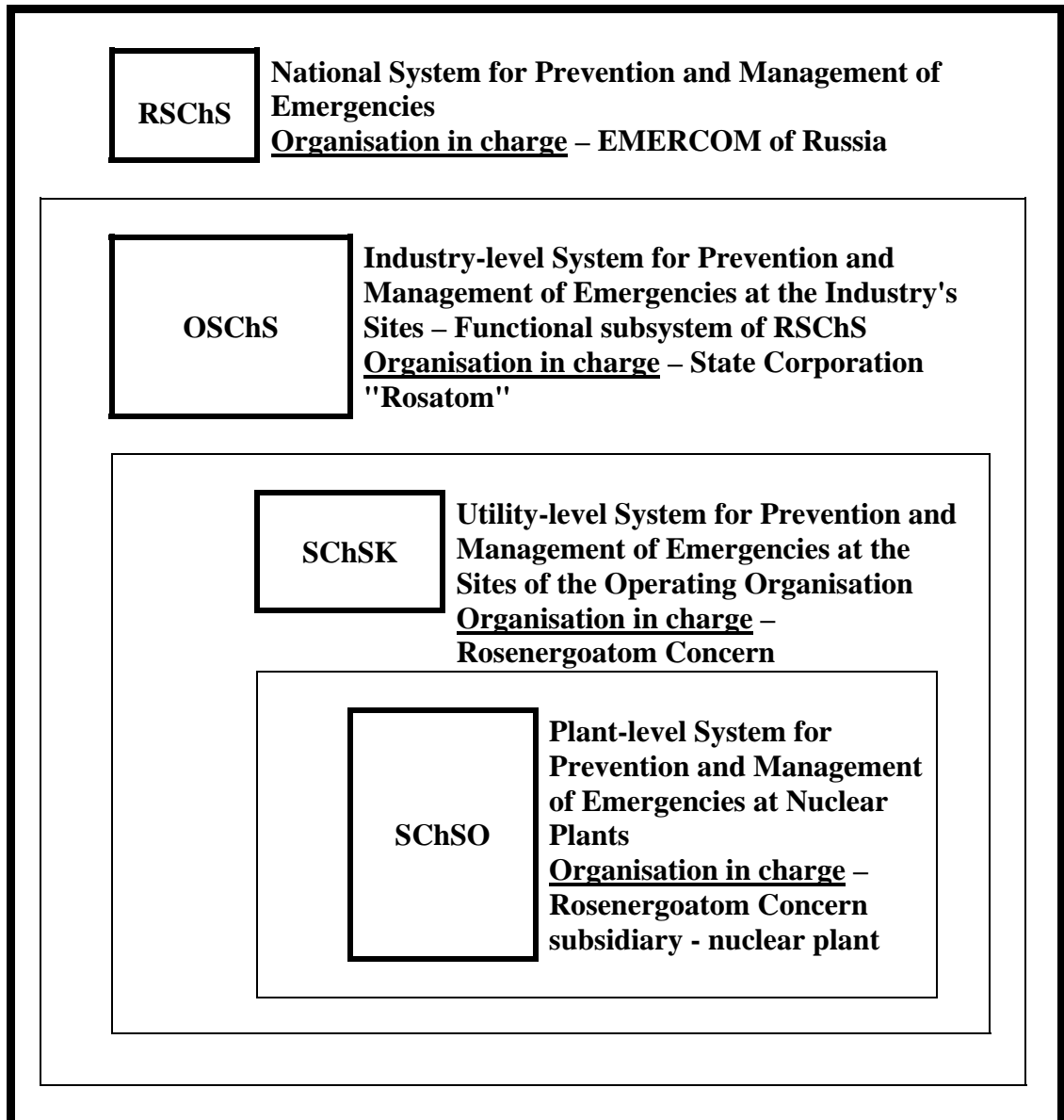


Figure 16.1 - System for Prevention and Management of Emergencies

In accordance with the Regulations for the OSChS system, each operating nuclear plant has created its own mature and manageable system for preventing emergencies and taking appropriate response actions. Seeking to ensure continued preparedness of the resources for response to potential radiological hazards, all nuclear plants developed and obtained approvals for their "Action Plan for Personnel Protection in Case of an Accident at the Nuclear Plant" following the requirements of the "Basic Safety Rules for Nuclear Plants" (OPB-88/97) and the "Typical Content of an Action Plan for Personnel Protection in Case of a Nuclear Plant Accident" (NP-015-2000). These plans define the accident notification procedure, the criteria for decision-making and personnel actions in

emergencies, personnel protection measures, as well as the procedure for NPP interaction with the territorial divisions of EMERCOM of Russia, other external organisations and local authorities.

The organisational, technical and other measures of assistance to the public in the areas in the vicinity of NPP sites are identified in the "Plan for Public Protection in Case of a Radiological Accident at the Nuclear Plant".

Such plans were developed and approved by executive authorities of the corresponding territories in the Russian Federation. The plans specify the ways of coordinating activities of the site-based and territorial divisions of EMERCOM of Russia, and of arranging their interaction with other ministries and agencies involved in the work for protecting the public against the consequences of accidents.

The Operating Organisation and each nuclear plant have both the main and backup means of communication with the State Corporation for Atomic Energy "Rosatom" and other higher-level organisations; with the federal safety authorities; territorial civil defence and emergency management bodies of EMERCOM of Russia, as well as with appropriate executive authorities of the RF subjects and local administrations.

The communication and notification systems available at the nuclear plants allow promptly notifying all stakeholders about an emergency at the plant and exchanging essential information.

The Operating Organisation is responsible for arranging and conducting activities to prevent and manage emergencies of both radiological and non-radiological nature.

The key elements in the system of emergency support to NPPs are the Emergency Response Centre ("Crisis Centre") of Rosenergoatom Concern, the Emergency Response Centre ("Situation and Crisis Centre") of the State Corporation "Rosatom", the Information and Analysis Centre (IAC) of Rostekhnadzor, and the Technical Support Centres (TSC) set up by the organisations acting as Chief Designers, Chief Scientists and Architect-Engineers for NPPs, as well as by the leading Russian institutes providing scientific and technical support to the nuclear plants. There are 14 Technical Support Centres operating at present. Arrangement of the communication between the organisations involved in the emergency response system is shown in Figure 16.2.

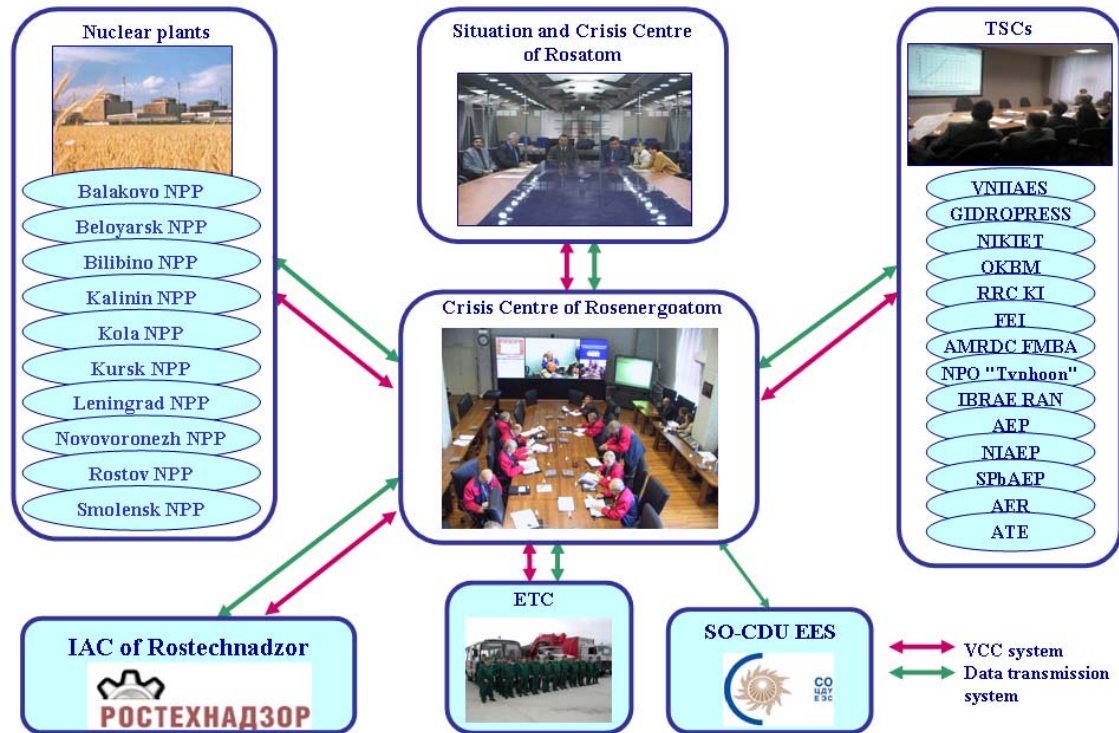


Figure 16.2 - On-line Communication of the Organisations Involved in the Emergency Response System

The role of these emergency response and technical support centres in improving emergency preparedness of the nuclear plants is defined in the "Regulation on Announcement of Emergencies, Early Notification and Organisation of Urgent Assistance to Nuclear Plants in the Event of Radiation Hazards" (NP-005-98) and in the "Procedure for Informing the Emergency Response Centre of Rosatom about the Current State of Nuclear Facilities and Abnormal Occurrences". This role lies in:

- ensuring emergency preparedness of the emergency prevention and management system;
- collecting objective technological and radiological information on the current state of nuclear units;
- continuously monitoring the process parameters and radiological characteristics of NPPs;
- checking the preparedness of NPPs and the availability of communication systems for continuous information exchange;
- analysing the situation based on the information acquired;

- promptly predicting the conditions on NPP sites and in the surveillance areas;
- giving timely notification of emergencies;
- providing engineering support to the affected NPP; interacting with the Technical Support Centres;
- informing the stakeholders about the situation at NPPs via operating communication channels;
- alerting the Team for Emergency Assistance to Nuclear Plants (OPAS);
- arranging interaction with the affected NPP, with the ministries and agencies concerned and communicating with the mass media and general public;
- monitoring the progress of the measures taken.

The above Centres operate round-the-clock, and their activities are coordinated.

At the site level, the Manager (Director) of a nuclear plant is responsible for the actions taken to prevent and eliminate the emergencies within the plant's exclusion zone and for implementing the "Action Plan for Personnel Protection in Case of an Accident at the Nuclear Plant".

The processes of taking measures to ensure emergency preparedness of Russian nuclear plants and of bringing into effect the "Action Plan for Personnel Protection..." are defined in the "Regulation on Announcement of Emergencies, Early Notification and Organisation of Urgent Assistance to Nuclear Plants in the Event of Radiation Hazards" (NP-005-98).

The latter establishes the criteria for announcing the states of "Emergency Preparedness" and "Emergency Situation" at the nuclear plants.

16.3. Measures to inform the public on emergency preparedness

The function of informing the general public is performed at Rosenergoatom Concern by the Information and Public Relations Department. In the event of an emergency at a NPP the Department organises the following activities:

- collection of information about accident initiation and progression at the NPP, about the measures taken to confine and manage it;
- preparation of press releases approved by the OPAS team leaders; prompt communication of the information to mass media;
- organisation of press conferences for the OPAS team leaders;

- monitoring of the electronic and publishing mass media for coverage of the situation at the affected NPP;
- arrangements to present information about the accident, its confinement and management actions on the Web-site of the Operating Organisation;
- interaction with the information divisions of the nuclear plants.

All nuclear plants have information divisions whose tasks are similar to those listed above.

16.4. Training and on-site emergency drills

Training of nuclear plant personnel for actions in emergencies includes studies at the Technical Support Centres; emergency drills; command post and special tactical exercises; field training.

Training of the Operator's staff, personnel of nuclear plants and employees of supporting organisations in civil defence, prevention and management of emergencies follows the requirements of the RF Government Ordinance No. 547 of 4 September 2003 "On Public Training in Protection against Natural and Human-Induced Emergencies" and the "Regulation on Arranging Public Training in Civil Defence" (in the revision of the RF Government Ordinance No. 501 of 15 August 2006).

