Convention on Nuclear Safety

6th Review Meeting

National Report of the Russian Federation

Country Group 4

24 March - 4 April 2014
Vienna

Contents

1. Overview of the national program

National program (1/2)

Nuclear power activity in the Russian Federation is regulated by the following programmatic documents:

- Long-term Activity Program of the State Atomic Energy Corporation ROSATOM (2009-2015), approved by Resolution of the Government of the Russian Federation No. 705 of 20 September 2008;
- Energy Strategy of Russia until 2030, approved by Directive of the Government of the Russian Federation No. 1715-r of 13 November 2009;
- General Scheme of Deployment of Energy Facilities until 2030, approved by Record of the Meeting of the Government of the Russian Federation of 3 June 2010

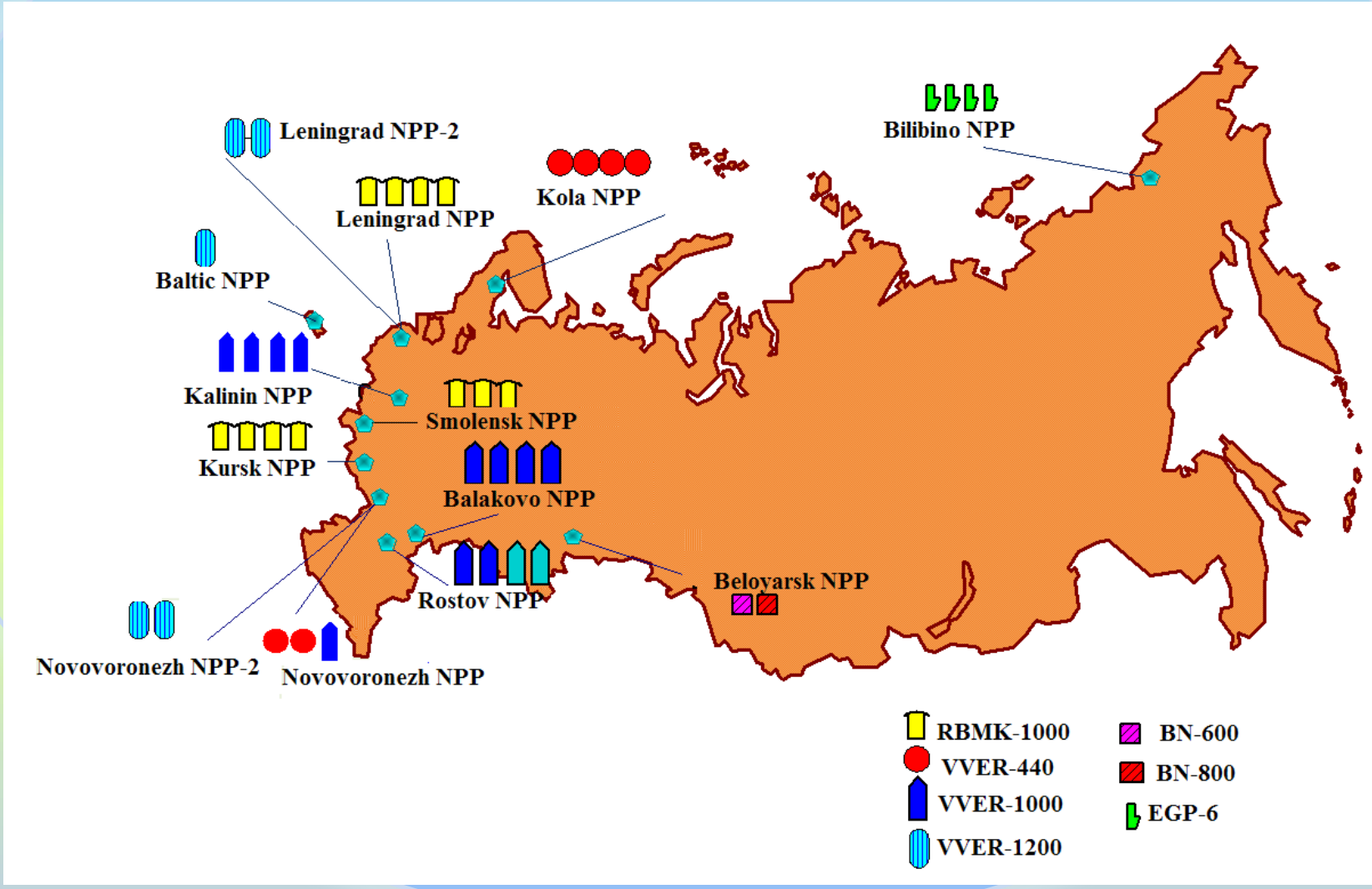
National program (2/2)

- **The Program provides for:**
  - **operation of existing reactors, considering newly commissioned**
  - **construction of new rectors to new designs**
  - **decommissioning of reactors exhausted their lifetimes**

Existing reactors and new builds in Russia

In operation: ***10*** **NPPs,** ***33*** **reactors,** $N_{inst.}$**=*25242* MW**

Under construction: ***8*** **NPP Units**



Reactors under construction, siting and decommissioning

Under construction:

- Beloyarsk 4 (BN-800)
- Rostov 3&4 (WWER-1000)
- Novovoronezh Phase II, Units 1&2 (WWER-1200 AES-2006)
- Leningrad Phase II, Units 1&2
- Baltic 1

Under siting process:

- 11 reactors have been granted siting licenses: Units 1&2 of Nizhniy Novgorod, Seversk, Tver, Central, Leningrad II Units 3&4, Baltic-2

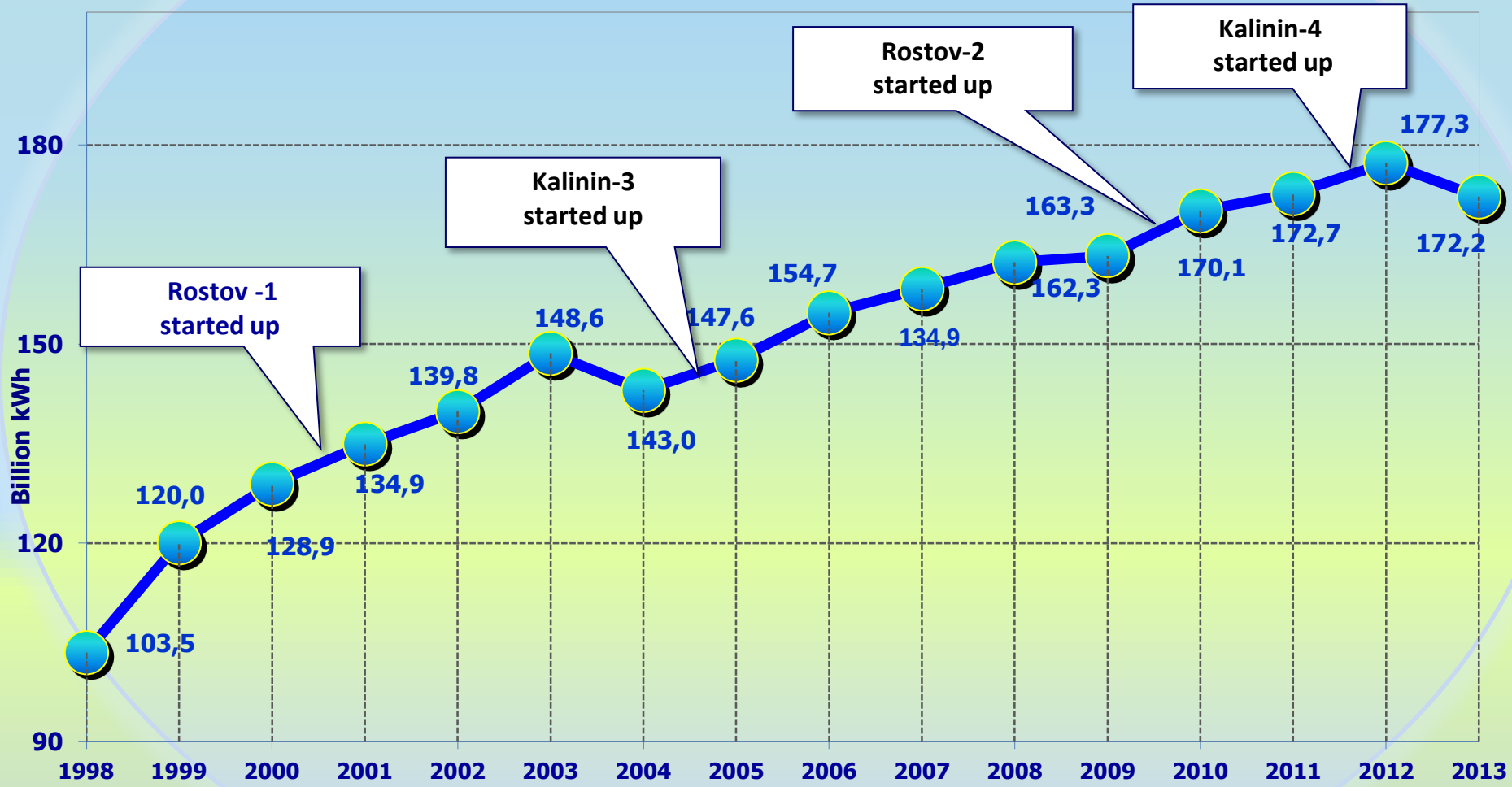
Under decommissioning:

