



Status of Nuclear Safety Culture Through Lessons Learnt from Licensing, Periodic Safety Review and Relicensing of Activities at Nuclear Research Installations in Russian Federation

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Outline

- The progress stages of regulatory regime
- Principal functions of safety regulation of atomic energy use
- Administrative licensing procedures in the field of the use of nuclear energy
- Periodic safety review and operating organization's annual report on safety status of NRI
- Current state of safety of NRIs
- The outcomes and lessons learnt from relicensing of NRIs
- Conclusion



The Progress Stages of Regulatory Regime in Russian Federation

- 1983 – establishment of the USSR State Committee on Supervision of Nuclear Power Safety
- 1991- establishment of the State Committee for Supervision of Nuclear and Radiation Safety renamed then to Federal Nuclear and Radiation Safety Authority of Russian Federation - RF Gosatomnadzor (GAN).
- 1993 - the RF Gosatomnadzor developed the temporary permits for activities in the field of atomic energy use for the operating time of 1-3 years until the Federal Law on the Atomic Energy Use has been developed, adopted and put in forth.
- 1995 - the Federal Law on the Atomic Energy Use was put in force.
- 1997 - the Licensing Regulations Governing the Atomic Energy Use were approved by Decree of the Government of the Russian Federation
- 2004 – the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostekhnadzor) was established



Rostekhnadzor Structure for Nuclear and Radiation Safety Regulation

HEADQUARTERS

Department for Safety
Regulation of Nuclear
Plants and Research
Nuclear Installations

Department for Safety Regulation of Nuclear Fuel
Cycle Facilities, Nuclear Power Installations of
Ships and Radiation Hazardous Facilities,
Supervision of Accounting and Control of Nuclear
Materials and Radioactive Substances and
Physical Protection

Interregional Territorial Departments for Nuclear and Radiation Safety Supervision (ITDs)

Central ITD

North-
European ITD

Don ITD

Volga ITD

Ural ITD

Siberian ITD

Far East ITD



Basic Functions of Nuclear and Radiation Safety Regulation

Development and putting in force codes and standards in the field of atomic energy uses (regulatory control)

Licensing of activities in the field of atomic energy uses (licensing)

Supervision of nuclear and radiation safety of atomic energy facilities, including supervision of nuclear material accounting & control and physical protection (supervision)



The Key Points of the Licensing Developed at the Initial Stage

- Specification of the list of licensed activities at NRIs;
- Definition of the scope of kind of licensed activity;
- Establishment of optimal period of licence validity for specific kind of activity taking into account the current state of the facility and its hazard potential.



Improvement of Regulatory Regime at the Stage of Initial Licences

- The set of Federal Norms and Rules in the Field of Atomic Energy Use (FNR).
- The administrative procedures for licensing of activities in the field of atomic energy use.
- The list of documents needed to be considered at each stage of the lifetime of NRI.
- The major safety documents.
- The operating organizations as being suitable to operate a nuclear installation, radiation source or storage facility
- The measures for enhancement of safety providing validity period of operation licence more than three years.
- Final shutdown of NRIs and subsequent decommissioning plan.



Lessons Learnt from Initial Licensing

The need to enhance efficiency of safety regulation of the following issues:

- Accounting of nuclear material, radioactive substances and radioactive waste;
- Security (physical protection);
- Emergency planning;
- Quality assurance programme;
- Ageing management programme.



Requirements for Justification of Possible Extension of Assigned Operating Life of Facilities Using Nuclear Energy, NP-024-2000

Requirement for the operating organization to implement the management programme of SSCs service life (ageing management pr.).

Operating life time less than 30 years:

- inspections to check compliance with the licence conditions
- relicensing.

Operating life time reached or more than 30 years:

- Comprehensive survey of NRI;
- Definition and justification of residual service life time of SSC;
- Arrangement for NRI to operate safely during extended operating time including
 - additional research to define residual service life time of SSC,
 - replacement of overage equipment and, if necessary, its modernization,
 - testing of SSC to the compliance with design requirements,
 - correction of documents justifying safety.



Evaluation of Potential Accidents

General Provisions for Nuclear Research Installations Safety, NP-033-01/10

Requirements to Contents of Safety Assessment Report for NRIs, NP-049-03

The design of NRI shall contain (NP-033-01/10, NP-049-03):

- List of initiating events for DBAs,
- List of BDBAs,
- Assessment of an accident probability and its sequence
- Assessment of radiation consequences.