Training of the Operator's staff, personnel of nuclear plants and members of their families, and employees of supporting organisations for actions in emergencies is set out in the "Guidelines on Preparing and Implementing Measures for Civil Defence, Prevention and Management of Emergencies at Nuclear Plants" (RD EO 0074-97).

Specialists of administration bodies and those working in the system for prevention and management of emergencies, nuclear plant personnel, and employees of supporting organisations are trained under specially developed programmes at institutions of continued professional education, at civil defence and emergency management training centres of the RF subjects, as well as at municipal civil defence courses.

Training of special units assigned to nuclear plants is arranged in accordance with the "Regulation on a Special Unit at a Nuclear Plant" (RD EO 0341-02).

The Operator, nuclear plants and supporting organisations annually plan and carry out exercises and drills:

- to check the preparedness of command bodies, forces and resources for actions in emergency;
- to practice actions in emergencies and during accidents at NPPs;
- to practice emergency interaction inside the shifts, as well as their interfacing with fire brigades, medical staff, emergency response and rescue teams and services;

- to train personnel in issuing warnings, in preventing adverse progression of accidents and in minimising their consequences;
- to test the abilities to apply first aid, to use the means of individual protection, fire-extinguishing equipment, etc.;
- to practice organisation of people evacuation;
- to check the preparedness of personnel for prompt and proper actions on their own.

The Operating Organisation pursues the following activities:

- methodological and training sessions for the officials and the civil defence and emergency management employees of the headquarters and nuclear plants – at least once a year;
- comprehensive emergency exercises for the OPAS Team, nuclear plants, Emergency Technical Centres (ETC), forces and resources, as well as for the federal stakeholders aimed at working through all the aspects of joint and individual actions in response to a radiological accident and in protecting personnel and the public, with involvement of civil defence resources – once a year;
- tactical antiterrorist exercises to practice interaction of the OPAS Team, Emergency Response Centre, Rosenergoatom divisions and TSC with task units of law enforcement agencies and medical services – once a year.

Nuclear plant activities include:

- methodological and training sessions for the managerial staff, officials and specialists in civil defence and emergency management – at least once a year;
- command and staff exercises aimed at improving the interaction between officials of the authorities concerned, which involve a package of tasks for organizing activities of accident management teams during both initiation of an accident and its mitigation – once a year;
- accident management and fire-fighting drills of the personnel as well as drills for actions in emergencies – according to annual time schedules developed by the NPP.

Such a time schedule provides for each member of the operating personnel to take part:

- in accident management drills – at least once in every three months, and in plant-scale drills – at least once a year;
- in accident management plus fire-fighting, drills – at least once in every six months.

Besides, the OPAS, ERC and TSC teams take part in command and staff exercises or plant-scale accident management drills to practice

concerted efforts at least once in two years in accordance with the time schedule developed annually by the Operating Organisation.

During the exercises and drills, use is made of simulator facilities, including full-scope simulators of the nuclear units.

The following exercises and drills were carried out in 2008-2009:

- comprehensive emergency management exercises at Rostov and Balakovo NPPs;
- 12 joint exercises of Operator and Technical Support Centres;
- drills of NPP personnel: no less than 30 drills at each plant.

16.5. Emergency technical centres

Pursuant to RF Government Ordinance No. 246 of 25 March 1993 "On Establishment of Technical Emergency Centres for Management of Emergencies at Nuclear Facilities in the Russian Federation", several Emergency Technical Centres (ETC) were set up in Russia including those in St. Petersburg, Moscow, Novovoronezh (Voronezh region), Seversk (Tomsk region). In 2006, following Rosatom directive, the Centres in Moscow, Novovoronezh and Seversk were affiliated to the St. Petersburg ETC. The Novovoronezh ETC is the Emergency Technical Centre of the nuclear industry designated for rendering assistance to nuclear plants in emergencies.

16.6. Governmental regulatory activities to ensure emergency preparedness of nuclear plants

In its activities to supervise the emergency preparedness management, the Federal Environmental, Industrial and Nuclear Supervision Service is guided by the laws, regulations and other documents listed in Section 16.1 of this Report as well as by the "Regulation on Investigating and Accounting of Operational Events at Nuclear Plants" (NP-004-08), which defines the categories of operational events that shall be reported to the Regulatory Body, notification procedure, subsequent reporting of the event, and event investigation procedure.

The main responsibilities of the Federal Environmental, Industrial and Nuclear Supervision Service in regard to emergency preparedness consist in supervising, on behalf of the state, development and implementation of accident prevention measures at the facilities under its authority; monitoring the preparedness of enterprises and organisations for minimising their consequences, and taking part in establishing the criteria and in developing rules and regulations for assuring emergency preparedness of the nuclear plants.

The way Rostekhnadzor fulfils these responsibilities is described below.

Licensing

In accordance with the "Licensing Regulations" and relevant procedures, the documents to demonstrate nuclear and radiation safety of NPP operation shall include accident management procedures, guidelines on the management of beyond-design-basis accidents, and action plan for personnel protection in case of an accident at the nuclear plant. These justification documents shall also contain information about the training and qualifications of plant personnel, including their preparedness for actions during design-basis and beyond-design-basis accidents.

These documents are assessed during NPP safety reviews. As a result of such assessment, a review report is produced with conclusions as to the soundness and sufficiency of the technical and organisational solutions made to ensure the preparedness of the NPP and the Operator for managing accidents and minimising their consequences.

The review report may contain proposals for the licence terms related to improvements in the emergency preparedness of the nuclear plant and/or Operating Organisation, which will be taken into consideration by the Regulatory Body in defining the licence terms.

Inspections

One of the objectives pursued by Rostekhnadzor in its inspection activities is to check nuclear plant preparedness for management and mitigation of accidents.

The following is checked and assessed during emergency preparedness inspections at the plants:

- the state of documentation describing personnel actions during accidents (accident management procedures, guidelines on management of beyond-design-basis accidents, action plan for personnel protection);
- the organisation of personnel training to develop and maintain their skills in controlling the plant during an accident;
- the availability of emergency notification system, including technical condition of communication channels;
- the condition of sheltered stations for control of accident management operations, their equipment, and availability of appropriate documents;
- the arrangements for plant personnel protection in case of a radiological accident as regards the preparedness of appropriate emergency response services and facilities;

- the plans and programmes for emergency drills and exercises at the plant, including interaction with the local and federal authorities to ensure preparedness for public protection.

If required, inspections also cover other, site-specific aspects of emergency preparedness.

Activities in case of nuclear plant operational events

Following the "Regulation on Investigating and Accounting of Operational Events at Nuclear Plants" (NP-004-08), in case of events having the symptoms and consequences of a radiological accident, the Federal Environmental, Industrial and Nuclear Supervision Service will set up a commission to investigate the event, unless the Russian Federation President or the Government of the Russian Federation take a decision on forming a governmental commission.

If "Emergency Preparedness" or "Emergency Situation" is announced at a nuclear plant, Rostechнадzor representative is included in the Team for Emergency Assistance to Nuclear Plants (OPAS). The main responsibilities of the Regulators representative in the OPAS Team include:

- ascertain that complete and timely measures are taken to restore the affected power unit to a safe condition, including recovery of the critical safety functions, to remedy the accident consequences, and to carry out personnel protection plan within appropriate time;
- check on the correctness and promptness of the published or transmitted information about the nature and consequences of the accident;
- periodically advise Rostechнадzor officials of the current status of nuclear and radiation safety at the plant and of the emergency management measures taken.

Rostechнадzor has its own Information and Analysis Centre (IAC), which, in accordance with "IAC Regulations" (RD-02-16-2004), has two modes of operation – routine and emergency response activities. In the latter case, the functions of the Centre include:

- collection and processing of Operators information on the current status of nuclear and radiation safety at the nuclear plant in question;
- notification of Rostechнадzor officials and division heads of its headquarters of the developments in the situation at the plant;
- provision of on-line communication between Rostechнадzor headquarters, Rosatom's Emergency Response Centre, Emergency Response Centre of Rosenergoatom and its regional branches, NPPs under supervision, and all the stakeholders; provision of information and technical support to the task teams analysing the emergency;
- assessment of the emergency at the NPP, prediction of its possible progression, and development of appropriate recommendations to Rostechнадzor management;

- review of the Operator's actions in restoring safety at the affected NPP, including recovery of the critical safety functions, accident mitigation, and timely implementation of the personnel protection plan.

The Chairman of the Federal Environmental, Industrial and Nuclear Supervision Service issued an order to update the membership of the IAC task teams involved in the activities during radiological emergencies at the nuclear plants. Regular exercises and drills are performed to keep the IAC and its task teams in readiness for action.

The Federal Environmental, Industrial and Nuclear Supervision Service, acting as an independent body, will notify, if required, the central and local authorities of the Russian Federation about the event at the nuclear plant and about the actions taken or in progress, and will arrange cooperation with the mass media.

The Russian Federation Ministry of Natural Resources and Environment has an Emergency Centre of its own.

Thus, proper attention is being paid to the issues of emergency preparedness in Russia. The State Corporation for Atomic Energy "Rosatom" set up an industry-level system for prevention and management of emergencies at nuclear plants. An important role in the emergency management activities belongs to the Emergency Response Centre of the State Corporation for Atomic Energy "Rosatom" and to the Emergency Response Centre of the Rosenergoatom Concern. Information and Analysis Centre is functioning within the Federal Environmental, Industrial and Nuclear Supervision Service. The RF Ministry of Natural Resources and Environment has an Emergency Centre.

Emergency exercises, regional and plant-level drills are conducted on a regular basis to keep nuclear plant personnel prepared for actions in emergencies.

Article 17. Siting of Nuclear Plants

Selection of a nuclear plant site and its acceptance as suitable for construction and safe operation of a nuclear plant are regulated by federal laws, federal rules and regulations in the field of nuclear energy as well as by other documents identified and described in the previous National Reports of the Russian Federation on the fulfilment of commitments resulting from the Convention on Nuclear Safety.

Current requirements for the sites of new nuclear plants under design at present are given below.

The natural and human-induced conditions in the region of potential NPP siting are investigated in keeping with the following rules and regulations:

- "Siting of Nuclear Power Plants. Basic Safety Criteria and Requirements" (NP-032-01);
- "Rules for Designing Seismically Resistant Nuclear Plants" (NP-031-01);
- "Consideration of External Impacts of Natural and Human-induced Origin at Nuclear Facilities" (NP-064-05).

According to the federal rules and regulations NP-032-01, the candidate site is considered to be suitable for housing a nuclear plant if it is possible to ensure safe operation of the plant taking into account the natural and human-induced processes, phenomena and factors, and provide safety of the public and protection of the environment against radiation impacts during normal operation and in design-basis accidents, and limit such impacts in case of beyond-design-basis events. Justification of site suitability for a nuclear plant should take into account:

- impact of natural and human-induced processes, phenomena and factors on NPP safety;
- radiological impact of the nuclear plant on the public and the environment;
- specifics of NPP site and area, which may encourage migration and accumulation of radioactive materials (topography, hydrogeology, stratification of air mass, rivers, other water reservoirs, etc.);
- civil defence activities (engineered features);
- the size of exclusion zone around the site, emergency planning and evacuation planning zones.

According to Article 31 of the Federal Law No. 170-FZ "On the Use of Atomic Energy", special zones are established around NPP sites to protect local public – an exclusion zone and a surveillance zone. Radiation monitoring shall be provided in the exclusion and surveillance zones. The size and boundaries of the exclusion zone are established in compliance with the rules and regulations on the use of nuclear energy in the exclusion

zone plan which is concurred with state sanitary and epidemiological authorities and approved by the local administration of municipal regions or city districts. It is prohibited to place within the exclusion zone any residential and public houses and child welfare institutions as well as medical and health-improving institutions, public catering, industrial, auxiliary and other buildings and facilities not associated with NPP operation and not included in the approved plan of the plant exclusion zone. State sanitary and epidemiological authorities may put restrictions on economic activities in the surveillance zone in compliance with the Russian legislation.

Section 3.3 of the federal rules and regulations NP-032-01 says that the boundaries of the exclusion zone, emergency planning and evacuation zones shall be justified in the design documentation considering the following:

The boundary of NPP exclusion zone shall be set in compliance with NPP health rules and regulations so that:

- in normal and abnormal operation (except for accidents) and during plant decommissioning, doses to the public (critical group) outside the exclusion zone will not exceed a quota (portion) of the reference dose limit;

- in case of design-basis accidents, predicted doses to the public at the exclusion zone boundary and beyond it shall not exceed values¹ requiring decisions on public protection measures in case of a radiological accident entailing land contamination.