- Novovoronezh 1&2
- Beloyarsk 1&2 (prepared for decommissioning)

Uprating of existing reactors

- Since 2008 the Operating Organization – Rosenergoatom – has been uprating a number of existing reactors
- Plant safety justifications and reports on uprated operation test results for the reactors were produced. The documents were reviewed by the Regulatory Body
- Currently, 9 WWER-1000 reactors and Kola-4 (WWER-440) operate at power higher than rated

Nuclear electricity generation in Russia



2. Changes in the national program

2.1 Changes in the legislative and regulatory framework (1/5)

The law "On the Use of Atomic Energy" was amended. The changes cover:

- **Priority of nuclear legislation over legislative requirements in other areas, e.g. in industrial safety;**
- **Legal status of the Regulatory Body as regards its authorities and separation**

2.1 Changes in the legislative and regulatory framework (2/5)

- The law identifies forth activities subject to licensing;
- Requirements for conducting periodic safety reviews of nuclear facilities each 10 years are stipulated;
- The state-level supervision, including continuous supervision, is introduced;
- The role of technical support organizations is made more clear.

2.1 Changes in the legislative and regulatory framework (3/5)

- Federal Law No. 190-FZ of 11 July 2011 "On the Management of Radioactive Waste and on Amending Certain Legal Acts of the Russian Federation" was adopted;
- Federal Law No. 68-FZ of 21 December 1994 "On the Protection of the Public and Territories against Natural and Man-Induced Emergencies" was amended;
- New "Provision on Licensing in the Field of the Use of Atomic Energy" was issued.

2.1 Changes in the legislative and regulatory framework (4/5)

In the reporting period 7 federal standards and regulations were drafted and approved:

- **"Requirements for emergency power supply systems of nuclear plants", 2012;**
- **"Requirements for layout and safe operation of lifting cranes of nuclear facilities", 2012;**
- **"Requirements for quality assurance programs of nuclear facilities", 2012;**

2.1 Changes in the legislative and regulatory framework (5/5)

- "Basic rules of control and accounting of radioactive substances and radioactive waste in an organization", 2012;
- "Basic rules of nuclear material control and accounting", 2012;
- "Sample content of a personnel protection action plan in case of an accident at the nuclear plant", 2012;
- "Rules of layout and operation of reactivity control rod actuators", 2012.

Drafted and approved:

- 4 Administrative Regulations of Rostechnadzor;
- 19 Safety Guides.

2.2 Implementation of the national program (1/7)

In 2012 Kalinin-4 commissioned for commercial operation

2.2 Implementation of the national program (2/7)

Beloyarsk-4 with BN-800 reactor nears construction completion and preparation for commissioning

2.2 Implementation of the national program (3/7)

Construction of new reactors continues:

Novovoronezh Phase II

Leningrad Phase II

Rostov Units 3 & 4

2.2 Implementation of the national program (4/7)

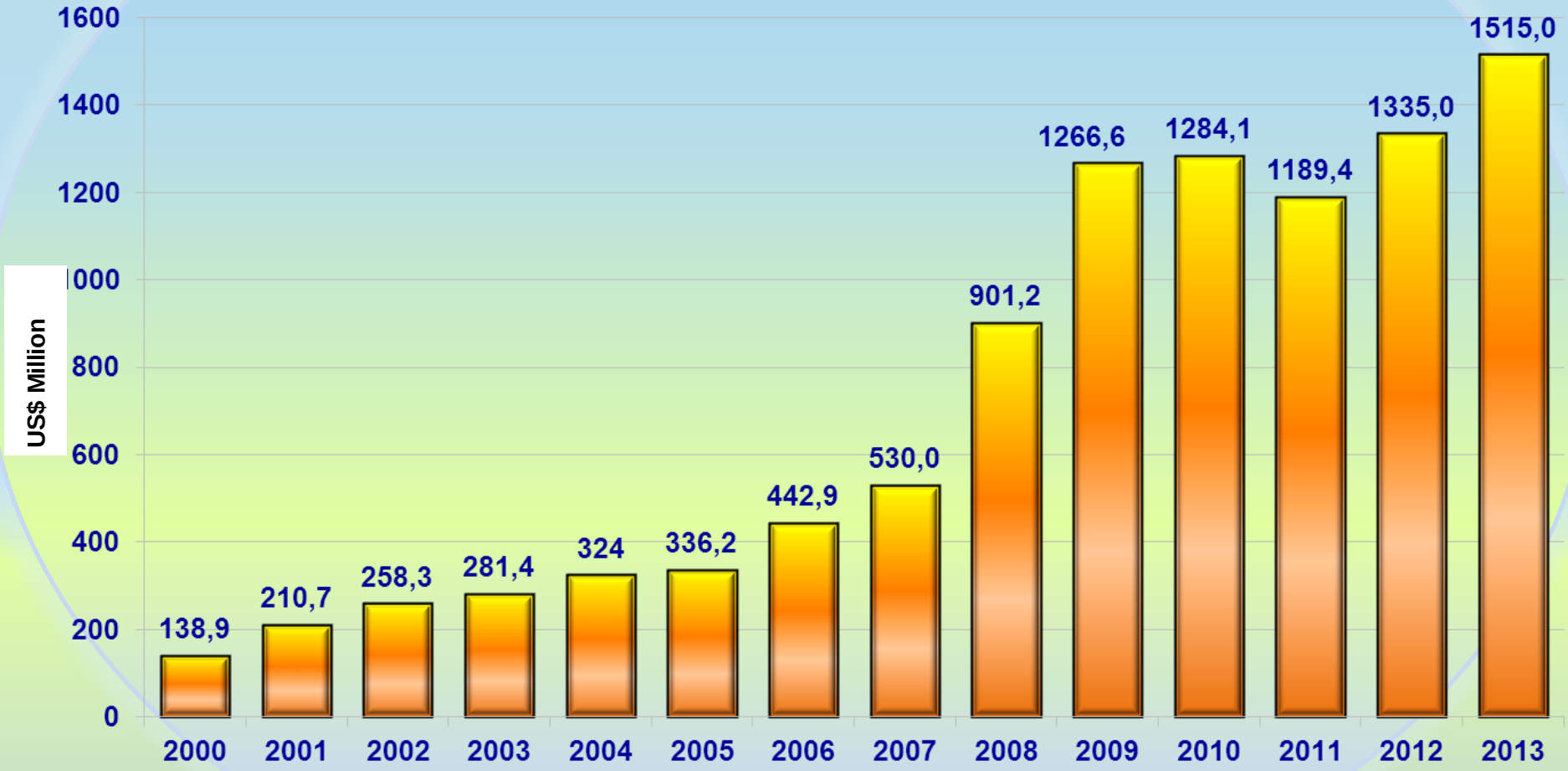
Reactor service lives extended at:

- **Novovoronezh NPP:**
  Unit 5 (from 2010 till 2015)
- **Leningrad NPP:**
  Unit 4 (from 2010 till 2025)
- **Beloyarsk NPP:**
  Unit 3 (from 2010 till 2020)
- **Kola NPP:**
  Unit 3 (from 2011 till 2016)
- **Smolensk NPP:**
  Unit 1 (from 2012 till 2022)
- **Kursk NPP:**
  Unit 3 (from 2013 till 2023)

2.2 Implementation of the national program (5/7)
Upgrading of operating NPP Units

Units	Work completed
Kalinin-1 Kola-3 Kursk-4 Smolensk-1&2 Novovoronezh-5	Upgrading of the monitoring, control and protection systems. Replacement of neutron flux and in-core monitoring hardware
Balakovo-1	Replacement of turbine condenser tubing, turbine-driven feedwater pumps
Balakovo-1 Kalinin-1&2 Novovoronezh-5	Replacement of copper-containing Low pressure preheaters tubing with stainless steel ones
Kursk-3&4	Upgrading of turbine steam separators, condensate pumps, generator stators
Smolensk-1&2	Upgrading of automatic control systems of K-1000 turbines and deployment of turbine generator mechanical parameter monitoring instrumentation
Outdoor switchyards 110÷750 kV	Replacement of electrical equipment (current and voltage transformers, air circuit breakers)