The design ground shall show that all external impacts peculiar to area of NRI location and having potential frequency 10^{-6} per year and more have been taken into consideration.



Acceptance Criteria

- **Deterministic (Radiation Safety Codes, NRB-99/2009):**
 - Occupational dose limit in average for any consecutive 5 years – 20 mSv/a (but annually not more 50 mSv);
 - Public dose limit in average for any consecutive 5 years – 1 mSv/a (but annually not more 5 mSv);
 - In case of accident the intervention level for urgent protective actions for public: sheltering - 5 mSv, evacuation - 50 mSv.
- **Probabilistic (General Provisions for Nuclear Research Installations Safety, NP-033-01/10; Nuclear Safety Rules for Research Reactors, NP-009-04):**
 - Probability of the reactor core melting shall not exceed 10^{-5} 1/a;
 - Probability of extreme radioactivity release requiring urgent protective actions for public shall not exceed 10^{-7} 1/a per facility.

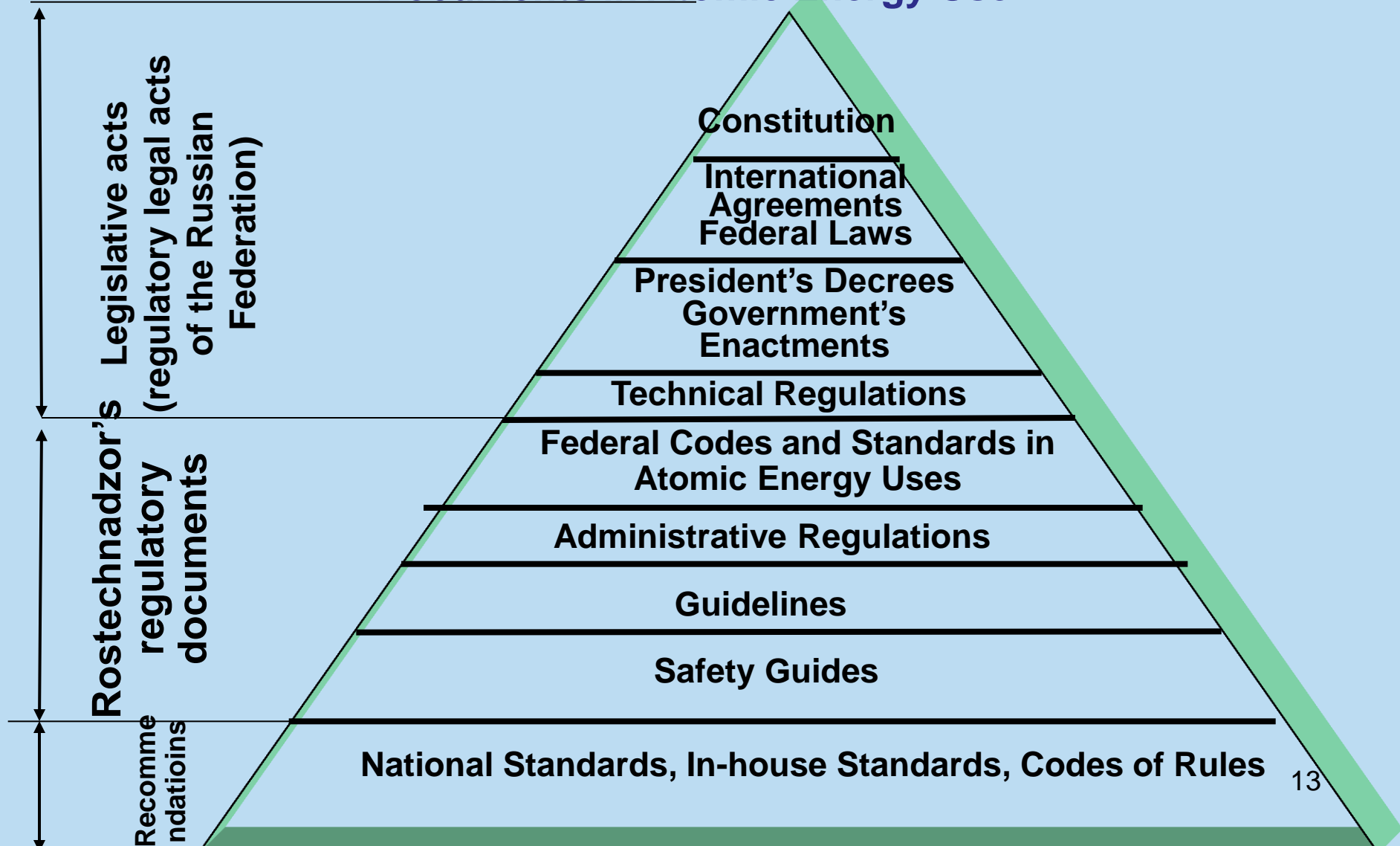