The boundary of emergency planning zone shall be established so that in case of a beyond-design-basis accident entailing maximum permissible emergency release² to the environment, predicted doses to the public at and beyond the boundary of emergency planning zone shall not exceed values established in the current Radiation Safety Regulations (NRB-99/2009) as criteria for making public protection decisions in the event of a radiological accident with territory contamination.

The boundary of the evacuation planning zone shall be established so that in case of a beyond-design-basis accident involving maximum permissible emergency release to the environment the dose limit set in the current Radiation Safety Regulations for mandatory evacuation of the critical group of the public in the initial stage of an accident is reached or exceeded within this area.

¹ These values are specified in the Radiation Safety Regulations (NRB-99/2009).

² According to the target specified in section 1.2.17 of the "Basic Safety Rules for Nuclear Plants" (OPB-88/97), estimated probability of the maximum emergency release established by these requirements should not exceed 10^{-7} per reactor/year.

Natural and human-induced factors to be investigated during NPP site selection process were described in the Fourth National Report of the Russian Federation.

The federal rules and regulations NP-064-05 say that in case of the low intensity of maximum credible external impacts (Hazard Category III – the lowest) adopted in the design basis, new nuclear plants should be designed to have:

- seismic resistance under free soil surface acceleration no less than 0.1 g (of the free fall acceleration);
- resistance to loads caused by an air-shock wave with the front pressure at least 10 kPa and compression phase time up to 1 s;
- safety-related buildings and facilities shall survive regular fires caused by external factors for at least 1.5 hrs;
- protective structures of confining systems shall resist local shock loads caused by an aircraft and missile crash equivalent to the shock load in contact zone resulting from a light airplane crash (5 t);
- safety systems and their trains shall be physically separated.

In the rationale for protection against external impacts which have Hazard Category I or II intensity according to NP-064-05, the decision not to take protective measures to prevent the potential damage associated with external impacts on the safety-related buildings and facilities of the plant shall be supported by proving that:

- unacceptable failures and damage to safety-related systems and components are precluded;
- the frequency of design-basis accidents and severity of their consequences estimated in the probabilistic safety analysis for external events do not differ essentially from the values defined in the probabilistic safety analysis for internal initiating events leading to design-basis accidents, and are acceptable;
- the frequency of beyond-design-basis accidents caused by natural and human-induced external events is low enough (less than 10^{-6} 1/year), or the frequency of maximum emergency release (discharge) to the environment in case of beyond-design-basis accidents caused by natural and human-induced external events is less than 10^{-7} 1/year.

The above shows that when new nuclear units are designed in the Russian Federation, the candidate sites are studied for suitability in terms of safety assurance with regard to the natural and human-induced processes, phenomena and factors.

Article 18. Design and Construction

The basic principles of NPP design and construction set out in the federal rules and regulations, and the results of their elaboration were described in detail in the previous National Reports of the Russian Federation.

18.1. Regulatory framework for design and construction of nuclear plants

The basic principles to be followed during NPP design and operation are stated in the following federal rules and regulations:

- "Basic Safety Rules for Nuclear Plants" (OPB-88/97);
- "Nuclear Safety Rules for Reactor Installations of Nuclear Plants" (NP-082-07);
- "Rules for Designing Seismically Resistant Nuclear Plants" (NP-031-01);
- "Siting of Nuclear Plants. Basic Safety Criteria and Requirements" (NP-032-01);
- "Consideration of External Impacts of Natural and Human-induced Origin at Nuclear Facilities" (NP-064-05);
- "Fire Safety Rules in the Russian Federation" (PPB 01-03);
- "Health Rules for Design and Operation of Nuclear Plants" (SP AS-03);
- and other.

18.2. Principal features and characteristics of new NPP designs

New nuclear plants are designed in full compliance with the federal rules and regulations on the use of nuclear energy and taking into account IAEA, ICRP, IEC and EUR recommendations and criteria.

During design, top priority is given to unconditional safety assurance with the fulfillment of integral criteria: core damage probability shall not exceed 10^{-6} and emergency radioactive release probability shall not be greater than 10^{-7} .

Table 18.1 gives principal technical and economic features of a new nuclear unit designed for the Novovoronezh NPP-2.

Table 18.1 - Principal Technical and Economic Characteristics of a New Unit of Novovoronezh NPP-2 with V-392M Reactor

	Characteristic	Value
1	Installed thermal power of the reactor, MWth	3200
2	Electrical power of the Unit, MWe	1200
3	Main components:	
	- V-392M reactor	1
	- K-1200-6.8/50 turbine	1
	- TZV-1200-2U3 generator	1
4	Average enrichment in a steady-state load, % Uranium-235	4.79
5	Average burn-up (steady-state campaign), MW·day/t U	55800
6	Design lifetime, years	50
7	Lifetime capacity factor, %	90
8	Annual use of installed capacity, h/year	7884
9	In-house power consumption, % of generation	7.0

New NPP designs employ the following engineering solutions to enhance safety:

- use of a safety system structure based on a combination of active and passive safety systems, each capable of performing key safety functions on its own;
- wide use of passive safety systems to give sufficient time (72 hrs and more) to restore active safety systems and other means for managing beyond-design-basis accidents;
- full implementation of the diversity principle, especially in the controlling safety systems;
- use of a special cooled corium catcher for beyond-design-basis accidents;
- use of a passive filtration system for containment leakages in the inner space in double-wall containment;
- extensive use of efficient automatic in-service inspection and diagnostic tools to check the condition of metal and of component on the whole;
- use of realistic rather than conservative models for assessing equipment reliability to avoid misrepresentation of risk profile;
- higher level of process automation in shutdown conditions to minimize impact of human errors.

The AES-2006 design is being implemented at Leningrad and Novovoronezh sites.

The construction of the two lead units is expected to be completed in 2013 (Unit 1 of Novovoronezh NPP-2) and in 2014 (Unit 1 of Leningrad NPP-2).

It is planned to put into operation by 2020 Kalinin 4; Beloyarsk 4; Unit 2 of Novovoronezh NPP-2; Units 2, 3 and 4 of Leningrad NPP-2; Rostov 3 and 4; Units 1 and 2 of Baltic NPP; Units 1 and 2 of Vilyuchinsk floating nuclear heat-and-power plant, and Units 1 and 2 of Pevek floating nuclear heat-and-power plant.

18.3. State of the art and prospects for construction of floating nuclear heat-and-power plants

Rosenergoatom Concern is currently building the first-of-the-kind floating nuclear heat-and-power plant of 70 MWe capacity with two 35 MWe reactors of KLT-40S type.

Construction of the first floating plant began in 2007 at Sevmash shipyard in Severodvinsk. In 2008 the Russian Federation Government decided to transfer the order for the construction of the first unit of the plant to Baltiisky Zavod in St. Petersburg.

Construction of the first unit at Baltiisky Zavod was started on 18 May 2009. Unit testing is planned at the end of 2011 with trial operation as part of the floating heat-and-power plant to begin in the end of 2012.

Most power components have been manufactured by now: both reactors of the unit were brought to Baltiisky Zavod; the first steam-turbine facility passed acceptance tests.

The town of Vilyuchinsk in Kamchatka region was chosen as the site for the first floating nuclear heat-and-power plant.

The plant will provide reliable energy supply to Vilyuchinsk residents and infrastructure facilities in this far-away region of Russia and will help reduce the region's dependence on fuel import.

The design documentation for the plant is currently undergoing State Review.

The site licence for the plant is expected to be obtained in 2010.

Preparations for plant operation, development of personnel training system are carried out according to the schedule.

This is a pilot project, and it is intended to give an opportunity to update the infrastructure in remote Russian regions relying on nuclear power; to raise energy security of the Arctic regions; reduce fuel delivery to the area and support development of mineral deposits in the North and in the offshore area of the Arctic seas.

Rosatom is considering possibility of building a series of floating nuclear plants. Pre-design activities are now in the final stage for the site of the second such plant in Pevek (Chukotka autonomous region). Consideration is given to building floating nuclear heat-and-power plants in Sakha Republic (Yakutia) and in other regions of Russia.

18.4. Licensing associated with design and construction of nuclear plants

Decision to build a nuclear facility is made by the Russian Federation Government.

The main safety evaluation of design solutions and measures intended to ensure the safety of the plant to be built is carried out at the construction licensing stage.

To obtain construction licence for a nuclear plant, the Operator shall submit to Rostekhnadzor an application for a construction licence together with a package of documents proving NPP safety.

In keeping with the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal Environmental, Industrial and Nuclear Supervision Service", the package of documents produced to demonstrate nuclear and radiation safety and submitted to obtain a construction licence should contain:

- Preliminary Safety Analysis Report (PSAR) for the nuclear plant;
- A global Quality Assurance Programme – POKAS(O);
- PSA Level 1;
- if necessary, on Rostekhnadzor request, design documents (including those for reactor, APCS, safety-related systems, and description of the physical protection system), test and R&D reports referenced in the PSAR.

The Quality Assurance Programmes are developed in compliance with the requirements laid down in the document entitled "Requirements for a Quality Assurance Programme of a Nuclear Plant" (NP-011-99).

The information presented in the "Preliminary Safety Analysis Report of the Nuclear Plant" (PSAR) is based on the documents pertaining to the design of the entire plant and the design of the reactor facility and safety-related systems. This information should be sufficient to give an adequate insight into plant design and its safety concept, into the Quality Assurance Programme and basic operation principles adopted by the Operating Organisation.

On the basis of the information found in the PSAR, the Regulator assesses the adequacy of the safety case and its compliance with regulatory requirements, in particular, with the federal rules and regulations.

The safety concept presented in the PSAR for the nuclear plant shall meet the existing regulatory requirements.

In 2007-2010 Rostekhnadzor reviewed applications for siting and constructing new nuclear units (mentioned above in the Report in the section describing the fulfillment of commitments resulting from Article 6), including those of new designs. The review of the applicant's safety documentation covered a wide range of issues associated with each safety

aspect (safety concept; site suitability; design approaches for safety-related systems, components and structures; reactor; primary circuit; steam turbine facility; I&C systems; power supply systems; radiation protection; safety systems; deterministic and probabilistic safety analyses; operation; commissioning; decommissioning). The safety case for Unit 1 of Novovoronezh NPP-2 was reviewed by 56 experts from several organisations; they produced 210 expert opinion statements. The review lasted for 11 months; 5 meetings were held between the experts and the Applicant to discuss preliminary conclusions of the review. There was also a meeting of the Scientific and Technical Board of Rostechнадзор attended by the Operator staff and people from design and engineering organisations.

The decision on granting a license or rejecting a license application is made by persons authorised accordingly by Rostechнадзор on the basis of the results produced by verification of the information presented in the application documents, by review of the documents to demonstrate the assured nuclear and radiation safety of the installation in question as well as by inspections. The decision is documented as officially required.

As evident from the above, a regulatory framework has been developed and is in use in the Russian Federation to deal with the design and construction of new nuclear plants, which is consistent with the international safety standards and requirements.

Nuclear plants are designed and constructed only under licences (permits) granted by Rostechнадзор.

Article 19. Operation of Nuclear Plants

19.1. Safety case and licenses for operation of newly built nuclear plants

The process for licensing the operation of nuclear power plants specified in the "Regulation on the Licensing in the Sphere of Nuclear Energy Uses" has seen no changes since the time of the Fourth Meeting of the Contracting Parties.

The decision on granting a license for the operation of a nuclear unit is taken by Rostekhnadzor upon review of the documents justifying the application made by the Operating Organisation.

The documents to prove the nuclear and radiation safety of a nuclear unit to be commissioned are defined in the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal Environmental, Industrial and Nuclear Supervision Service".

Before a unit may be brought into operation reports will be sent to Rostekhnadzor to present the results of the first-criticality and first-power tests as well as of pilot operation of the unit in question, with a report issued at the end of each stage in the pre-commissioning activities prior to the beginning of the next one. Besides, on completion of the tests, all changes and deviations will be taken into account during finalisation of the Safety Analysis Report and of the operational documents.