2.2 Implementation of the national program (6/7)
Spending for plant upgrades



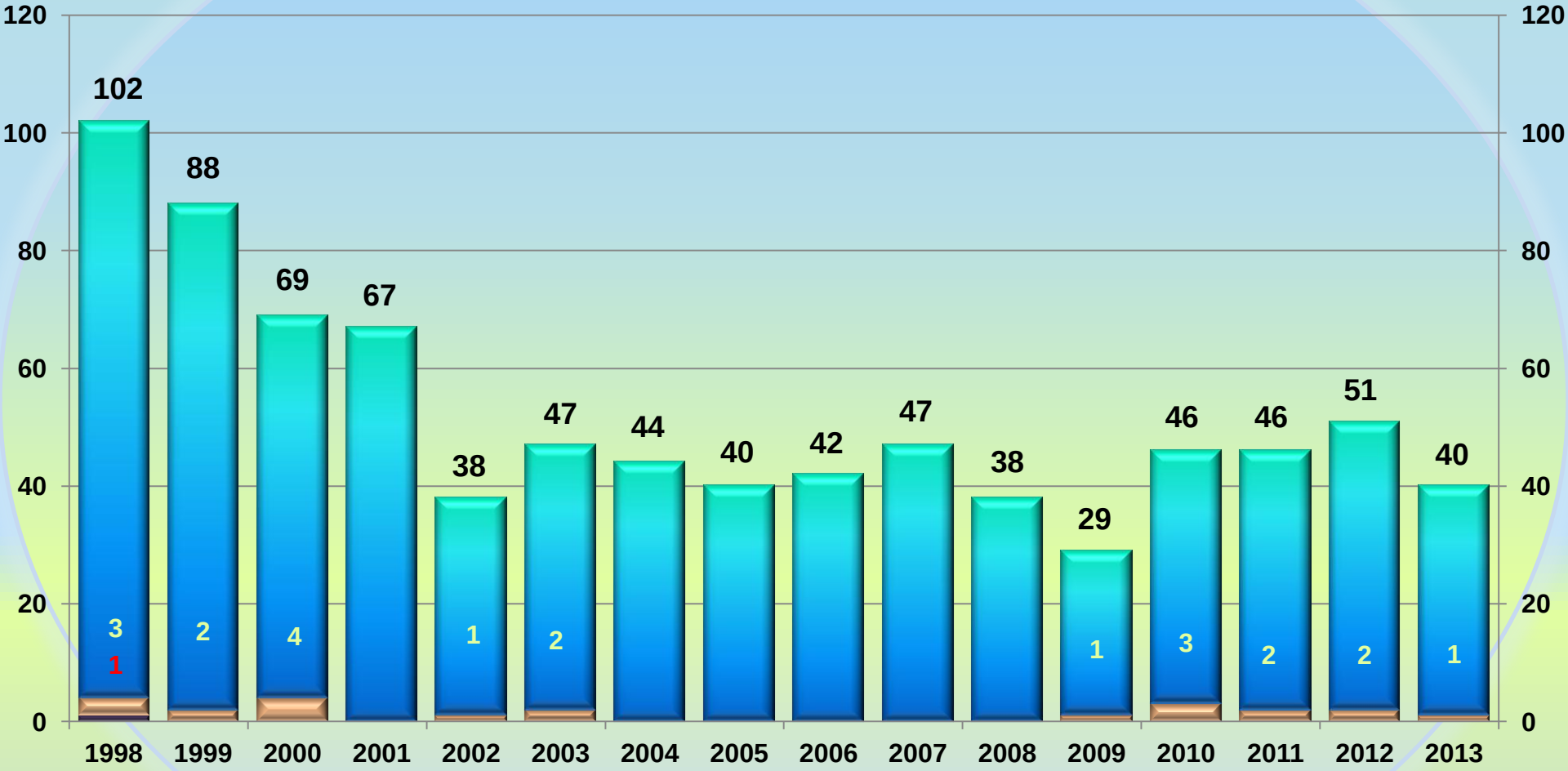
2.2 Implementation of the national program (7/7)

Key results of Russia's NPPs operation in 2010-2013:

- **Electricity was generated safely**
- **No events involving radiation consequences**
- **Safety significant events are isolated: 8 INES Level 1 events over the period of 2010-2013**

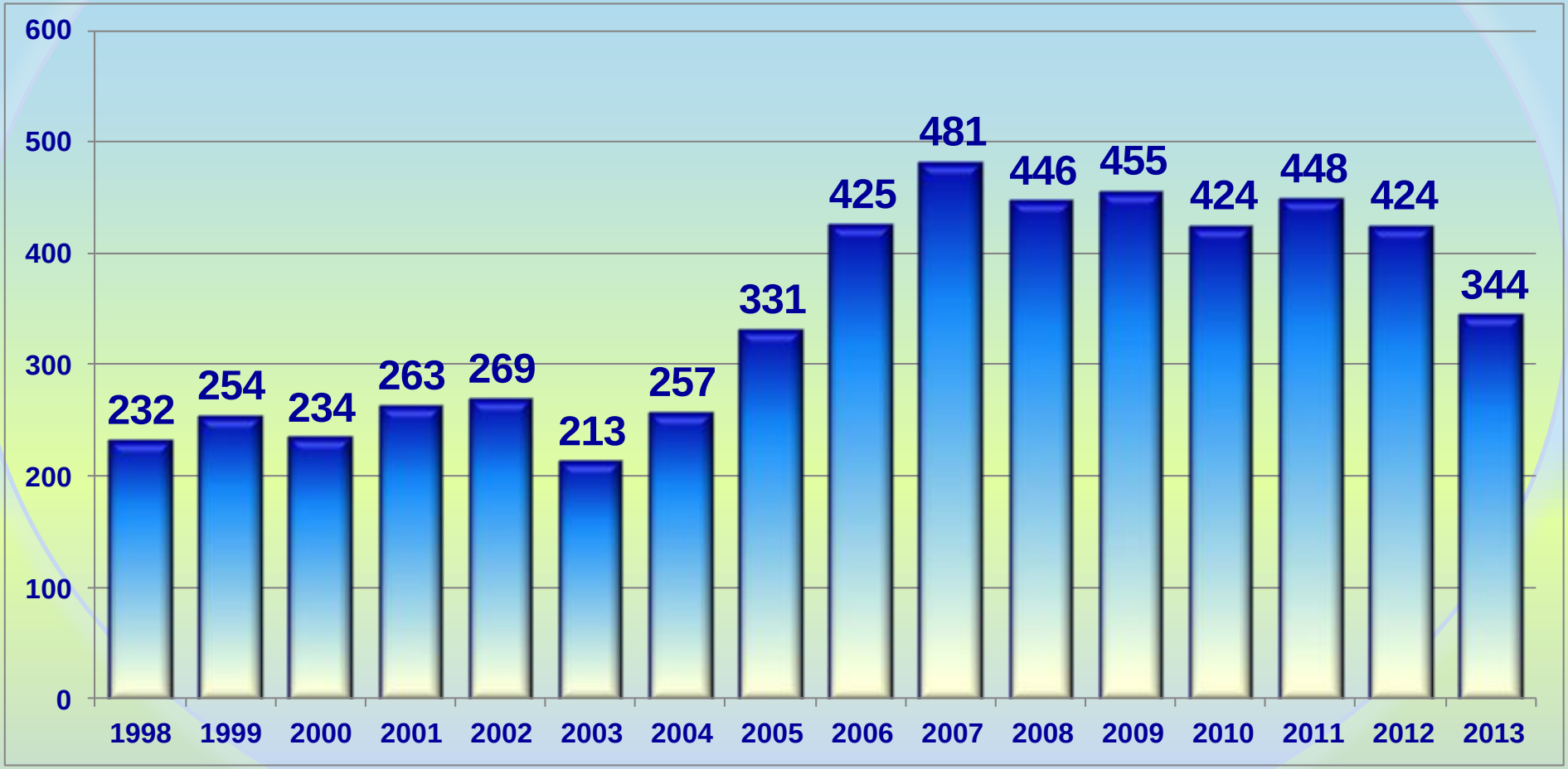
3. Significant events over the reporting period

Plant events reportable to the Regulatory Body



1 - Level 1 events INES 1 - Level 2 events INES 1 - Total

Events reportable to the Operating Organization



SCRAMs at Russian and world NPPs

INES Level 1 events at NPPs in 2011-2013 (1/2)

- Spontaneous opening and unfitting of SG-1 PORV due to break-up of the safety valve's control train tube at Balakovo-4 (2011)
- Damage of CPS rod drives due to an inner dynamic impact at the primary pressure drop after pressure tests at Kalinin-3 (2011)
- Failure of the steam generator safety valve due to erosion of PORV plate and seat at Balakovo-4 (2012)

INES Level 1 events at NPPs in 2011-2013 (2/2)

- Unauthorized opening of ECCS fast-acting valves due to a malfunction of the controlling safety systems' equipment at Leningrad-4 (2012)
- Violation of the pressurizer level safe operation limit due to erroneous actions of the personnel when disconnecting Kalinin-1 from the grid because of damage to tension bolts of the generator rotor's clutch-exciter armature (2013)

Improvement of Operator's operating experience feedback activities

- Analysis and performance assessment of corrective and preventive measures at NPPs by Operator's divisions
- At the Operator's level: development of industry-wide measures on each event reportable to Rostechnadzor, which are mandatory for all plants
- Significant increase in volume of information on events at Russian plants and international information in frames of WANO's "Operating experience" program
- Enhancement and development of an all-plants-embracing electronic system of accumulation of and remote access to the information on Russian and international operating experience

Examples of Regulator's actions (1/4)

Steam generator MSV failure at Balakovo-4

Rostechnadzor required:

- to work out measures to rule out unauthorized actuation of safety devices of safety related for all power units
- to plan and conduct extraordinary inspections of PORVs installed at safety related systems during upcoming outages

Operator fully met Rostechnadzor's requirements

Examples of Regulator's actions (2/4)

Damage of CPS rod drive tubes at Kalinin-3

Rostechnadzor required:

- ROSATOM to take measures to eliminate and avoid in future such events, and provide information on the measures taken

Operator introduced changes to:

- Process regulations of WWER power units;
- Primary water chemistry standard;
- Personnel skills maintaining program.