Definition of Radiation Source Term for BDBAs

- Reasonably accurate source term calculations and analysis of BDBAs consequences are very important issue for:
 - overall identification of appropriate accident management strategies,
 - development of emergency response plans and
 - mitigation measures (particularly given that many research reactors are located in fairly densely populated areas).
- Calculations of the source term is necessary in the case of new fuels or recently qualified fuels for research reactors.



Present Structure of Russian Legislative and Regulatory Documents in Atomic Energy Use





Structure of Federal Codes and Standards (Federal Norms and Rules) in Atomic Energy Use

Level 1

General safety provisions for each nuclear facility (NPPs, RRs, icebreaker reactor, nuclear fuel cycle facilities, radiation sources)

Level 2

ACTIVITIES

For all types of nuclear facilities

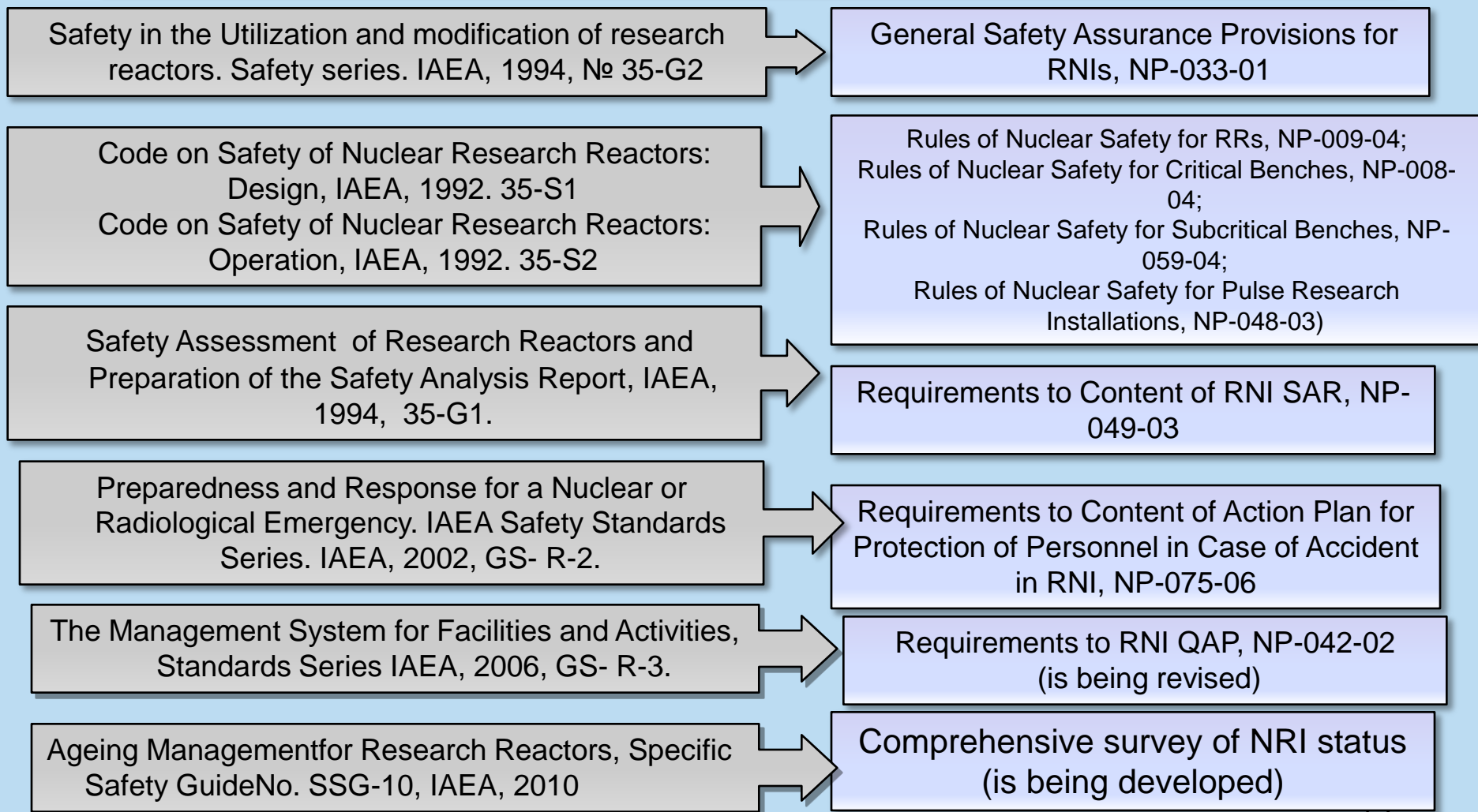
For each nuclear facility, including RNIs