The first-criticality and first-power runs will not be made until Rostekhnadzor inspects the unit for its actual operational availability.

Following this procedure, Rostov 2 carried out preparations for service in 2009-2010 and on February 20, 2010 launched its programme for first-power activities and attainment of the design power level.

19.2. Current system for updating safe operation limits and conditions

The Safe Operation Procedure following the requirements of the "Basic Safety Rules for Nuclear Plants" (OPB-88/97) is the main document to guide operation of a nuclear unit. It specifies the limits and conditions of safe operation, which are justified at the design stage and are updated with regard to the results of pre-commissioning works, first-criticality and first-power activities. Besides, this Procedure defines the rules and main practices of safe operation of a plant, and the general order of operations relating to nuclear plant safety.

The order of making changes to the design and operational documents, including those concerning changes in the limits and

conditions of safe operation, is set forth in the "Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal Environmental, Industrial and Nuclear Supervision Service". Such changes including updates in the Operating Procedure entail changes in the terms of licensing.

A permit for changing the terms of the license may be given by Rostekhnadzor upon review of the justification documents.

The limits and conditions of safe operation may be revised if the changes are shown to be appropriate by the results of safety analyses (including probabilistic safety analysis) or in-depth safety assessment.

19.3. Current system for scheduling maintenance and repairs, inspections and tests at nuclear plants

The nuclear power industry of Russia has a common system for in-service maintenance and repairs (M&R) applicable to nuclear plants of different types and taking into account the design features specific to reactors and major equipment.

The full list of documents that should be available at a nuclear unit during its operation, including those on maintenance, repairs, inspections and tests, is set forth in the standard of the Operating Organisation entitled "Basic Safety Rules for the Operation of Nuclear Plants" (STO 1.1.1.01.0678-2007). Following the current M&R documents, the management of each nuclear plant develops a specific work programme based on M&R schedules prepared and approved for each type of components and systems. This work is done in accordance with the regulations for maintenance and repair of safety-related systems and with the time schedule available at each unit and approved by plant management.

Maintenance of components and systems is carried out mainly by plant personnel and covers monitoring of variations in the parameters of operating equipment aimed at early detection of deviations, execution of preventive measures and specified tests of components, instruments and systems.

All repairs are carried out by plant personnel as well as by contractors holding Rostekhnadzor licenses.

Planned repairs at a nuclear plant are performed irrespective of the actual technical condition of the equipment at the time of their scheduled commencement, at intervals and in the scope established by M&R Procedure.

The intervals and scope of planned maintenance and repair of components and systems are dictated by the need for keeping such

components and systems available as required by safe operation conditions and operating limits set in the plant design. The necessity of unplanned maintenance and repair of components and systems is determined by the results of their examination.

An appropriately approved examination and test procedure specifies such activities for safety-related systems.

The system of nuclear plant inspections by the Regulatory Body and by the Operating Organisation is implemented in accordance with annual inspection schedules. Plant inspection issues were covered at length in Article 14.

The results of inspections and examinations performed by the Operating Organisation are presented in special reports which will contain critical remarks, if any, and will identify the deficiencies discovered and the measures proposed for their correction.

19.4. Procedure for accounting operational events with safety implications

At present, analysis and accounting of operational events at nuclear plants, including events with safety implications, are regulated by the following documents:

- "Regulation on Investigating and Accounting of Operational Events at Nuclear Plants" (NP-004-08);
- "Regulation on the Transfer of NPP Operational Information from Nuclear Plants to Rosenergoatom Concern, Rosatom, Rostekhnadzor, OJSC "SO-CDU EES" (RD EO 0331-2006);
- "Regulation on the Organisation of Investigations of Operational Events at Nuclear Plants in Rosenergoatom Concern" (RD EO 0163-2005);
- "Methodological Guidance on the Analysis the Causes of Operational Events at Nuclear Plants, Fires, Industrial Accidents, and Damage to Buildings and Structures" (RD EO 0095-2004);
- Internal regulatory documents of nuclear plants on the investigation and accounting of operational events.

The regulatory framework for these activities was developed with due regard for IAEA recommendations contained in the relevant Safety Guides and technical documents, and was based on extensive experience of Russia with the IAEA/NEA Incident Reporting System (IRS) as well as on the country's involvement in WANO's Operating Experience Programme (exchange of information on events at NPPs).

Document NP-004-08, which is part of the relevant Federal Regulations, establishes:

- the categories of NPP operational events to be reported to the Regulatory Body;
- the procedure for accounting and reporting of occurrences;
- the procedure for investigation of occurrences.

Operational events fall into the following categories:

- "accidents" classed according to the extent of onsite and offsite radiation impacts;
- "incidents" classed according to the degree of impairment of the defence in depth and onsite radiation impact.

Operational events at NPPs include the onsite events resulting in deviations from normal operation, from the established limits and/or conditions of safe operation.

All the onsite events with the symptoms and consequences of operational events are reported by the plant management to the Operating Organisation and the Regulatory Body as an early notification within one hour from their occurrence or detection and then as a preliminary report within 24 hours from their occurrence or detection.

During the next 15 days the event will be investigated by a commission, whereupon the nuclear plant will send to Rostechнадзор and Operating Organisation its full report on the investigation and the proposed corrective measures aimed at preventing similar occurrences in future. Each event is rated according to the International Nuclear Event Scale (INES) using the INES User's Manual (IAEA-INES-2001).

Document RD EO 0331-2006 (a guidance document of the Operating Organisation) seeks to bring the requirements of corporate documents in compliance with the industry-level and federal documents which regulate the order of informing relevant authorities and organisations about the current condition of and contingencies³ at nuclear plants.

"Regulation on the Organisation of Investigations of Operational Events at Nuclear Plants in Rosenergoatom Concern" (RD EO 0163-2005) establishes requirements for the organisation and conduct of such investigations by Rosenergoatom Concern including the categories of events that are not subject to reporting to the Regulatory Body. This document aims at establishing at Rosenergoatom Concern a systems approach to the investigation of upsets and early detection of deviations from normal operation which can potentially have more severe consequences.

"Methodological Guidance on the Analysis of the Causes of Operational Events at Nuclear Plants, Fires, Industrial Accidents and Damage to Buildings and Structures" (RD EO 0095-2004) specifies the

³ A contingency is a disruption of normal industrial, radiation, fire and chemical safety as well as social conditions at a nuclear plant.

procedures for identifying the root causes of and the factors contributing to abnormal events at NPPs with the consequences classed as operational events, fires, industrial accidents, damage to buildings and structures, etc., with the aim of developing appropriate corrective actions as well as measures to prevent recurrence of such events.

The "Methodological Guidance" was developed with regard to the IAEA ASSET methodology (IAEA-TECDOC-632) as well as to that of the US Institute of Nuclear Power Operations (INPO 90-004), which proved their practical worth in many countries operating nuclear plants.

Application of the "Methodological Guidance" suggests that besides using the recommended methods for analysing the causes of abnormal events at nuclear plants, special methods should be employed, wherever required, to analyse the direct causes of system component failures (such as methods for metal inspection, water chemistry control, radiochemical methods for determining the dose received, methods for strength analysis of structural components, etc.).

"Methodological Guidance" RD EO 0095-2004 is resorted to when the following operational events are investigated and analysed:

- operational events at NPPs including those subject to investigation in accordance with NP-004-08;
- fires (ignitions);
- industrial accidents;
- damage to buildings, structures, to their parts and structural elements;
- damage to engineered features of hazardous industrial facilities;
- overexposure of personnel;
- significant contamination of the environment.

"Methodological Guidance" is also used during investigation and analysis of the causes of events associated with poor management of various activities, such as violation of time schedules and infringement of work rules, failures to supply materials and spare parts, breaches of technological or financial discipline.

NPP operational event reports are kept at the plant till its decommissioning. The Operating Organisation has a computer database with information on accounting and analysing operational events, which is maintained by VNIAES.

The Operating Organisation arranges and provides for the issuing of quarterly and annual reports with a survey of all operational events including those with safety implications, which identify the root causes of and the factors contributing to such events and indicate the corrective actions taken to preclude recurrence.

The surveyed results of such investigations are brought to the attention of managerial, operational and maintenance personnel of plant

divisions. Besides, the Russian nuclear plants review and analyse all the accounts and reports on events (incidents) coming from other nuclear plants and VNIIAES, from IAEA/NEA IRS, and WANO. The safety problems identified in the accounts and reports are analysed from the viewpoint of their significance for specific plants. Besides, useful information is picked out for the purpose of using it in the training of operation and maintenance personnel. It is analysed by instructors of training points and centres and is subsequently used in the training and retraining of plant personnel.

The accounts of and reports on operational events at Russian and foreign nuclear plants will also contain additional recommendations to managerial, operation and maintenance personnel for prevention of such events. These documents are sent out to all NPPs, to divisions of the Operating Organisation Headquarters, to Rostekhnadzor and to the organisations responsible for the scientific and engineering support to NPP operation.

Analysis of operational events at Russian nuclear plants in 2009 shows that out of 29 events that occurred, 5 do not fall under INES criteria, i.e. are "Out of scale" and 23 belong to Level "0". Of their total number, only one event proved to be safety-related, i.e. rated by INES as Level "1".

The distribution of NPP operational events by INES Levels in 2007–2009 is presented in Appendix 9, and their trends during the same period according to INES are shown in Appendix 10.

As can be seen from the data presented, the number of operational events at Russian NPPs decreases from year to year, while their "severity" under the INES criteria, is rather low.

19.5. Actions of personnel during accidents and emergencies

In case of occurrence of accidents or pre-accident conditions at nuclear units, their operating personnel will follow the requirements of emergency action documents, such as instructions to cope with pre-accident conditions and design-basis accidents, guidelines for the management of beyond-design-basis accidents, and plans for personnel protection measures.

Should symptoms of an accident or pre-accident conditions be discovered at a nuclear plant, the Plant Shift Supervisor will immediately report it to the plant management (Director or Chief Engineer), who would in turn inform the organisations and officials concerned in accordance with the list found in Appendix 11 to this Report.

The procedure for dealing with pre-accident conditions and design-basis accidents prescribes the actions to be taken by the operating personnel

in order to restore the nuclear unit to its normal condition. This procedure addresses initiating events and emergencies at systems and components as well as departures from the specified parameters, which lead or may lead to design-basis accidents. For each initiating event, out of those credible, consideration is also given to the conditions of its occurrence and to the possible ways of accident progression leading to the most severe consequences (a conservative approach).

Progression of initiating events to design-basis accidents and of the latter - to beyond-design-basis accidents is prevented by safety systems. Nuclear plants of next generation are designed to have novel safety systems of passive action, which makes the fulfillment of the required safety functions more reliable.

The main regulatory requirement, which must be complied with for operation of the plant to be permitted, is the availability of procedures for the management of beyond-design-basis accidents, which describe the measures to be taken to cope with such accidents and mitigate their consequences.

Special attention is paid to protecting the sealed enclosure of the reactor facility against failure during beyond-design-basis accidents, and to keeping it available. The main approach to such protection was to equip the associated systems at Russian NPPs with passive autocatalytic recombiners which provide hydrogen oxidation (recombination) beyond the ignition limits and thus would prevent impacts from a fire or explosion on the leak-tight rooms of the unit under conditions of a progressing severe beyond-design-basis accident.

Following the requirements of the "Basic Rules of Nuclear Plant Safety" (OPB-88/97) which demand that personnel in their actions should be guided by the symptoms of events and conditions at the reactor facility as well as by the prediction of the conditions during accident progression, the Operating Organisation developed the Symptom-Based Emergency Procedure (SOAI) for all nuclear units with WWER and RBMK reactors. This Procedure provides emergency guidance fully in line with the concept of accident management actions by personnel based on the condition of the reactor facility and physical safety barriers. Using predictions, the SOAI Procedure specifies and directs the actions of operating personnel to terminate the emergency and to return the unit to a controllable state stopping the chain fission reaction, cooling the nuclear fuel, and confining radioactive materials within proper boundaries. In doing so, normal operation systems may be used.

19.6. Engineering and scientific support to nuclear plants

Throughout the life cycle of nuclear plants, the essential engineering and scientific support is provided to them by the Operating Organisation both on its own and with the help of external organisations.