Examples of Regulator's actions (3/4)

Collapse of containment structure components during construction of Leningrad Phase II

Rostechnadzor's regional department suspended the principal contractor's activities by revoking the license

Rostechnadzor conducted an off-schedule comprehensive inspection when the principal contractor applied for the license renewal after elimination of violations

Based on the inspection results, Rostechnadzor ruled to renew the principal contractor's license

Examples of Regulator's actions (4/4)

RBMK-100 graphite stack problem:

- Shut down requirement when safety criteria are reached
- Safety review of repair and recovery operations on the graphite stack
- Power limitation and stepped build-up at reactors and limitation of their operation period
- Requirement of a periodic monitoring of pressure tube bowing to confirm projections on the reactor stack geometry changes
- Requirement to write action plans of RBMK-1000 lifetime performance management

4. Measures planned as based on outcomes of the 5-th Review Meeting

Issues recommended for inclusion in the National Report of the Russian Federation to the 6th Review Meeting (1/3)

- To ensure that the Regulatory Body has necessary human and financial resources for solving issues of plant life extension and new construction
- To take account of recommendations and proposals of the IRRS mission and host IRRS follow-up mission

The relevant information on sufficiency of human and financial resources of the Regulatory Body and on outcomes of implementation of the recommendations and proposals, as well as of the IRRS follow-up mission is provided in the 6th National Report and answers to questions related to Article 8

Issues recommended for inclusion in the National Report of the Russian Federation to the 6th Review Meeting (2/3)

- In cases where new NPPs are planned to build near national borders, the Contracting Parties shall, as per CNS, to establish appropriate procedures for transfer of information, upon request, to:
  - facilitate management of emergency preparedness and response;
  - assess impact on nuclear safety.

The procedures for providing the relevant information on new NPPs under construction to neighboring states have been established and are in effect in the Russian Federation.

Issues recommended for inclusion in the National Report of the Russian Federation to the 6th Review Meeting (3/3)

- **Results of international peer reviews of both NPPs and Regulatory Body shall be included as an intrinsic part of national reports under CNS**

  The 6th National Report and answers to the questions contain relevant information on outcomes of the peer reviews of the Russian Regulatory Body, Operating Organization and nuclear plants over the reporting period

- **The issue of management of accumulated hydrogen and its potential explosion in the severe accident conditions**

  The systems for hydrogen monitoring and recombination within enclosures and reactor containments have been introduced at operating plants, system of emergency filtered evacuation of gases from reactor containment is preparing to implementation

Peer reviews by the IAEA

- **5-22 September 2011: OSART mission at Smolensk NPP**

  Results: recommendations – 2, proposals – 10, good practices - 10

- **13-17 May 2013: OSART follow-up visit to Smolensk NPP**

  Results: of 12 recommendations and proposals 9 addressed completely; for 3 – adequate progress recorded

Experts' judgment:

- **75% of recommendations and proposals were implemented, 25% - of them have advanced well and require a long time for implementation; the plant has taken all necessary measures in their regard**





Peer reviews by the WANO

Corporate peer reviews of Rosenergoatom

- **09-22 April 2011 :** corporate peer review of Rosenergoatom
- **2013:** WANO's follow-up corporate peer review of Rosenergoatom

Peer reviews of Rosenergoatom's nuclear plants

- 2011: WANO's peer reviews at Balakovo, Bilibino and Novovoronezh NPPs;
- 2012: peer reviews at Beloyarsk and Kola NPPs, follow-up peer reviews at Kalinin and Rostov NPPs;
- 2013: peer reviews at Smolensk, Rostov and Kursk NPPs, follow-up peer reviews at Novovoronezh, Bilibino and Balakovo NPPs;
- 09-21 February 2014: pre-startup peer review at Beloyarsk NPP unit 4

Joint inspections of Balakovo NPP by Rostechnadzor and French regulatory body (ASN)

- The integrated inspection of Balakovo NPP was conducted by a Rostechnadzor's commission with the participation of representatives of the French regulatory body (ASN) from 23 July till 03 August 2012

- The commission found out that Balakovo plant observes on the whole license conditions and requirements of the federal standards and regulations on nuclear and radiation safety when operating its Units 1 – 4

IAEA's IRRS follow-up mission

- held on 11-19 November 2013 upon request of the Government of the Russian Federation

  15 experts from different countries conducted the follow-up comprehensive assessment of Rostechnadzor

- IRRS follow-up mission objective: the assessment of Rostechnadzor results of implementation of recommendations and proposals made by the 2009 IRRS mission and the assessment of 2 areas not covered by the 2009 mission (emergency preparedness and post-Fukushima measures)

IAEA's IRRS follow-up mission (2/3)

IAEA's IRRS follow-up mission (3/3)

- Following the results of the follow-up mission, the IRRS expert team pointed out that of 25 recommendations resulted from the inception mission 10 were completed, 8 were closed based on assurance that the goal will be reached, and 7 remained open;
- of 34 proposals 15 were completed, 7 were closed based on assurance that the goal will be reached, 12 remained open;
- Following the results of assessment of additional modules uncovered by the inception mission, the IRRS experts gave 2 recommendations and 7 proposals, and pointed out 3 good practices;
- a report on results of the IAEA follow-up mission was produced;
- Rostechnadzor wrote a mission's recommendations implementation plan and started executing it

5. Actions taken in the light of the Fukushima-Daiichi accident

Improvements of designs of existing plants to prevent and mitigate severe accident consequences

- Deployment of additional emergency equipment for emergency power and water supply at NPPs;
- Improvement of reliability of confining systems;
- Deployment of systems for monitoring and recombining of hydrogen in reactor containments;
- Deployment of systems for emergency filtered evacuation of gases from reactor containments;
- Deployment of seismic protection systems;
- Supply of “emergency” I&C designed to operate under BDBAs to NPP units;
- Introduction of emergency and post-accident sampling;
- Improvement of protection degree of Main control rooms and Standby control rooms.

(for more details please refer to co-report of Rosenergoatom)

Emergency response and planning enhancement measures (1/2)

- WANO's Regional Crisis Center for plants with WWERs was set up at the Crisis Center of Rosenergoatom.
- State-of-the-art digital radio communication system was set up at Kalinin, Leningrad and Beloyarsk plants, and Rosenergoatom's Crisis Center. The project is continued to cover other plants.
- Mobile control posts and mobile communications posts of emergency operations commanders set up at Kalinin, Novovoronezh, Kursk, Smolensk, Balakovo, Leningrad, Beloyarsk and Rostov plants, and at Rosenergoatom's Crisis Center

Emergency response and planning enhancement measures (2/2)

- Rosenergoatom conducted integrated emergency exercises: in 2011 at Novovoronezh NPP, in 2012 at Kursk NPP, in 2013 at Kalinin NPP. All exercises were held with the account taken of lessons learned from the Fukushima NPP accident.
- Each exercise involved representatives of various ministries and agencies (up to 1,100 persons and up to 100 special machinery items)

The exercises were highly appraised by international observers from Armenia, Finland, France, Germany, Norway, South Korea, Ukraine, USA and IAEA, and were positively treated by mass media.