- Account for external impacts
- Radwaste management
- Accounting and control
- Physical protection

- Quality assurance
- Siting. Design. Safety justification.
- Construction
- Operation
- Emergency preparedness
- Decommissioning



Basic Codes and Standards for Nuclear and Radiation Safety of Research Reactors





The Licensing of Activities in the Field of Atomic Energy Use in Russian Federation (1/2)

Legal basis (www.gosnadzor.ru):

- Federal Law on Atomic Energy Use, November 21, 1995, №170-FZ;
- Provision on Licensing of Activities in the Field of Atomic Energy Use, Decree of the Government of the RF, July 14, 1997, № 865;
- Administrative Regulation to Perform the State Function of Licensing Activity in the Field of Atomic Energy Use by the Federal Environmental, Industrial and Nuclear Supervision Service, Order of the Ministry of Nature Recourses and Ecology № 262, October 16, 2008.



The Licensing of Activities in the Field of Atomic Energy Use in Russian Federation (2/2)

Established Licensing Procedures:

- Examination of the licence application and a preliminary check of the accompanying documentation;
- Review, including expert review of safety relevant documents and, if needed, inspection to confirm reliability of submitted documents.
- Decision-making to issue or refuse the licence;
- Grant of a licence and specification of its terms and conditions for performance;
- Follow-up procedures including inspection to check compliance with the licensing conditions;
- Licence conditions correction or amendment during the activity;
- Extension, suspension or termination (cancellation) the licence.

In general, the Russian licensing procedures and principles correspond to IAEA recommendations (Licensing Process for Nuclear Installations. Specific Safety Guide, Safety Standards Series No SSG-12, 2010) .