The types and forms of engineering support vary at the stages of construction, commissioning and operation, depending on the objectives faced by the Operating Organisation and the specific nuclear plant.

Normally, the Operating Organisation and nuclear plants will enlist the required services by making contracts with research, design, maintenance, adjustment and other companies as well as with nuclear equipment manufacturers.

The system of the State Corporation for Atomic Energy "Rosatom" includes major design and research institutes, process development organisations, maintenance, construction, installation and other companies which have extensive experience of operation in the nuclear power sector and Rostekhnadzor licenses for the relevant activities. Such organisations providing essential and effective support to nuclear plants include:

- OJSC "Experimental Design Bureau Gidropress" (OKB Gidropress);
- OJSC "N.A. Dollezhal Research and Development Institute of Power Engineering" (NIKIET);
- OJSC "I.I. Afrikantov Experimental Mechanical Engineering Bureau" (OKBM Afrikantov), Nizhniy Novgorod;
- OJSC "Atomenergoproekt" (AEP), Moscow;
- OJSC "St. Petersburg Research and Architect Engineering Institute Atomenergoproekt" (SPbAEP);
- OJSC "Nizhniy Novgorod Engineering Company Atomenergoproekt" (NIAEP);
- National Research Centre of the Russian Federation "A.I. Leipunsky Physics and Engineering Institute" (FEI);
- OJSC "All-Russian Research and Design Institute of Integrated Energy Technology" (VNIPIET);
- "Research and Design Institute of Installation Technology" (NIKIMT);
- OJSC "Atomtechenergo" (ATE);
- OJSC "Atomenergoremont" (AER).

The Operating Organisation enjoys continuous scientific and technical support in operational issues from OJSC "All-Russian Research Institute for Nuclear Power Plants Operation" (VNIIAES).

Scientific support in a wide range of safety issues is provided to the Operating Organisation and to the nuclear plants by the Russian Research Centre "Kurchatov Institute" (RRC KI).

19.7. Programmes for collection and analysis of information on operation of nuclear plants. System for the use of operating experience of Russian and foreign nuclear plants

In accordance with this Article of the Convention on Nuclear Safety, the general technical principles of NPP safety specified by the IAEA in INSAG-12 "Basic Principles of Nuclear Plant Safety", in Report No. 110 "Safety of Nuclear Installations", and in Safety Guides NS-R-2 "Safety of Nuclear Plants: Operation" and NS-G-2.11 "System for Feedback of Experience from Events at Nuclear Installations", the Operating Organisation – OJSC "Rosenergoatom Concern" – organises and coordinates activities to ensure proper functioning of the Industry-level System for Analysis and Use of Information on Operating Experience of Nuclear Power Plants (SAI OE) with scientific and technical support provided by OJSC "VNIIAES".

For its operation this system relies on: the documentation management system of Rosenergoatom; the human resources management system; the Industry-level Information and Analysis System for Operating Experience of Nuclear Power Plants (OIS OE); the financing system; and the management and supervision system.

Organisation of efficient data collection, storage, processing, analysis, exchange and distribution as well as of operational feedback processes is based on the systems approach. The key function to this end is performed by the information system deployed at the industry and plant levels, which operates in the common information space and uses a common information medium. The OIS OE System of Rosenergoatom Concern is meant for collection, accumulation, storage, exchange and analysis of various structured information on the operation of NPPs and is part of the Corporate Information System of Rosenergoatom. It deals with information on all occurrences at NPPs including potential precursors of serious incidents and accidents.

Performance of the OIS OE is largely dependent on the development and implementation of procedures for interaction between the participants of the information system and for circulation of information within the system. To this end, the Operating Organisation developed a package of guidance and methodological documents. Such is, for instance, the guidance document of the Operating Organisation entitled "The Basic Principles of Organising the Industry-Level OE Information and Analysis System of Rosenergoatom Concern" (RD EO 0152-2005). The purpose of

this document is to organise effective exchange and use of information on the operation of NPPs by the nuclear sector entities, such as nuclear plants in operation and under construction, companies and organisations of Rosenergoatom Concern, research and design organisations of the State Atomic Energy Corporation "Rosatom" as well as to ensure safe, reliable and economically efficient operation of nuclear plants.

The document contains requirements for the organisation of OIS OE operation and for relevant procedures along the following lines:

- OIS OE composition and structure in terms of its subject area;
- organisation of subject-based information processes and information resources of OIS OE at the industry and plant levels;
- organisation of subject-based information processes of OIS OE at the interdepartmental and international levels;
- responsibilities for supervision, coordination and conduct of activities, for methodological support and for proper operation of OIS OE.

An important addition to the "Basic Principles" RD EO 0152-2005 is a package of methodological documents developed by VNIIAES, which specify the procedure for preparation (scope, form, etc.), transfer and use of various information on the operation of nuclear plants and companies (organisations) within OIS OE, i.e.: "Methodological Guidance on the Collection, Processing and Use of Information on the Operation of Nuclear Plants" (RD EO 0194-00).

The information coming from nuclear plants is used by VNIIAES for maintaining industry-level databases along the subject areas of OIS OE.

In order to establish basic requirements for accumulation, analysis, use and dissemination of operational data in the industry throughout the life cycle of nuclear plants with the aim of reducing the adverse impacts on the plants and enhancing their performance, the Operating Organisation developed a standard named "Analysis and Use of Operating Experience of Nuclear Plants. Basic Provisions" (STO 1.1.1.01.002.0646-2007). The basic provisions cover the organisation and functioning of the System for Analysis and Use of Information on Operating Experience of Nuclear Power Plants (SAI OE) at home and abroad, during operation or under construction, as well as at the structural divisions of Rosenergoatom Concern. This document establishes the main principles and rules for:

- organisation of analysis and use of OE information at the plant and industry levels;
- the main sources of OE information;
- the criteria for assessing and selecting information on operating experience for in-depth analysis;

- development of corrective actions and supervision of their implementation;
- analysis of operating experience, documenting, use and dissemination of its results;
- quality control in accumulation, analysis and use of OE information.

To make the basic provisions of this standard more detailed both at the industry and plant levels (i.e. at all the organisation levels of the OE analysis and use system), Rosenergoatom Concern brought into effect in 2009 a model "Administrative Instruction on the Analysis and Use of OE Information" (AI 1.3.2.06.014.0017-2008).

The Operating Organisation has developed and has been implementing since 2005 a special programme for training and retraining the staff of Rosenergoatom Headquarters, nuclear plants and supporting organisations, who investigate and analyse the causes of events and use OE information at the plant and industry levels.

VNIIAES, which takes care of Russia's participation in IAEA information systems (IRS, PRIS, INES) and is a member of WANO Moscow Centre, receives and distributes in the nuclear industry the following information on foreign experience:

- events at nuclear plants;
- performance of nuclear plants;
- operation experience of nuclear plants;
- experience with peer reviews at nuclear plants;
- good practices.

Use of Russian and foreign experience of plant operation allows preventing operational events at nuclear plants and enhancing their safety.

Information on equipment malfunctions and failures received from the nuclear plants is also used in dealing with the following objectives:

- acquisition of statistics for probabilistic safety assessments;
- estimation of main equipment reliability indicators;
- determination of trends in and comparative assessment of operations;
- detection of recurrent events at NPPs and identification of their causes;
- optimisation of design-basis sequences as compared with those of real-life emergencies;
- analysis of safety systems' operation modes;
- development of recommendations for the prevention of operational events.

Based on the analysis of NPP operational events and using other information from nuclear plants, nuclear sector enterprises, international

and foreign organisations, VNIIAES publishes various information and analytical reports on the operating experience of domestic and foreign nuclear plants, which contain both general information and specific facts of potential interest to specialists. These include:

- annual summary reports on the operational safety of nuclear units in Russia;

- quarterly and annual reports on the main technical and economic performance data of Russian nuclear plants;

- quarterly and annual reports on operational events at Russian NPPs with descriptions of these events, identification of their causes and safety implications, assessment of personnel actions and of the planned corrective measures to preclude similar events in future;

- formats of event rating by INES;

- quarterly reviews of equipment defects, damages and failures at Russian NPPs with recommendations for improvement of such equipment;

- summary lists of engineering solutions adopted at Russian NPPs;

- NPP operational event reports;

- reports on events at foreign NPPs (from IAEA/NEA IRS);

- technical statements on the results of the use of domestic and foreign OE information by nuclear plants and other industrial entities.

The main information and analytical materials of VNIIAES on the operating experience of domestic and foreign NPPs are distributed among more than 25 addressees in various divisions of the Operating Organisation, nuclear plants and its subsidiaries, in the supporting companies (organisations) as well as in the divisions of State Corporation "Rosatom" and Rostechndzor.

Seeking to ensure effective exchange and use of OE information by the SAI OE participants in improving the safety, reliability and efficiency of plant operation, as well as to have proper control of the measures taken, and to assess the effectiveness of analysing and using the OE information, a system of feedback in 2010 was extended at the industry and plant levels of SAI OE. The new "Regulation on the Development, Implementation and Assessment of the Effectiveness of Measures Taken as a Result of Analysis and Use of Operating Experience" (RD EO 1.1.2.01.0798-2009) introduced a list of documents describing the measures taken and subject to a follow-up through the feedback system including information letters and bulletins of the Operating Organisation, reports from VNIIAES, IAEA/NEA IRS and WANO, and reports on the investigation of NPP operational events.

For the purpose of faster data dissemination and its subsequent use in the local computer networks of nuclear plants, such material is sent out to all NPPs in electronic format and is placed in the VNIIAES-maintained system of web servers of OIS OE, which is accessible to hundreds of authorised representatives of all nuclear plants appointed by the Chief

Engineer (other managerial staff members), other subsidiaries and divisions of the Operating Organisation.

19.8. Management of radioactive waste and spent fuel on plant sites and measures taken to reduce their volumes

19.8.1. Radioactive waste of nuclear plants and measures taken to reduce its volumes

The main objectives of radioactive waste (RW) management at NPPs are:

- to minimise the RW quantities to be treated;
- to develop and introduce new efficient and economically justified technologies for solidification of liquid radioactive waste (LRW);
- to develop RW storage and disposal technologies.

The main purpose of developing techniques for LRW treatment is to reduce the total waste volume while minimising the risk of radionuclides release into the environment. Accomplishment of these objectives is largely facilitated by solidification of liquid waste and its subsequent placing in storage facilities with the possibility of monitoring its condition for a long time.

The processes, methods and equipment for solid RW processing are designed to reduce its mass and volume and to improve the confinement of radioactive material.

The nuclear industry's strategy in the area of managing radioactive waste from nuclear plants called for taking the following steps:

- LRW collection and sorting by the activity level, salt content, and presence of surfactants. Solid radwaste (SRW) is also classed by the activity level and, besides, is divided into categories of combustible and non-combustible materials, metals, and other groups depending on the decision made for their subsequent treatment or storage;
- RW concentration (volume reduction). The concentration methods practiced at NPPs are evaporation for LRW and compression and incineration for SRW;
- temporary storage of concentrated waste in the onsite storage facilities. Storage may be dictated both by the absence of final treatment facilities and by the need for reducing waste activity through decay of short-lived radionuclides;
- waste conditioning, with liquid and solid waste converted to a form suitable for storage, shipment off the site and disposal in a repository;

- onsite storage of conditioned waste is viewed as a temporary measure dictated by the need for waste activity reduction. In this case, the waste is kept in special engineered structures (storages) built on NPP sites;
- transportation and final disposal of waste from the sphere of human activities through its burial in special repositories.

By now, the first three steps of the above concept have been fully implemented at nuclear plants, with the fourth being in progress at some NPPs.

All the RW management activities are described in the industry-level "Working Programme of RW Management at nuclear plants of Rosenergoatom Concern for 2009-2012" prepared with due regard of the current regulations.

Based on the industry-level "Working Programme...", an individual working programme and a site-specific RW management plan are developed for each NPP. In deciding on the plan, consideration was given to the current storage conditions, availability of facilities, and plant operating conditions.

Besides, each plant develops and annually updates the measures for reducing the amounts of RW.

Administrative instructions on RW management are being followed at all NPPs as part of the QA system.

All the above documents were developed with regard to and in compliance with the current safety regulations.