Enhancement of Rostechnadzor efficiency (1/5)

- Post-Fukushima events: in March-April 2011 Rostechnadzor conducted inspections of degree of protection against external events at Russian NPPs
- Stress test results were reviewed. Implementation of the Plan of Measures to enhance safety of Russian NPPs is monitored
- Measures of the Action Program of Russian Authorities and Organizations Concerned in Implementation of the IAEA Action Plan on Nuclear Safety are monitored

Enhancement of Rostechnadzor efficiency (2/5)

Improvement of the legal regulatory framework

Federal standards and regulations under revision:

- **General safety provisions of nuclear plants**
- **Siting of nuclear plants. Basic safety criteria and requirements**
- **Design standards of seismic nuclear plants**
- **Accounting of natural and man-induced external impacts**

New safety guides under drafting:

- **Emergency I&C requirements**
- **Recommendations for a management guide for beyond design basis accidents, including severe accidents**

Enhancement of Rostechnadzor efficiency (3/5)

Plant safety inspections by Rostechnadzor

- **Legally established rules of state supervision (article 24.1 Law "On the Use of Atomic Energy")**
- **Russian Government's resolution approved the "Provision of continuous state-level supervision of nuclear facilities." A List of facilities subject to the continuous supervision was approved**
- **The above provides for the permanent stay of authorized officials of Rostechnadzor at the plants and for conduct of safety oversight measures by these officials**
- **More than 9,000 inspections were conducted in frames of the continuous oversight regime at the plants**

Enhancement of Rostechnadzor efficiency (4/5)

Improvement of emergency response efficiency

- Regular trainings jointly with the Operator and TSO at Rostechnadzor's IAC;
- Drafting of IAC Work Plan with consideration of emergency preparedness assessments of other nuclear facilities (in particular, NRI)

Enhancement of Rostechnadzor efficiency (5/5)

- **To improve effectiveness of IAC, the following was carried out in 2013:**
  - **modernization of IAC rooms, equipment and communications channels;**
  - **installation of new software (domestic and imported) at IAC;**
  - **development of high-speed computer codes for express assessments during exercises involving an accident release and spread of radionuclides in field;**
  - **RTN methodology of estimating the efficiency of Rosenergoatom emergency response exercise is implemented**

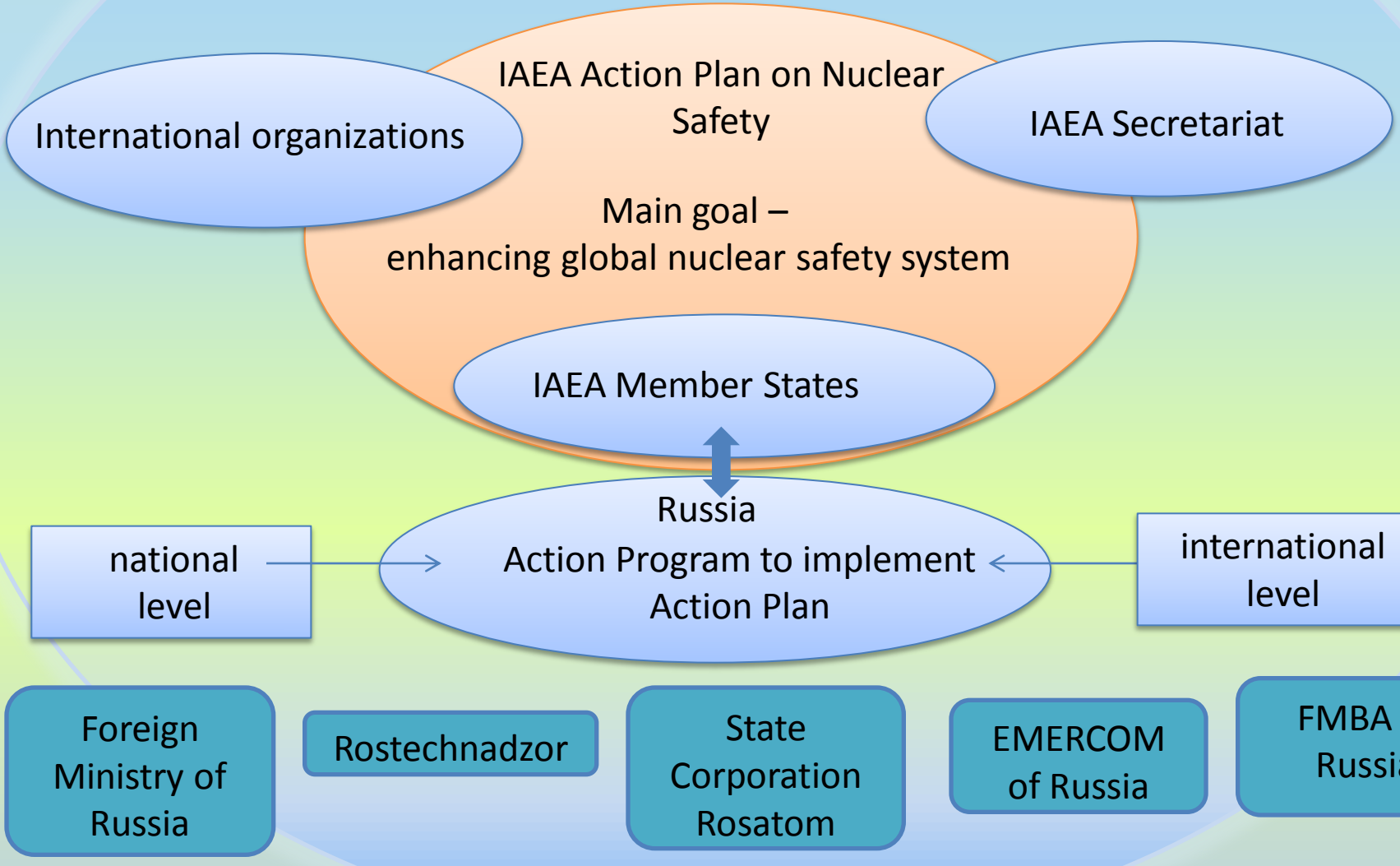
Enhancement of international cooperation (1/2)

- Follow-up mission 2013
- Rostechnadzor representatives participate in the work of the IAEA's safety standards Commission and committees. They are members of working groups on the operating experience analysis (NEA WGOE), regulating of new reactors (NEA WGRNR), accident management (NEA TGAM)
- joint plant inspections with French and Finnish regulators
- workshops with French regulators (with involvement of Russian and French operating organizations) and Finnish regulators on plant stress test results exchange and implemented/planned measures to improve plant safety

Enhancement of international cooperation (2/2)

- development of interaction with regulatory bodies of countries who plan to build NPPs to Russian designs (Belarus, Turkey, Vietnam, etc.) at the bilateral and multilateral bases (in frames of the Regulatory Cooperation Forum and TSO Forum):
  - training of specialists of foreign regulatory bodies,
  - consulting services in development of national legal regulatory documents,
  - consulting services in review of safety justification documents,
  - consultancy and training in supervision of NPP construction and operation

Implementation of IAEA Action Plan on Nuclear Safety in Russia



6. Planned measures to improve plant safety

Planned measures

- **Continuation of mid- and long-term safety enhancement measures developed based on results of the additional assessment of plant's degree of protection against external extreme impacts**
  For more details please refer to co-report of Rosenergoatom

- **Implementation of measures outlined in the course of peer reviews**

- **Implementation of Rostechnadzor's Plan of Measures following the IAEA follow-up mission results (IRRS)**

International activities

- OSART missions:
  - Kola NPP – Q4 2014
  - Novovoronezh NPP – Q3 2015
- WANO peer review missions
- Set up of a WWER working group within MDEP
- Environmental review of EIA of Baltic NPP by the IAEA
- Review of AES-2006 and WWER-TOI designs by the IAEA
- October 2014: Rostechnadzor jointly with the IAEA - an international workshop on exchange of experience in conducting of the IAEA regulatory performance assessment missions (IRRS mission, IRRS follow-up mission)

7. Current and future challenges

Current and future challenges (1/2)

- **Efficient state-level safety supervision in conditions of nuclear power development in Russia:**
  - **Development and introduction of a funding mechanism aiming at attraction of additional skilled staff to Rostechnadzor**
- **Preservation and transfer of knowledge with the account taken of building NPPs abroad to Russian designs:**
  - **Development of an effective system for Rostechnadzor's and Rosenergoatom's staff training and retraining**
- **Assistance in development of the necessary framework to nuclear newcomers:**
  - **Enduing Rostechnadzor with the authorities and financial resources necessary for assisting national regulators in the countries receiving Russian nuclear technologies**

Current and future challenges (2/2)

- Off-shipment of spent nuclear fuel of RBMK reactors from sites to ensure safe storage of SNF on sites
- Expanded monitoring and lifetime performance management of RBMK graphite stack

8. Good practices and efforts

Safety management and safety culture (1/2)

- WANO's Regional Crisis Center for WWER plants was established at the Crisis Center of Rosenergoatom
- Mobile command posts and mobile communication units for emergency operation commanders were set up at the plants and in the Crisis Center of Rosenergoatom
- Psychologists are involved on a permanent basis in emergency drills at the full-scale simulator for mastering interaction in emergency conditions
- At each plant a workstation of the WANO MC's Representative is arranged; procedures of interaction with plants have been written

Safety management and safety culture (2/2)

- Video conferencing on plant safety with participation of all plants, Rosenergoatom and support organizations,
- Operating organization has developed a three-level pattern for building up and maintaining the safety culture based on OPG patterm (Canada),
- Commissioning for pilot commercial operation of RBMK SNF container storage facilities at Leningrad and Kursk NPP. Off-shipment of Leningrad NPP's SNF to Mining and Chemical Combine has started.