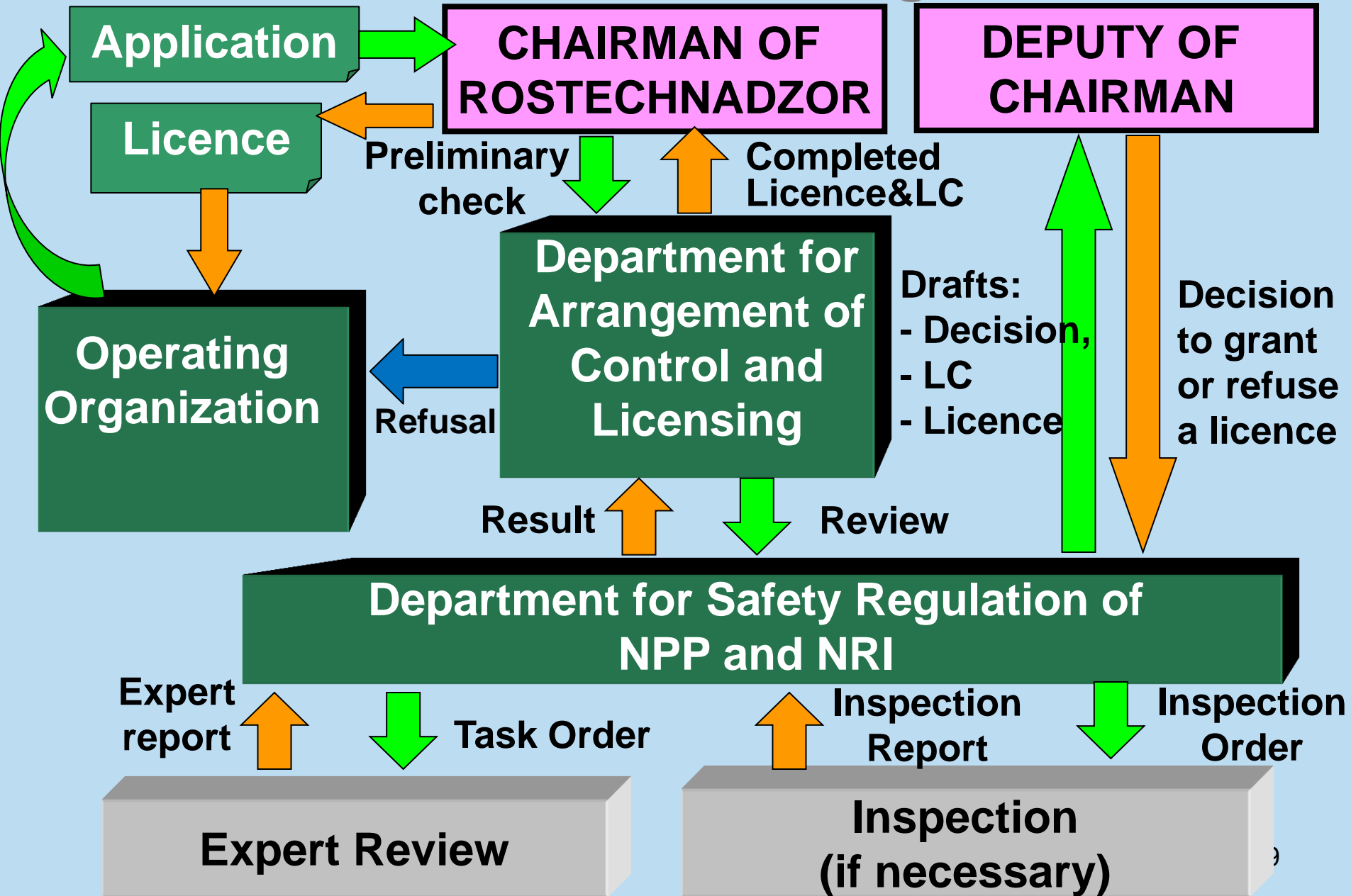
Activities through NRIs Lifecycle Licensed by Rostekhnadzor

- CONSTRUCTION,
- OPERATION,
- DECOMMISSIONING,
- NUCLEAR MATERIAL MANAGEMENT,
- RADIOACTIVE SUBSTANCE MANAGEMENT,
- RADIOACTIVE WASTE MANAGEMENT,
- UTILIZATION OF NUCLEAR MATERIAL DURING RESEARCH AND DEVELOPMENT (PART OF OPERATION LICENSE),
- UTILIZATION OF RADIOACTIVE SUBSTANCE DURING R&D (PART OF OPERATION LICENCE),
- FACILITY DESIGN AND ENGINEERING,
- FACILITY EQUIPMENT DESIGN,
- FACILITY EQUIPMENT MANUFACTURE,
- REVIEWS OF SAFETY DEMONSTRATION DOCUMENTS.

Graded approach to completeness and content of package of documents describing current status of nuclear installations.

Graded approach is applied to determine amount of review of activities considering RNI potential risk.

Flowchart of Licensing Procedures





Main Issues for Peer Review

- General description of the facility
- Safety principles and criteria
- Characteristics of the site
- Structures, systems and components, important to safety
- Results of works carried out to justify possibility to extend service life of SSC (for ageing NRI)
- Accident safety analysis (DBA and BDBA)
- Limits and conditions of safe operation (OLCs)
- Nuclear Safety (core management)
- Radiation safety (personnel, public, monitoring)
- Fuel and radiation material accounting
- Facility, fuel and radiation material physical protection
- Industrial safety (pressure vessels, lifting devices)
- Emergency preparedness (personnel and the public)
- Fire protection
- Quality Assurance
- Decommissioning



Licence Conditions

- Shall form an integral part of the licence;
- Shall include Rostekhnadzor's requirements concerning the safety of the licensed activity;
- Shall not include restrictions of activity, which were not established in the Federal Legislation and Legislative Acts of Russian Federation in the field of atomic energy use.