All the operating nuclear plants of Russia are equipped with radwaste treatment facilities which reduce the activity of waste and decrease its volume.

Advanced evaporation facilities are available at Balakovo and Novovoronezh NPPs, and an advanced evaporation facility with the functions of cementation and prepacking of cement compound in metal-and-concrete containers is in operation at Rostov NPP.

An LWR treatment complex put into operation at Kola NPP comprises facilities for ozonation, ion-selective treatment and cementation.

According to plans, LRW solidification facilities will be commissioned in 2010-2011 at Kursk, Leningrad, Beloyarsk, Smolensk and Novovoronezh NPPs.

A bituminisation facility is in service at Leningrad NPP.

Beloyarsk NPP has introduced the process of ion-selective sorption for LRW treatment, with other plants soon to follow it.

Besides, it is planned to commission a facility for advanced decontamination of spent ion exchange resins at Kalinin NPP.

The Waste Treatment Centre operating at Balakovo NPP site includes facilities for sorting, incineration, compaction and cementation.

Compaction facilities are in service at Balakovo, Beloyarsk, Kalinin, Kola, Kursk, Smolensk and Novovoronezh NPPs.

Incinerators operate at Balakovo, Beloyarsk, Kalinin, Kola, Kursk, Smolensk and Leningrad NPPs.

RW storage conditions on plant sites are kept under systematic surveillance by the Operating Organisation.

19.8.2. Onsite storage of spent fuel

Spent nuclear fuel (SNF) is handled at Russian NPPs in compliance with the Federal Programme "Nuclear and Radiation Safety Assurance for 2008 and for the Period up to 2015" and with SNF Management Concept of the State Corporation "Rosatom" approved by Order No. 721 of December 29, 2008.

The state policy of the Russian Federation in the field of SNF management is based on the principle of a closed fuel cycle.

Today, depending on the back end of the fuel cycle, nuclear plants handle their spent fuel in the following ways:

- WWER-440 and BN-600 plants operate in a closed fuel cycle, with SNF interim storage in at-reactor spent fuel pools before it is shipped off the plant site to the reprocessing facility;
- At WWER-1000 plants SNF is cooled in at-reactor pools before shipping to the Krasnoyarsk Mining and Chemical Complex (GKhK) for storage with a view to future reprocessing;
- Spent fuel from RBMK-1000, EGP-6 and AMB plants is not reprocessed at present and is stored in special onsite storage facilities.

On plant sites SNF is placed in at-reactor spent fuel pools as well as in the pools of special separate-standing storage facilities. Leaky spent fuel assemblies are enclosed in flasks and kept in the pools.

Having been cooled in the pools, WWER-440 spent fuel is shipped to "Mayak" Complex to be reprocessed at RT-1 Facility.

The shut down Novovoronezh Units 1 and 2 are completely cleared of spent fuel.

At WWER-1000 plants spent fuel assemblies are first kept in the pools and then are shipped to the Krasnoyarsk GKhK for wet storage.

RBMK-1000 spent fuel is stored in the water of at-reactor pools and will then go to the onsite interim storage facility.

Today, RBMK-1000 fuel is not shipped off the site.

To deal with the accumulating RBMK fuel, work is under way to arrange onsite pads for long-term dry containerised storage with a view to subsequent shipment to the Krasnoyarsk GKhK where the construction of a dry storage facility has been started.

At Bilibino NPP SNF management process is limited to storage in at-reactor SNF pools. The schedule of activities for safe handling of spent fuel at Bilibino NPP and preparation of plant units for decommissioning includes a package of measures for long-term safe storage of spent fuel in the onsite facilities awaiting its removal from the plant territory. Onsite long-term dry storage in the existing facilities and in the additional SNF pool (No. 4) is still the prevailing option of fuel handling.

Spent fuel of the AMB reactors (Beloyarsk Units 1 and 2 shut down in 1981 and 1989 respectively) was partly shipped off the site during preparations for decommissioning, and the remaining fuel assemblies enclosed in dry casks are being cooled in the onsite SNF pools. A programme is in progress to ensure safe storage of spent fuel from the AMB reactors and to prepare it for shipment from Beloyarsk NPP site.

Thus, the existing Russian system for regulating the operation of nuclear facilities including their maintenance and repairs, inspections and tests, accounting and analysis of operational events, as well as radioactive waste and spent nuclear fuel management, provides for safe operation of such facilities.

This is assisted by the scientific and technical support given to the Operating Organisation and to the nuclear plants by a number of research, design and architect-engineering institutes, and the availability of a system for analysis of information on the operating experience of nuclear plants including foreign NPP operating experience.

Major Findings and Conclusion

Major Findings

1. The signing of the Convention on Nuclear Safety by the Russian Federation and the practical implementation of its requirements have contributed to more effective resolution of a whole number of issues related to safety in the operation of nuclear installations.
2. An effective legislative and regulatory framework exists in the Russian Federation to guide safety management at nuclear installations. Evolutionary changes in this framework are aimed at improvement of the existing standards and at further expansion of nuclear power.
3. The Russian Federation has independent regulatory bodies, such as the Ministry of Natural Resources and Environment and the Federal Environmental, Industrial and Nuclear Supervision Service that are subordinate and report directly to the RF Government. These regulatory bodies are provided with human, financial and technical resources which enable them to perform their intended functions while retaining their independence.
4. The priority of safety issues for nuclear installations has been affirmed by legislation and is a matter of normal practice. The Operating Organisation, in accordance with national and international legal norms, bears full responsibility for the safety of nuclear plants, and to this end it has the needed financial, human and other resources.
5. The requirements for the quality assurance programmes of nuclear plants have been defined in the regulatory documents.
6. Safety level of all nuclear plants is being reviewed and assessed systematically throughout plant life cycle. The results of such reviews and safety analyses are taken into consideration by Rostekhnadzor of Russia when licenses are granted for further operation of nuclear plants.
7. Analysis of the operating experience of nuclear units over the recent years has shown steady trends towards a decrease of radioactive releases and discharges to the environment as well as of personnel exposures. This testifies to the efficiency of measures taken by the Operating Organisation to improve the operational safety of nuclear units.

8. Proper steps have been taken at the state level to provide emergency preparedness of nuclear plants and to ensure the safety of personnel, population and the environment in the location of NPPs.
9. The inspections completed by the Russian Regulatory Body and international missions have confirmed the positive trends in the operational activities as well as personnel commitment to further improve NPP safety level.

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.


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State Corporation
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Minister for Natural
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Yu.P. Trutnev

Chairman of the Federal
Environmental, Industrial and
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N.G. Kutin

APPENDICES

Appendix 1.
List of Russian NPPs

Operating nuclear units

NPP name, Unit number	Type of reactor	Rated power, MWe	No. of unit operation license issued by Rostekhnadzor
Balakovo-1	WWER	1000	GN-03-101-2060
Balakovo-2	WWER	1000	GN-03-101-2061
Balakovo-3	WWER	1000	GN-03-101-2063
Balakovo-4	WWER	1000	GN-03-101-2062
Beloyarsk-3	BN	600	GN-03-101-2075
Bilibino-1	EGP-6	12	GN-03-101-1977
Bilibino-2	EGP-6	12	GN-03-101-2237
Bilibino-3	EGP-6	12	GN-03-101-2040
Bilibino-4	EGP-6	12	GN-03-101-2041
Kalinin-1	WWER	1000	GN-03-101-2065
Kalinin-2	WWER	1000	GN-03-101-2186
Kalinin-3	WWER	1000	GN-03-101-2187
Kola-1	WWER	440	GN-03-101-2049
Kola-2	WWER	440	GN-03-101-2050
Kola-3	WWER	440	GN-03-101-2051
Kola-4	WWER	440	GN-03-101-2188
Kursk-1	RBMK	1000	GN-03-101-2064
Kursk-2	RBMK	1000	GN-03-101-1991
Kursk-3	RBMK	1000	GN-03-101-1915
Kursk-4	RBMK	1000	GN-03-101-1931
Leningrad-1	RBMK	1000	GN-03-101-2027
Leningrad-2	RBMK	1000	GN-03-101-2032
Leningrad-3	RBMK	1000	GN-03-101-2031
Leningrad-4	RBMK	1000	GN-03-101-2026
Novovoronezh-3	WWER	417	GN-03-101-3036
Novovoronezh-4	WWER	417	GN-03-101-1967
Novovoronezh-5	WWER	1000	GN-03-101-1968
Rostov-1	WWER	1000	GN-03-101-2232
Rostov-2	WWER	1000	GN-03-101-2362
Smolensk-1	RBMK	1000	GN-03-101-1963
Smolensk-2	RBMK	1000	GN-03-101-1992
Smolensk-3	RBMK	1000	GN-03-101-2017

Nuclear units shut down for decommissioning

NPP name, Unit number	Type of reactor	Rated power, MWe	Date of construction start	Start of commercial operation	Decommis- sioning
Beloyarsk-1	AMB	108	01.06.1958	26.04.1964	01.01.1983
Beloyarsk-2	AMB	160	01.01.1962	01.12.1969	01.01.1990
Novovoronezh-1	WWER	210	01.07.1957	31.12.1964	16.02.1988
Novovoronezh-2	WWER	365	01.07.1964	14.04.1970	29.08.1990

Units having Rostekhnadzor licenses for siting and construction

NPP name, Unit number	Type of reactor	Rated power, MWe	No. of license	Type of licensed activities
Balakovo Unit 5	WWER	1000	GN-02-101-2030	Construction
Beloyarsk Unit 4	BN	800	GN-02-101-2095	Construction
Kalinin Unit 4	WWER	1000	GN-02-101-2069	Construction
Kursk Unit 5	RBMK	1000	GN-02-101-2043	Construction
Leningrad NPP-2, Unit 1	WWER	1160	GN-02-101-2067	Construction
Leningrad NPP-2, Unit 2	WWER	1160	GN-02-101-2148	Construction
Leningrad NPP-2, Unit 3	WWER	1160	GN-02-101-2344	Siting
Leningrad NPP-2, Unit 4	WWER	1160	GN-02-101-2345	Siting
Novovoronezh NPP-2, Unit 1	WWER	1160	GN-02-101-1976	Construction
Novovoronezh NPP-2, Unit 2	WWER	1160	GN-02-101-2068	Construction
Rostov Unit 3	WWER	1000	GN-02-101-2166	Construction
Rostov Unit 4	WWER	1000	GN-02-101-2167	Construction
Seversk Unit 1	WWER	1160	GN-01-101-2207	Siting
Seversk Unit 2	WWER	1160	GN-01-101-2208	Siting
Baltic Unit 1	WWER	1160	GN-01-101-2288	Siting
Baltic Unit 2	WWER	1160	GN-01-101-2289	Siting

Appendix 2.
Major performance indicators of Russian NPPs in 2007-2009

WWER-440 plants

Indicator	NPP	Kola				Novovoronezh		All WWER- 440 plants
	Unit	1	2	3	4	3	4	
1. Operating time factor, %	2007	88.35	85.32	74.27	87.21	70.25	74.07	-
	2008	84.21	88.36	84.31	88.73	86.33	84.97	-
	2009	83.71	78.45	83.79	86.05	60.45	86.53	-
2. Capacity factor, %	2007	74.57	70.10	50.71	71.61	52.17	68.43	64.67
	2008	75.30	71.22	52.53	77.01	57.02	84.98	69.65
	2009	64.07	66.66	57.41	68.48	54.97	86.92	66.34
3. Availability factor, %	2007	91.10	85.69	82.86	89.86	52.43	69.95	78.96
	2008	84.50	90.59	83.82	85.32	58.01	85.87	81.52
	2009	83.93	80.55	83.84	83.93	55.95	88.01	79.50
4. Number of automatic scrams per 7000 hours of operation	2007	0.00	0.94	0.00	0.00	1.14	1.08	0.53
	2008	0.00	0.00	0.00	0.00	0.00	0.94	0.16
	2009	0.00	0.00	0.00	0.00	1.32	0.00	0.22