Ageing management and plant upgrades (1/2)

- **Implementation of modernization and life extension programs at Kola-4, Smolensk-1 and Kursk-4, for instance:**
  - **at Kola-4 the equipment of controlling safety systems is fully replaced in frames of upgrades in the course of service life extension**
  - **at Smolensk-1 the CSS-T equipment exhausted its service life was replaced and algorithms of emergency actuation of ECCS at signs of design basis accidents were upgraded**

Ageing management and plant upgrades (2/2)

- Approaches to reactor graphite stack lifetime performance management were tested
- Gradual service life extension of power units
- Implementation of equipment upgrading and replacement measures

Regulatory practices efficiency

- Joint inspections with foreign regulatory bodies to exchange best practices, including of supervision of nuclear facilities
- Drafting of the National Program in support of the IAEA Action Plan on Nuclear Safety

Regulatory practices efficiency (as assessed by 2013 IRRS follow-up mission)

- The regulatory framework includes clear-cut and comprehensive requirements to contents of emergency plans for all activities where atomic energy is used
- During emergency drills fast running computer tools are used for express assessment of the accident progression on a regular basis
- RTN methodology of estimating the efficiency of Rosenergoatom emergency response exercise is implemented

9. Contracting Parties' questions to the National Report of the Russian Federation

Summarized answers to questions of the Contracting Parties on the 6th National Report

240 questions on the 6th National Report of the Russian Federation were received from 26 Contracting Parties

- **All questions were extensively answered, with answers posted to the IAEA website (www-cnsweb.iaea.org)**
- **Most of questions deal with general aspects as well as Articles 6, 7, 8, 14, 15, 16, 17, 18 and 19 of the Convention on Nuclear Safety**
- **Summarized brief answers to the questions on the above Convention articles are given below**

General (1/5)

21 questions: public accessibility of information on safety assessments, IAEA mission findings, current activities of the regulatory body and operating organization, design changes in the light of the Fukushima-Daiichi accident

- The national reports of Russia under CNS have been published on the websites of ROSATOM and Rostechnadzor starting from the 3-rd report
- Decisions of the regulatory body are published on Rostechnadzor's website
- Key information on findings of the IAEA missions as well as WANO's peer reviews is published on websites of Rostechnadzor, ROSATOM and Rosenergoatom
- The concerned citizens can access main conclusions of analyses of NPP operational events, deficiencies in organization of NPP operation cited in annual reports of Rostechnadzor, which are freely accessible on Rostechnadzor's website

General (2/5)

- Materials of operating license packages are not published and regulatory body's reports on SAR reviews are not published
- Rostechnadzor holds public consultations and round-table discussions. Current issues related to safety are discussed in frames of interactions with mass media. All mass media requests are processed within time period established by the Russian legislation
- Rostechnadzor has a public liaison office, which processes citizens' requests related to Rostechnadzor's activities
- Rosenergoatom provides access for the general public to final revisions of EIA documents
- Rosenergoatom holds regular public discussions of planned economic and other activities; these include round-table discussions, public consultations, plant visits, "forum-dialogues", etc.

General (3/5)

- **For NPPs planned for construction in Russia the following design decisions are used, in particular:**
  - **robustness with regard to a safe shutdown earthquake (SSE) of 8 points as per MSK-64;**
  - **mobile air-cooled diesel generator;**
  - **mobile pump (backed up) for making up spent fuel pools, PHRS tanks, and primary circuit from an external source;**
  - **a larger inventory of the boron solution through installation of additional tanks**

General (4/5)

- inner and outer containments of the reactor: the inner containment is pre-stressed reinforced concrete with the leak-tight steel lining to retain pressure; the outer containment is reinforced concrete designed to protect against external natural and man-induced impacts;
- core melt trapping and cooling system;
- passive heat removal system from steam generators;
- passive hydrogen recombiners;
- alternative cooling loop of the reactor and containment with a chimney air cooling tower with fans.

General (5/5)

- **ROSATOM has made no decisions as to build units other than AES-2006 on the site of Baltic NPP, which was granted a construction license**

  In case a decision is made to build a different power unit on this site, all procedures stipulated in the Russian legislation regarding licensing, including public hearings on EIA, will be repeated.

Article 6 (1/4)

41 questions: measures taken in the light of the Fukushima-Daiichi accident, additional safety assessments (consideration of beyond design basis seismic loads), severe accident management measures, a compilation of a list of mobile equipment at the plants, duration of life extensions of reactors, restoration of lifetime performance of RBMK graphite stack, plant self-reliance in case of blackout

- **Answers to questions regarding measures taken in the light of the Fukushima-Daiichi accident are provided in Sections 5 and 6 above herein and in the co-report**
- **Beyond design basis seismic loads were considered in the additional assessments, and available seismic resistance margins were evaluated**

Article 6 (2/4)

- SAMGs are produced for all WWER units in operation and under construction. In 2012 SAMG was written for Balakovo-4. SAMGs for RBMK, BN and EGP-6 units will be produced as a stand-alone document or as part of the Severe Accident Management Guides in 2015-2016. Industry data are used for preparing SAMGs

- Types and characteristics of diesel generators and mobile pumps are identified based on results of a calculation analysis of beyond design basis accident scenarios for different types of reactors. When defining a necessary quantity of the mobile equipment, a plant-wide beyond design basis accident, which simultaneously affected all units on the plant site was postulated

Article 6 (3/4)

- A set of activities to prepare a power unit for service life extension is planned and implemented proceeding from the concept of life extension of RBMKs for 15 years and WWERs for 30 years. The Operating Organization suggests duration of the extended life of the power unit basing on carried out upgrades and safety justifications.

  Rostechnadzor grants a license for operation beyond the design lifetime for the period of time, which is determined individually for each power unit as based on outcomes of the review of justification documents provided by the Operating Organization.

Article 6 (4/4)

- In 2013 at Leningrad-1, upon completion of the restoration activities, the regulated characteristics of the reactor structural components were restored and a further operation permit was obtained from Rostechnadzor. Currently, the power unit operates at the rated power. The experience gained at the power unit will allow solving RBMK-1000 reactor problems and ensuring their safe operation

- Additional emergency equipment was supplied to Russian NPPs to manage beyond design basis and severe accidents involving the plant blackout and/or loss of the ultimate heat sink. The use of additional equipment will ensure safety, "survivability" and self-reliance of the plant during at least 5 days in case of a beyond design basis or severe accident, including in case of the station blackout

Article 7

12 questions: compliance of Russian requirements with the IAEA recommendations; participation in international missions

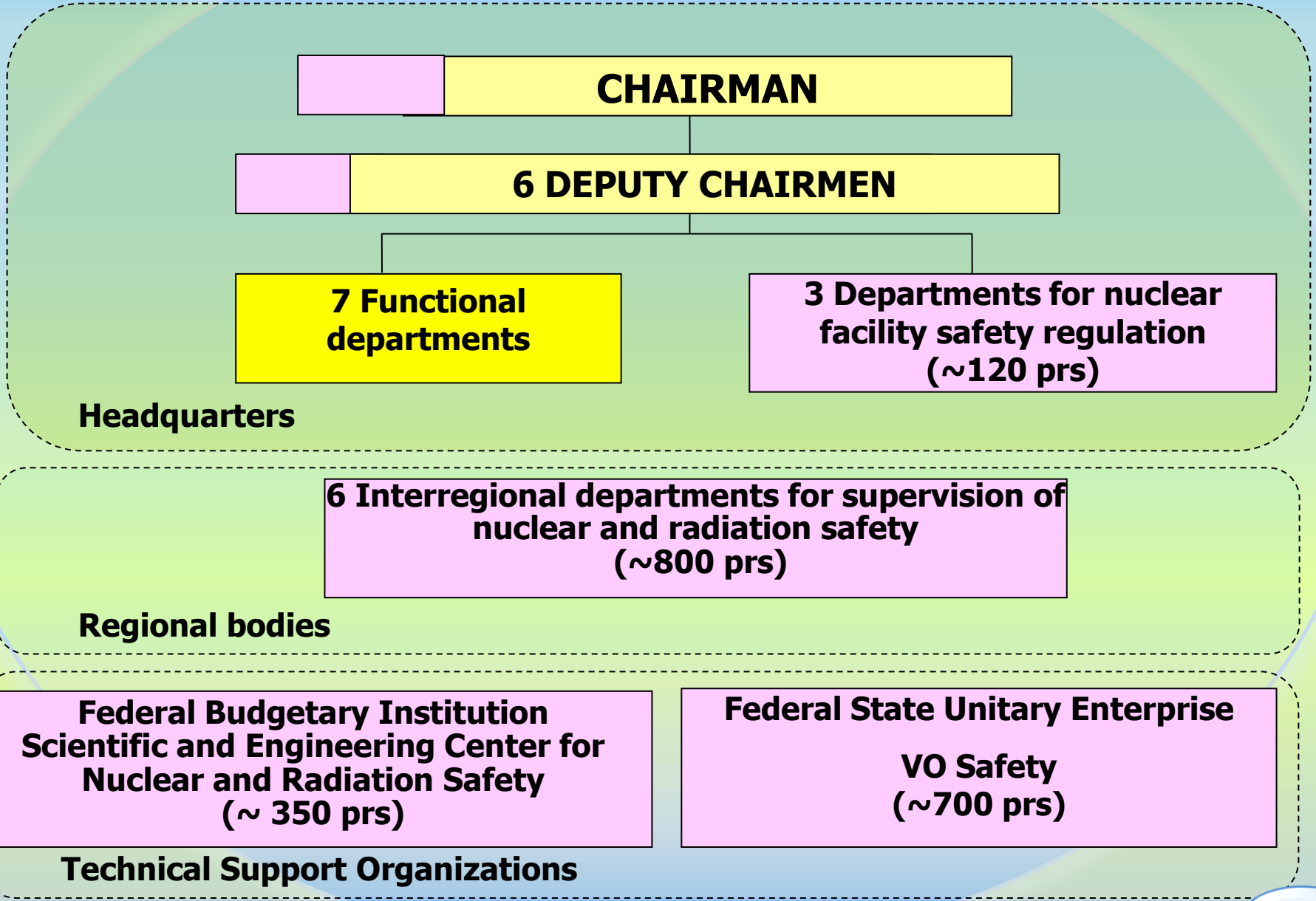
- **Russian regulatory documents were compared to the IAEA standards SSR-2/1 and SSR-2/2, which establish plant safety requirements for design and operation. Based on the comparison results, a conclusion was drawn out that the requirements match on the whole; any discrepancies are taken care of in revisions of the Russian regulatory documents.**