General requirements to structure and contents of licence conditions were included in Administrative Regulation (www.gosnadzor.ru)



Operation Licence Conditions

- Operator shall carry out activity in accordance with Design, SAR, EP, Engineering procedures, Operating instruction, QA programme;
- Operator shall fulfillment requirements of codes and standards included in the “List of Legislative Acts and Normative Documents Related to Sphere of Activity of Rostekhnadzor, P-01-01-2009”;
- Operator shall carry out analysis of licensed activity in compliance with requirements of codes and standards and improve activity in accordance with safety requirements development..



Periodic Safety Review

- No specific requirements to PSR now.
- Practically safety review of NRIs is being performed every five years:
 - licence is issued for a five year period and
 - on expiry of this period of time the operator shall obtain a new licence.
 - During a new licensing process the operator shall submit a safety justification of NRI operation including updated SAR.
- Complexity and radiation risk of the NRI shall be taken into account in relicensing.

The draft of regulations on NRI periodic safety review was developed in 2011 and will be completed in 2012:

- Federal Law on the Atomic Energy Use does not limit the term of licence validity;
- a trend is being observed to extend period of operation licence validity more than for five year period.



Annual Report on Status of Nuclear and Radiation Safety at NRIs, RB-025-03

- Fulfillment of licence conditions,
- Fulfillment of the Rostechnadzor's prescriptions,
- Fulfilled and planned measures of safety enhancement, unsolved safety issues,
- Data on technical state of SSC, ageing management programme,
- Radiation doses to personnel and researchers,
- Personnel skills and training,
- Emergency preparedness and training.
- State of operational documents,
- Fulfillment of quality assurance programme,
- Data on accounting of nuclear materials, radioactive substances and radwaste,
- State of physical protection.



Status of NRIs

1991

113

- Lack of program for research
- Financial difficulties
- Safety problems (ageing)

2011

70

19 Operating Organizations

Oldest: F-1 1946
 "Youngest": PIK- 2011



RR	30
23/19	5
	2

CA	28
26/17	2
	0

SCA	12
11/10	0
	1

Operation /age>30
 Decommissioning
 Construction



Program of Targeted Safety Assessments (stress tests)

- As a result of licensing, inspection checks of compliance with the licence conditions, expert reviews, review of operating organizations' annual reports Rostekhnadzor estimates the current status of safety and security at NRIs as satisfactory.
- Stressing the importance of preliminary lessons learned from Fukushima-Daiichi NPP accident it was arranged the additional goal reviews of safety of Russian NRIs regarding to possible extreme external events, which could be those of potential resultant severe BDBA.
- At present the Program of targeted safety assessment for NRIs of Russia (stress tests) is being in progress.



The General Outcomes of Relicensing of NRIs and Activities in the Field of Atomic Energy Use in Russian Federation

- Methodology of safe termination of activity, decommissioning, release of facility from regulatory control have been provided;
- Procedures of granting of permits to personnel for activities has been established;
- The number of disturbances at NRIs is decreased;
- Interdepartmental information exchange has been improved.



The Major Lessons Learnt from Relicensing of NRIs and Activities in the Field of Atomic Energy Use in Russian Federation

- Strengthening of the state management system and system of safety regulation of atomic energy use on the legislative basis,
- Improvement of the management systems of organizations in a way that permits and promotes the development of a strong safety culture together with the achievement of high levels of safety performance,
- Strengthening of professional staff of authorities,
- Elimination of deficiency in industrial legislations regarding priority of nuclear legislation applying to industrial facilities that are part of nuclear facility,
- Providing of proper conditions for comprehensive independent expert review of safety of activity at NRIs by funds of the Federal Budget



Conclusion

- Practice of licensing of NRIs in Russian Federation indicate that there were no safety issues where the lack of scientific and technical data could cause a weakness in safety regulation and safe utilization of NRIs.
- The strategy of further development of licensing shall be addressed to securing the global safety regime at NRIs including safety and security risk management.
- As a scientific and technical support for decision-making in licensing process the following issues constitute priority in further investigation of NRIs safety:
 - Clarification of different types of NRIs, including new projects of NRIs;
 - Ageing management, clarification of ageing mechanism of SSC;
 - Validation of numerical tools (codes) applied to assessment of potential severe accidents and their consequences and increasing codes accuracy.
- The favorable conditions for partnership and exchange of experience including lessons learnt from licensing promote safety and security cultures.



***Thank you
for your
attention***