WWER-1000 plants

Indicator	NPP	Balakovo				Ros- tov	Kalinin			Novo- voro- nezh	All WWER -1000 plants
	Unit	1	2	3	4	1	1	2	3	5	
1. Operating time factor, %	2007	88.25	83.64	91.89	88.89	86.03	85.51	86.06	85.68	81.51	-
	2008	82.92	88.23	87.58	99.94	88.78	82.07	88.30	88.08	87.86	-
	2009	100.00	89.00	83.06	88.21	90.37	87.55	82.74	86.22	78.37	-
2. Capacity factor, %	2007	88.29	79.67	88.58	85.51	87.58	85.66	86.55	86.40	78.91	85.24
	2008	81.28	88.82	88.03	99.04	92.45	83.00	89.04	88.41	87.37	88.60
	2009	94.93	91.12	82.92	88.32	95.00	86.68	83.94	82.20	78.36	87.05
3. Availability factor, %	2007	89.73	84.42	92.80	89.34	87.78	86.86	87.88	86.94	80.27	87.34
	2008	83.91	91.02	88.78	101.81	92.48	83.69	91.23	89.25	87.60	89.98
	2009	101.49	92.49	83.93	90.11	95.33	89.33	85.52	87.10	78.65	89.33
4. Number of automatic scrams per 7000 hours of operation	2007	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.1
	2008	0.00	0.00	0.00	0.00	0.00	0.00	0.902	0.00	0.00	0.1
	2009	0.00	0.90	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.31

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. Operating time factor, %	2007	87.56	70.86	74.60	94.73	94.81	80.79	55.02	65.22	81.48	55.69	94.14	-
	2008	86.48	83.69	27.06	74.91	73.10	88.91	64.12	99.20	95.97	89.07	61.43	-
	2009	92.10	77.38	93.79	54.63	95.72	94.86	70.87	53.60	79.62	94.51	76.55	-
2. Capacity factor, %	2007	83.37	70.48	71.47	91.67	93.28	79.90	47.39	60.63	80.94	50.70	93.79	74.87
	2008	79.79	83.89	26.33	74.41	72.25	86.67	62.57	94.04	95.63	82.62	62.91	74.65
	2009	88.32	78.80	94.18	51.66	94.24	90.13	67.18	50.79	75.65	94.04	75.54	78.23
3. Availability factor, %	2007	89.66	70.99	74.15	94.71	94.38	81.05	54.43	65.57	81.50	51.78	94.49	77.52
	2008	84.74	84.89	27.63	75.43	74.08	89.43	63.33	95.94	96.07	84.48	63.02	76.28
	2009	90.41	79.09	96.76	52.76	96.05	94.36	71.22	53.59	78.49	95.22	76.55	80.41
4. Number of automatic scrams per 7000 hours of operation	2007	0.00	1.13	1.07	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.85	0.37
	2008	0.92	0.00	2.94	0.00	1.09	0.00	1.24	0.00	0.00	0.00	0.00	0.56
	2009	0.00	0.00	0.00	0.00	0.00	0.00	2.25	1.49	2.01	0.00	1.04	0.617

BN-600 and EGP-6 plants

Indicator	NPP	Belo- yarsk 3	Bilibino				EGP-6 plants
	Unit		1	2	3	4	
1. Operating time factor, %	2007	80.92	81.67	85.37	82.84	68.30	-
	2008	78.07	71.28	73.88	83.50	79.95	-
	2009	76.87	00.00	84.34	91.00	87.48	-
2. Capacity factor, %	2007	77.78	37.91	37.03	35.72	27.60	34.57
	2008	77.49	37.35	37.52	42.34	39.18	39.10
	2009	76.53	00.00	53.67	54.01	52.08	39.94
3. Availability factor, %	2007	78.07	84.10	86.06	84.74	74.49	82.35
	2008	77.59	71.30	75.78	84.25	84.78	79.03
	2009	76.56	00.00	85.46	91.02	87.85	66.08
4. Number of automatic scrams per 7000 hours of operation	2007	0.00	0.00	0.00	0.00	1.16	0.29
	2008	0.00	0.00	1.08	0.00	0.99	0.52
	2009	0.00	0.00	0.95	0.00	0.00	0.23

Appendix 3.

**Main measures taken to improve safety and reliability during
upgrades at some Russian NPP units in 2008-2009**

Balakovo NPP

Unit	Work completed
No. 2, 3, 4	Upgrading of the monitoring, control and protection systems as part of the programme for raising thermal power of reactor facility by 4 %
No. 1-3	Upgrading of steam separators-reheaters
No. 1	Introduction of the system for online display of current safety information
No. 2, 3	Introduction of the system for gas fire extinguishing in rooms with electronic equipment
No. 1	Introduction of the system for detection of leaks from the upper reactor block and pressurizer pipelines
No. 2, 3, 4	Upgrading of the system for automatic control of K-1000 turbines
No. 4	Upgrading of the refuelling machine

Beloyarsk NPP

Unit	Work completed
No. 3	Replacement of steam generator modules (49 out of 72)
No. 3	Measures to improve fire safety
No. 3	Installation of thermal imaging equipment for monitoring of electrical components
No. 3	Replacement of TG excitation system (for TG-5, TG-6)
No. 3	Introduction of mechanical monitoring hardware at TG-6

Bilibino NPP

Unit	Work completed
No. 1	Replacement of thyristor chopper TP-1 with a new, modern one
No. 1, 2	Dismantling (to be followed by replacement) of the pipelines for ventilation of the space between the biological shielding tank and the reactor vessel
No. 3	Manufacture and installation of the device for monitoring of steam drum displacement
No. 4	Replacement of a section in the deaerator overflow and drainage pipeline

Kalinin NPP

Unit	Work completed
No. 1	Replacement of the Kompleks-Uran information computer system
No. 1	Replacement of the neutron flux monitoring hardware
No. 1, 2	Step-by-step replacement of current transformers with fire- and explosion-proof ones
No. 1, 2	Upgrading of steam separators-reheaters
No. 2	Replacement of the in-core instrumentation system
No. 1, 2	Replacement of the generator excitation system
No. 1, 2	Upgrading of the refuelling machine
No. 1, 3	Installation of self-flushed filters on circulating and service water pipelines

Kola NPP

Unit	Work completed
No. 1-4	Upgrading of steam separators-reheaters
No. 3, 4	Replacement of diesel generator excitation system
No. 1, 2	Upgrading of the system for shielding the reactor pit space under the dome
No. 3	Upgrading of the information computer system and in-core instrumentation system
No. 3, 4	Replacement of the KRU-6 and 0.4 kV circuit breakers
No. 3	Replacement of pipe seals of the reactor coolant pumps and tubular electric heaters of the pressurizer
No. 1-4	Replacement of aerosol and iodine filters
No. 1-4	Introduction of a video surveillance system for the turbine hall

Kursk NPP

Unit	Work completed
No. 1-3	Upgrading of the Integrated Monitoring, Control and Protection System for power increase
No. 1, 2	Integrated programme for step-by-step thermal power increase by 5% above the nominal level
No. 1-3	Provision of an information system to support units decommissioning
No. 1-4	Procurement of servo-motors for control rods
No. 3	Upgrading of the control unit in the blowdown and cooling system
No. 4	Upgrading of the unit for control of feedwater flow to steam drums

Leningrad NPP

Unit	Work completed
No. 1, 2	Improvement of the techniques for monitoring the availability and increasing the fail-safety of the Main Safety Valve
No. 3, 4	Upgrading of the Emergency Core Cooling System and Accident Localisation System
No. 4	Installation of Uninterruptable Power Supply System
No. 4	Replacement of 199 pressure tubes to recover the "graphite - fuel channel" gap

Rostov NPP

Unit	Work completed
No. 1	Installation of a remote visual surveillance system (industrial television)
No. 1	Upgrading of the steam generator blowdown system
No. 1	Implementation of fire safety measures, including replacement of doors, application of a fireproof coating on cables, replacement of smoke detectors
No. 1	Upgrading of the system for control of the refuelling machine

Smolensk NPP

Unit	Work completed
No. 1, 2	Upgrading of the layout of helium gas pipelines from the manifold to the gas circuits
No. 1, 2	Introduction of cluster-type control rods, including those to replace the rods with expired service life
No. 3	Replacement of throttle control valves in pressure pipelines of the main coolant pumps
No. 3	Upgrading of the generator's gas cooling system
No. 3	Replacement of casings of low-pressure reheaters made of perlitic steel with new casings of austenitic steel

Appendix 4.

List of federal regulations and guidelines, regulatory documents on matters of safety regulation

A. Federal regulations on safety of nuclear plants put into force over the period since the submittal of the Fourth National Report:

- Requirements for the Arrangement of Material Balance Areas (NP-081-07);
- Main Requirements for Fuel Rods and Fuel Assemblies with Uranium-Plutonium (MOX) Fuel for Nuclear Plants (NP-080-07);
- Requirements for Systems of Physical Protection of Nuclear Materials, Nuclear Installations and Nuclear Material Storage Facilities (NP-083-07);
- Nuclear Safety Rules for Reactor Facilities of Nuclear Plants (NP-082-07);
- Regulation on Investigating and Accounting of Operational Events at Nuclear Plants (NP-004-08);
- Typical Content of an Action Plan for Personnel Protection in Case of a Nuclear Plant Accident (NP-015-2010).

B. Regulatory documents (except for federal regulations addressing nuclear energy uses) on nuclear and radiation safety regulation adopted by the Ministry of Natural Resources and Environment of the Russian Federation in 2008-2010:

- Procedure for Authorising Activities in the Field of Nuclear Energy Uses to be Carried out by Personnel of Nuclear Cycle Facilities Posing Potential Nuclear and Radiation Hazards, Companies (Organisations) Operating Commercial Reactors, Companies (Organisations) Transporting Nuclear Materials, Radioactive Substances or Associated Products – approved by Minprirody of Russia on July 22, 2009, Order No. 222;
- Administrative Regulation of the Federal Environmental, Industrial and Nuclear Supervision Service for Performing the State Function of "attending to public complaints, making sure that spoken or written complaints are addressed fully and in good time, and that they are acted upon by decision-making and responses in writing within the time specified by the RF legislation" – approved by Minprirody of Russia on June 29, 2009, Order No. 172;
- Standard Regulation on an Interregional Territorial Authority for Supervision over Nuclear and Radiation Safety of the Federal Environmental, Industrial and Nuclear Supervision Service – approved by Minprirody of Russia on April 15, 2009, Order No. 94;

- Procedure for Authorising Activities in the Field of Nuclear Energy Uses to be Carried out by Personnel of Nuclear Plants – approved by Minprirody of Russia on January 29, 2009, Order No. 13;
- Administrative Regulation on Implementation of the State Function of Licensing Activities in the Field of Nuclear Energy by the Federal Environmental, Industrial and Nuclear Supervision Service – approved by Minprirody of Russia on October 16, 2008, Order No. 262;
- Procedure for Technical Investigation of the Causes of Accidents and Incidents at Facilities under Jurisdiction of the Federal Environmental, Industrial and Nuclear Supervision Service - approved by Minprirody of Russia on June 30, 2009, Order No. 191.

Appendix 5.

Guidance documents and manuals on safety regulation at nuclear facilities (safety guides) developed and put into force by Rostekhnadzor during the period since the submittal of the Fourth National Report

Guidance Documents

- Regulation on Administrative Management (RD-01-01-2008);
- Regulation on the Authority for Safety Management at Nuclear Plants and Nuclear Research Facilities (RD-01-05-2008);
- Regulation on the Division for Safety Regulation at Nuclear Fuel Cycle Facilities, Nuclear-Powered Ships and Facilities Posing Radiation Hazards, for Supervision of Nuclear and Radioactive Material Accounting and Control, and Physical Protection (RD-01-06-2008);
- Regulation on the Quality Assurance System of the Federal Environmental, Industrial and Nuclear Supervision Service in the Field of State Regulation of Safety in Nuclear Energy Uses (RD-03-29-2008);
- Methodological Guidance on Establishing the Terms of Licenses for Specific Activities in the Field of Nuclear Energy Uses (RD-03-31-2008);
- Regulation on the Involvement of the Central Headquarters and Interregional Territorial Authorities for Nuclear and Radiation Safety of the Federal Environmental, Industrial and Nuclear Supervision Service in Providing the Functioning of the System for Certification of Components, Products and Technologies Meant for Nuclear Installations, Radiation Sources and Storage Facilities (RD-03-32-2008);
- Instructions on Organising Reviews of the Software Products Used to Justify and (or) Assure the Safety of Nuclear Energy Facilities (RD-03-33-2008);
- Methodological Guidance on Supervising the Compliance with the Federal Regulations Related to Nuclear Energy Uses as well as the Compliance with License Terms during Construction of Nuclear Energy Facilities (RD-04-05-2008);
- Methodological Guidance on the Order of Conducting Audits of Nuclear Material Accounting and Control Systems (RD-07-15-2008);
- Methodological Guidance on the Application of Statistical Methods in Inspecting Nuclear Material Accounting and Control Systems with the Use of Measuring Hardware (RD-07-16-2008);

- Regulation on Supervising Physical Protection of Radiation Sources, Radioactive Material and Radioactive Waste (RD-07-17-2008);
- Standard Inspection Programme as Part of State Supervision of Construction Processes on Nuclear Energy Facility Sites (RD-11-08-2008).