- **Participation in international missions (OSART missions, IRRS follow-up missions) – *see above herein***

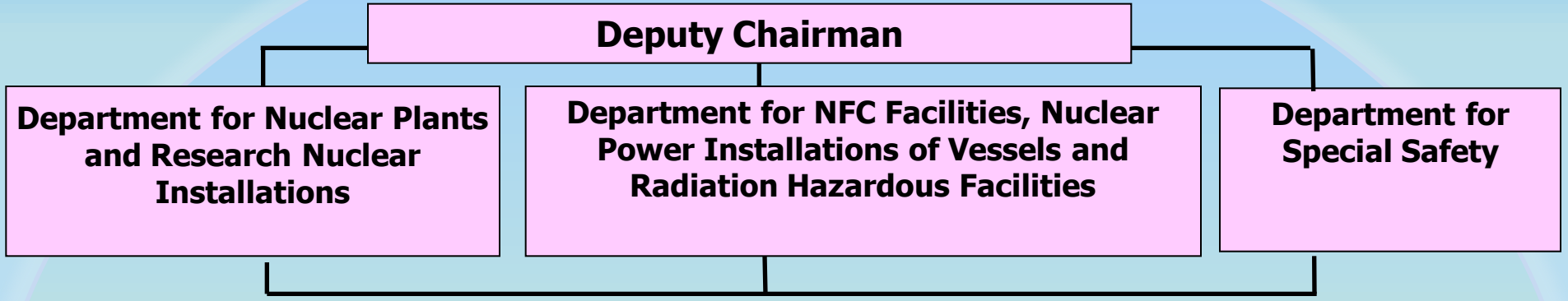
Article 8 (1/4)

19 questions: place of the Regulatory Body in the structure of the Government, role and organizational structure of the Regulatory Body, separation of the Regulatory Body, outcomes of the IAEA IRRS mission

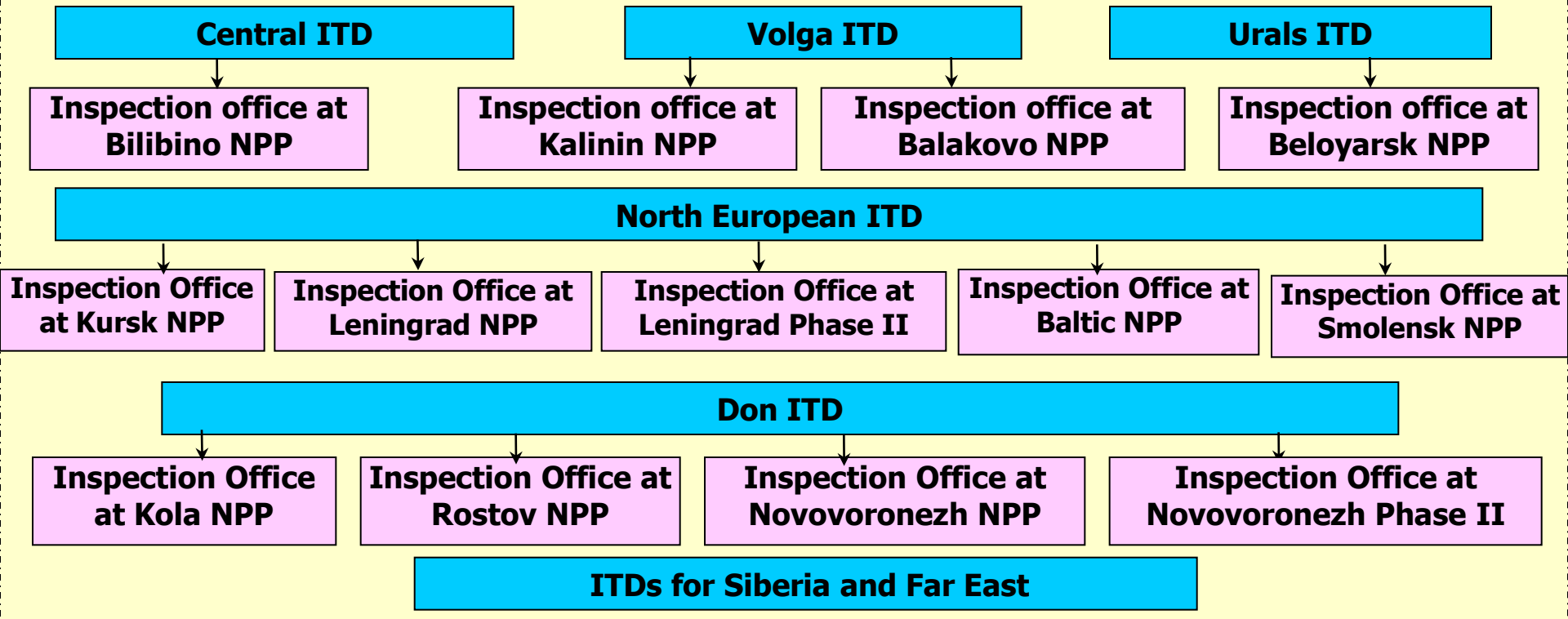
Article 8 (2/4)


CHAIRMAN
6 DEPUTY CHAIRMEN
7 Functional departments
3 Departments for nuclear facility safety regulation (~120 prs)
Headquarters
6 Interregional departments for supervision of nuclear and radiation safety (~800 prs)
Regional bodies
Federal Budgetary Institution Scientific and Engineering Center for Nuclear and Radiation Safety (~ 350 prs)
Federal State Unitary Enterprise VO Safety (~700 prs)
Technical Support Organizations

Article 8 (3/4)



INTERREGIONAL TERRITORIAL DEPARTMENTS FOR NUCLEAR AND RADIATION SAFETY AND SECURITY SUPERVISION (ITDs)



Article 8 (4/4)

- **Independance of the regulatory body: Rostechnadzor was withdrawn from subordination to the Ministry of Natural Resources and Environment of the Russian Federation and re-subordinated directly to the Government of the Russian Federation**
- **Outcomes of the IRRS mission: *see above herein***

Article 14 (1/3)

26 questions: probabilistic safety analyses (PSA) Level 2 and 3, outcomes of the IAEA OSART mission, core damage frequency at RBMK plants, application of Rostechnadzor's inspection findings

- PSA Level 2 was developed for all operating plants with WWER-1000 reactors

  PSA Level 3 for plants with WWERs is not planned at this time

  PSA Level 2 development and refining for pressure tube and fast neutron reactors is planned for the period up to 2018

  PAS Level 3 first stage now is planned for Smolensk NPP in 2018

Article 14 (2/3)

- **Low CDFs at plants with RBMKs are conditioned by:**

  1. Implemented upgrades with deployment of safety systems at RBMK power units.

  2. Technical modifications:

  - transition to new types of nuclear fuel (2.8 % U, 0.6 % Er);

  - implementation of new types of control and protection rods (CPS rods);

  - upgrades of special systems' equipment (introduction of two-set MCP complex, ERPPS, control computer system SKALA-micro).

Article 14 (3/3)

- Rostechnadzor assesses safety level of the plants, basing on inspection findings
- Based on results of the plant safety assessments, Rostechnadzor, as necessary:
  - ❖ plans for additional checks (inspections) to study causes and conditions that led to operational events at the plants;
  - ❖ requires additional or repeated studies, tests, reviews, investigations and other controlling measures with involvement of experts and expert organizations in accordance to the procedure stipulated in the legislation of the Russian Federation

Article 15 (1/4)

17 questions: personnel exposure doses, environmental releases from plants, measures to reduce personnel exposure and environmental releases, principle of the use of the best available technologies for treating discharges, radiological monitoring, Rostechnadzor's role in ensuring observance of radiation safety standards

The implemented organizational and technical measures at the plants minimized a number of employees exposed to doses in excess of the reference level of 18 mSv/year

Actual radioactive substance releases from NPPs were well below permissible values in both the reporting period and preceding years

Article 15 (2/4)

- Reduction of exposure doses to the personnel at Russian NPPs is ensured through a set of organizational and technical measures:
  - shorter time of the personnel stay in ionizing radiation fields;
  - improvement of the dose burden management system;
  - implementation of the ALARA methodology at the plants
- Substantial reduction of radioactive substances ingress into the environment is conditioned by:
  - higher fabrication quality of fuel rods,
  - implementation of state-of-the-art technologies for clean-up of gas-aerosol process media
  - higher safety culture of the personnel

Article 15 (3/4)

- The use of BAT (best available technology) principle in regard of discharge treatment is one of the fundamental principles of the federal law "On the Environmental Protection" (Article 3). Article 14 of this law declares taxation and other relieves for implementation of BAT.
  - At Russian NPPs air has to pass through complex multi-component clean-up systems before it enters the atmosphere
  - Older power units use advanced treatment filters of discharge water before it is drained to surface water bodies
  - Designs of plants with WWER-1000 reactors rule out radioactive substance discharges to surface water bodies

Article 15 (4/4)

- Gamma radiation monitoring in the plant region is carried out automatically by automated environment radiation monitoring system (AERMS)
- AERMS system is an independent subsystem of the radiation monitoring system (RMS) of the plant, which operates in the mode of information exchange with on-site subsystems of RMS
- A check on whether the plant meets radiation safety requirements is carried out by Rostechnadzor and Federal Medical Biological Agency (FMBA)

Article 16 (1/3)

18 questions: responsibility for emergency management and response, Rostechnadzor's functions in case of emergency at the plant, strengthening of capabilities after the accident at Fukushima-Daiichi, information of the public residing near nuclear facilities on emergency planning and emergencies

- **In Russia there is a special body, which is responsible for emergency management. This is the Governmental Commission for prevention and elimination of emergencies and for fire safety.**

  The system of assistance to nuclear power plants in case of radiation hazardous situations includes 19 ministries and agencies.

Article 16 (2/3)

- In case of emergency Rostechnadzor controls the Operator's activities to manage the accident and limit its impact on the personnel, public and environment. In particular, Rostechnadzor monitors correctness of attributing the accident category and if there is a threat (accidents of A01-A04 categories under the adopted classification) it issues a departmental order to appoint a commission for investigation of the accident causes and consequences.
- Given a larger volume of drills and improvement of the emergency preparedness interaction system of Russia's NPPs after the Fukushima-Daiichi accident, in 2012 the decision was made to establish the 8-th operating personnel shift, which includes staff holding essential positions.

Article 16 (3/3)

- According to ROSATOM's order "Regarding organization of drafting of messages and public information in case of events affecting safe functioning of organizations within the ROSATOM system", in case of a threat or events affecting safety and when regimes "Alert" or "Emergency" are declared, overall coordination of providing the citizens and entities' access to information on ROSATOM's activities, public information and interaction with mass media is carried out:

  - at the federal level, by ROSATOM's commission for prevention and elimination of emergencies and for fire safety;

  - at the facility level (in organizations and their branches), by commissions for prevention and elimination of emergencies and for fire safety.

Article 17 (1/2)

26 questions: changes in regulatory documents on siting of NPP as based on results of the Fukushima-Daiichi accident, NPP site selection criteria, IAEA missions to assess the site and its degree of protection against external impacts

- **Currently, several federal nuclear standards and regulation are under revision process: "General safety provisions of nuclear power plants", "Siting of nuclear power plants. Basic safety criteria and requirements", "Design standards of seismic nuclear power plants", "Accounting of impacts external impacts of natural and man-induced origin on nuclear facilities." The revision process takes account of lessons learned from the analysis of the Fukushima-Daiichi accident.**

Article 17 (2/2)

- Site selection criteria are taken as per requirements of the regulatory documents "Siting of nuclear power plants. Basic safety criteria and requirements", "Design standards of seismic nuclear power plants", "Accounting of impacts external impacts of natural and man-induced origin on nuclear facilities." In addition, the IAEA standards are taken account of in the process of the site assessment.
- A decision to invite an IAEA's Site and External Events Design Review Mission to selected sites in the Russian Federation has not been made yet because such type of missions was proposed by the IAEA to the Member States quite recently (late 2012).

Article 18 (1/3)

22 questions: features of the floating nuclear power plant design, changes in nuclear standards and regulations as regards FNPPs, probabilistic safety criteria applied to floating NPPs, aircraft crash considered in the design (Baltic NPP)

▶On the floating nuclear co-generation plant (FNPP) a nuclear facility is the floating power unit (FPU), which is non-self-propelled vessel with a nuclear power installation. Main differences of FPU from ground-based plants include the design features; place of FPU construction (a shipyard); the use of ship nuclear reactors; operation in aqueous environ; integration in FNPP as a separate component; possibility to change the place of operation of FPU; scheduled outages at a shipyard; features of the personnel training

Article 18 (2/3)

- To capture features of FPU construction, transportation and decommissioning, the existing federal standards and rules in the field of the use of atomic energy as well as industry-wide regulations were expanded.
- Probabilistic safety criteria are applied to FPU as a nuclear-propelled vessel. FPU is subject to the probabilistic safety assessment and to the deterministic safety assessment obtained through reviews of technical processes and documentation, monitoring, tests, acceptance, decision-making on permitting further manufacture and certification.

Article 18 (3/3)

Design basis events

AES-2006 design takes account of a light airplane crash with a weight of 5.7 tons at a speed of 100 m/s

WWER-TOI design takes account of a Phantom RF-4E aircraft crash with a weight of 20 tons at a speed of 215 m/s. For this event the design meets all safety requirements with the conservative approach.

Beyond design basis event is a crash of a Boeing 747-440 aircraft with a weight of 400 tons at a speed of 150 m/s, given fuel fire. For this event the design ensures that no radioactive releases into the environment will occur.

Article 19 (1/3)

13 questions: operating experience feedback in periodic maintenance programs, role of the Regulatory Body in the approval process of the maintenance and repair schedules, schedules of inspections and tests, correspondence of the symptom-based procedures to the international practices, SNF and radwaste management

- **Operating experience is taken account of in the periodic maintenance programs through their changes based on results of investigation reports on deviations (operational events) at the plants.**

Article 19 (2/3)

- Schedules of maintenance and repair, inspections and tests are written by the plants with the account taken of the timeframe of technical examination of the equipment and pipelines, but they are not approved by Rostechnadzor. Test programs and methodologies are coordinated with the plant designers and approved by the plant Operating Organization. Rostechnadzor permits tests in accordance with terms and conditions of transition from one work stage to another, as set forth in the license, and they are carried out upon a permit given by the plant Operating Organization.
- Russian SB EOPs were developed using procedures similar to foreign ones, in particular, those that are in use at Westinghouse Electric Co. for PWRs.

Article 19 (3/3)

- The issue of SNF importation pertains to the domain of the Joint Convention. The SNF importation from foreign states for temporary storage and (or) reprocessing is governed by the Russian legislation and international treaties.

  The procedure of importation and return of SFAs and their reprocessing products (including radwaste) is established by the resolution of the Government of the Russian Federation "Regarding the procedure of importation of irradiated fuel assemblies of nuclear reactors to the Russian Federation"

10. Updates to the National Report since its submission

- Changes in the legal regulatory framework, including new administrative regulations of Rostechnadzor and safety guides
- IRRS follow-up mission in November 2013 (described above herein)
- Operating license granted to Beloyarsk-4. Now the unit implements the first criticality program

Conclusion (1/4)

- The up-to-date legislative and regulatory framework, which spells out rules of ensuring and regulating safety of nuclear installations has been developed
- The independent Regulatory Body – Rostechnadzor - is in place, which is subordinate and reports on its activities directly to the Government of the Russian Federation
- The priority to safety of nuclear installations is secured in the legislation and exercised

Conclusion (2/4)

- NPP units' level of safety is inspected and assessed consistently over the lifecycle of nuclear power plants
- The operating experience analysis of NPP units over the recent years has demonstrated sustainable downward trends in releases and discharges to the environment and in dose burden to the personnel
- Required emergency preparedness measures of nuclear power plants and measures to ensure safety of the personnel, general public and environment in the plant location region have been implemented at the state level

Conclusion (3/4)

- Rostechnadzor's inspections and missions of international organizations have confirmed the positive trends in operation-related activities
- Regulatory Body and Operating Organization act in the open manner, while continuously pursuing higher transparency of their activities

Conclusion (4/4)

- The additional assessment of a degree of protection of Russian NPPs against extreme external impacts carried out after the Fukushima-Daiichi accident confirmed that Russian plants are generally robust in regard of such impacts.
- Measures taken by the Operating Organization to raise the degree of protection of the plants against impacts in excess of design bases are adequate and implemented as planned under supervision on the part of the Regulatory Body.

The Russian Federation fulfills its obligations resulting from the Convention on Nuclear Safety