Safety Guides

- Main Recommendations for Probabilistic Safety Analysis, Level 2, for Nuclear Plants with WWER Reactors (RB-044-09);
- Dynamic Monitoring of Structural Components at Nuclear Energy Facilities (RB-045-08);
- Monitoring of Meteorological and Aerological Conditions in the Locations of Nuclear Energy Facilities (RB-046-08);
- Guide on the Conduct of Periodic Safety Assessment of a Nuclear Plant Unit (RB-041-07);
- Computational Correlations and Techniques for Calculating Hydrodynamic and Thermal Characteristics of Components of Water-Cooled Nuclear Power Facilities (RB-040-09).

Appendix 6.

**Data on the actual number of personnel at the territorial authorities
for nuclear and radiation safety of the Federal Environmental,
Industrial and Nuclear Supervision Service, and on the number of
organisations supervised in 2009**

Index	Total	CMTU	SEMTU	UMTU	DMTU	VMTU	SMTU
Personnel size, persons	979	184	168	136	162	185	144
Number of organisations supervised	4905	1893	588	462	425	999	538

Acronyms:

CMTU – Central Interregional Territorial Authority for Nuclear and Radiation Safety

SEMTU – North-European Interregional Territorial Authority for Nuclear and Radiation Safety

UMTU – Ural Interregional Territorial Authority for Nuclear and Radiation Safety

VMTU – Volga Interregional Territorial Authority for Nuclear and Radiation Safety

DMTU – Don Interregional Territorial Authority for Nuclear and Radiation Safety

SMTU – Siberian Interregional Territorial Authority for Nuclear and Radiation Safety

Note: This Appendix presents data pertaining only to the interregional territorial authorities responsible for nuclear and radiation safety regulation at nuclear plants.

Appendix 7.

**Financing of the Federal Environmental, Industrial and Nuclear
Supervision Service from the federal budget of the Russian Federation
in 2008-2010**

Divisions and subdivisions in the functional classification of federal budget items	Actually financed in 2008, thous. rubles	Actually financed in 2009, thous. rubles	Planned for 2010, thous. rubles
Territorial authorities	402630.10	429033.20	326730.20
Applied research <i>including:</i>	223061.4	289081.8	341741.0
Research and development efforts under governmental contracts	84000.0	132873.9	201500.0
Support to the activity of subordinate organisations	44461.4	67722.9	63700.0
Federal Programme "Nuclear and Radiation Safety Assurance in 2008 and for the Period up to 2015"	94600.0	88485.0	76541.0

Appendix 8.

Requirements for the content of documentation to prove nuclear and radiation safety to be submitted to Rostekhnadzor together with a license application

Requirements for the content of documentation to prove nuclear and radiation safety in siting a nuclear facility, a radiation source, a nuclear material storage facility, a radioactive waste storage facility (for a nuclear plant unit):

- Technical and economic feasibility documents as part of the siting justification;
- A safety analysis report (containing all the essential evidence in support of the site selection and addressing the safety-related aspects as required by the current applicable regulations; providing a general description of the nuclear energy facility and demonstrating its safety for the environment and the public including preliminary physical protection safety analysis) produced in compliance with the current regulatory documents;
- A general (global) quality assurance programme;
- A quality assurance programme for siting.

Requirements for the content of documentation to prove nuclear and radiation safety during construction of a nuclear facility (nuclear plant unit):

- A preliminary safety analysis report;
- A general (global) quality assurance programme;
- A quality assurance programme for construction;
- Design documents (including those for reactor facility, safety-related systems and physical protection); reports on research and development efforts as well as on the tests referred to in PSAR⁴;
- Probabilistic Safety Analysis Level 1 for the nuclear unit.

⁴ Submitted on request from Rostekhnadzor after an application is filed to obtain a license for construction of a nuclear unit.

Requirements for the content of documentation to prove nuclear and radiation safety during operation of a nuclear facility (nuclear plant unit):

- Final Safety Analysis Report or documents equivalent to it (technical safety case of a nuclear unit and that of its reactor facility, in-depth safety assessment report);
- Operating procedure of the nuclear unit;
- PSA Level 1;
- Certificate for the reactor facility of a nuclear unit;
- Instructions on accident mitigation at a nuclear unit;
- Guidelines for beyond-design-basis accident management at a nuclear unit;
- Action plan for personnel protection in case of an accident at a nuclear unit;
- Operational quality assurance programme for a nuclear unit;
- Compensatory measures in case of departures from the rules and regulations in the field of nuclear energy uses;
- Action plan to compensate for departures from the rules and regulations in the field of nuclear energy uses;
- Information on recruitment, training, retraining and admission of plant personnel to work on their own;
- Results of surveillance over buildings and structures classed under categories I and II in terms of safety implications covering the whole observation period (subsidence, tilts, etc.);
- Instructions on nuclear safety assurance during storage, transportation and handling of nuclear fuel;
- Instructions, programmes and schedules for maintenance, repairs, tests and inspections of safety-related systems⁵;
- Certificates of accounting and control of nuclear materials, radioactive substances and radioactive waste;
- Physical protection certificate;
- Operating procedures for radioactive waste handling systems;
- Programme of nuclear unit preparation for life extension and a certificate of its progress⁶;
- Report on comprehensive examination of a nuclear unit⁶.

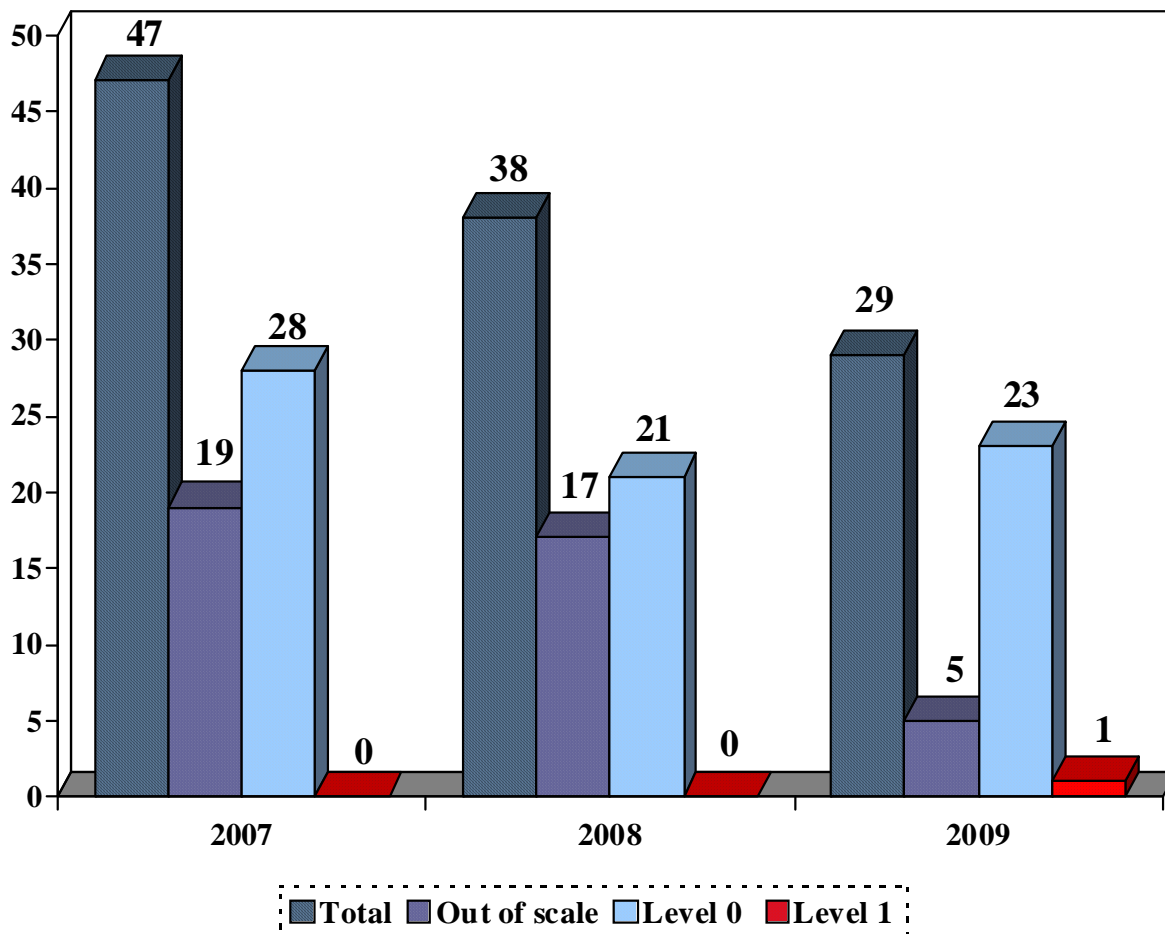
⁵ Submitted on request from Rostekhnadzor after an application is filed to obtain a license for construction of a nuclear unit.

⁶ Submitted together with the application filed to obtain a license for continued operation during an additional period.

Appendix 9.
**Distribution of Russian nuclear plant operational event ratings by
INES in 2007–2009**

Plant name	Number of operational events corresponding to INES Levels						
	Out of scale	0	Out of scale	0	Out of scale	0	1
	2007		2008		2009		
Balakovo	2	1	3	3	0	1	0
Kalinin	0	3	1	1	0	4	0
Kola	2	2	1	1	3	1	0
Novovoronezh	3	9	1	3	1	4	0
Rostov	3	0	0	0	1	0	0
Kursk	5	3	4	5	0	2	0
Leningrad	0	4	2	4	0	5	1
Smolensk	3	4	1	2	0	5	0
Beloyarsk	1	0	1	0	0	0	0
Bilibino	0	2	3	2	0	1	0
Total	19	28	17	21	5	23	1
	47		38		29		

Appendix 10.
**Trends in operational events at Russian NPPs
with ratings by INES in 2007–2009**



Appendix 11.
**Pre-accident situations or accidents at NPPs, and
organisations and officials to be notified by NPP management**

Description of a breach of NPP safe operation regime	Officials and organisations to be notified at all kinds of breaches of NPP safe operation regime
<p>Declaring an "Emergency Preparedness"</p> <p>Declaring an "Emergency Situation"</p> <p>Fire with a potential for causing a radiation accident</p> <p>Natural calamities (earthquakes, hurricanes, floods, etc.) with a potential for causing a radiation accident</p> <p>Attempted unlawful actions with a potential for causing a radiation accident</p>	<p>Dispatcher on duty at "Rosenergoatom Concern". Situation and Crisis Centre of "Rosatom". Territorial emergency management authorities of the town and region (autonomous district). Head of Regulatory Body inspection at the plant. Environmental protection committee of the region. Local Rostekhnadzor officer on duty (in case of damage to plant components on the list of Rostekhnadzor). Head of the municipal authority. Dispatcher of the local office of the Russian United Power System (in the cases provided for in the current regulation on NPP-Power System interfaces). Medical service of the plant. Division of the National Fire Fighting Service in charge of the plant safety and the regional fire prevention unit. Military unit of the Security Troops of the RF Ministry of Internal Affairs in charge of NPP security (officer on duty, commander of the guard). RF MIA and FSS bodies attending to NPP security. Territorial Rosgidromet body attending to NPP safety. Organisations of other ministries and agencies within NPP and exclusion zone territory. Administration of the localities within 5-kilometer zone around the plant. Emergency management commission of the State Corporation "Rosatom".</p>