



New Safety Requirements Addressing Feedback From the Fukushima Daiichi Accident

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The 18th International Group on Research Reactors (IGORR)
Conference/the IAEA Workshop on Safety Reassessment of
Research Reactors in Light of the Lessons Learned from the
Fukushima Daiichi Accident, Sydney, Australia 3 - 7 December 2017



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Enhancement of Safety: Regulatory Aspects (1/2)

- Supplementary safety assessment (reassessment) of Russian NRFs showed the following:
 - Operating organizations have carried out safety reassessments of NRFs and took measures for improvement of EPR, if they were needed;
 - Rostechнадзор has reviewed the operators' reports, taken measures and drafted ***“Concept on Development of Legislative Framework of Nuclear Safety Regulation and Certification in the Field of Nuclear Energy Use.”***



cont' (2/2)

- Rostechnadzor revised licensing procedures and updated licensing conditions for operation of NRFs;
- Process of improvement of emergency preparedness and response (EPR) for NRFs is ongoing:
 - Information and Analysis Centre (IAC) of Rostechnadzor is developing;
 - webinars with regional offices of Rostechnadzor is performing systematically at the IAC since 2015;
 - emergency exercises at NRFs is planned to carry out on regular basis with the IAC involved.



Feedback from Safety Reassessments of Russian NRFs



General Observations in a Global Manner

International Conference on Nuclear Security: Commitments and Actions, 19–23 October 2015 Vienna:

- strengthen EPR infrastructure;
- improve the interface between nuclear safety and nuclear security.

International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements, 11-15 April 2016 Vienna:

- sustain strong regulatory systems to maintain nuclear safety and security, and public trust;
- harmonization national regulatory requirements with IAEA standards;
- encourage research on ageing to support the licensing;
- develop an integrated management system to promote safety culture.



Feedback from Safety Reassessments of Russian NRFs

Operator's reassessments showed:

- most facilities did not identify a need for updating;
- additional equipment were needed for some NRFs (for example, mobile diesel generators, reliable back-up batteries and pump for site of JSC «SSC RIAR»);
- seismic monitoring and scram system were required in some cases.

Rostechnadzor review showed:

- national safety requirements are in compliance with the IAEA standards;
- no significant areas of weakness;
- small set of amendments should be provided for strengthening safety of research reactors with potential core damage and off-site consequences.



Challenges faced by Rostechнадзор

- In many cases facility blackout has not been assessed.
- Additional safety requirements should be implemented to provide operation of systems important to safety in case of blackout.
- There are need to review organizational aspects of EPR:
 - responsibility for taking decisions in case of emergency situation;
 - communication with off-site authorities,
 - role of the regulatory body in emergency at a NRF.



**Update of Safety
Requirements.
New Safety Regulations.**

Self-Assessment of Regulatory Framework



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Areas for updating

- ***Design requirements:***
 - need to expand groups of beyond design basis accidents (BDBAs, design extension conditions - DEC);
 - considering combination of natural hazards;
 - updating seismic analyses.
- ***EPR requirements:***
 - harmonization between the national safety regulations;
 - need to develop a new regulations on announcement and communication in case of emergency at a NRF.

Future activities

- Implementation a graded approach methodology for enhancement efficiency of regulatory activities including safety assessment, licensing, inspections, EPR.



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Status of Specific Safety Regulations for NRFs

Title	Year	Status
General NRF Safety Regulations	NP-033-11	In force
Rules on Nuclear Safety of Critical Stands	NP-008-16	New, 2016
Rules on Nuclear Safety of Research Reactors	NP-009-17	New, 2017
Rules on Nuclear Safety of Pulse Reactors	NP-059-05	In force
Rules on Nuclear Safety of Subcritical Stands	NP-048-03	In force
Requirements to the Content of NRF Safety Analysis Report	NP-049-03	In revision
Provisions on Investigation and Reporting on Anticipated Operational Occurrences and Accident at NRFs	NP-027-10	Will revised
Requirements to the Content of Action Plan to Protect Personnel in Case of an Accident at NRF	NP-075-06	In revision
Safety Rules on Decommissioning of NRFs	NP-028-17	New, 2017
Periodic Safety Reviews for NRFs	NP-092-14	In force
Rules for Arrangement and Exploitation of Actuators of Control Rods	NP-086-12	New, 2017
Provision on Arrangements for Notification, Prompt Information Transfer and Urgent Assistance in Emergency Situation at NRF	—	New. Term of reference April 2017

Revision of NP-009-04 →

NP-009-17 (*put in force in 2017*) (1)



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- **Clarification of the external impacts:**
 - all **specific for the research reactor site external impacts** of natural origin and human induced shall be taken into consideration (**updated**);
 - the design and operational documentations shall include analysis of response of important to safety systems on internal and external impacts of natural origin and human induced **taking into account their combination along with the impact of other interdependent processes (new)**.
- **Reviewing of BDBAs (DEC):**
 - the design and operational documentations shall include the list of initial events of design basis accidents (DBAs) and a list of BDBAs (**including research reactor blackout, loss of ultimate heat sink, the aircraft crash**), as well as the results of DBAs and BDBAs analysis and their consequences (**new**);



- ***Emergency electrical power supply:***
 - the reactor design shall provide the technical means for ensuring reactor nuclear safety including **(updated)**:
 - ***redundant power supply*** of systems and elements used for planned shutdown and subsequent cooling of the reactor core in case of failure of the main (working) electric power supply;
 - ***emergency electrical power supply***, providing operation of at least two channels of the reactor power level control, work of the position indicators of control rods, temperature control of the reactor core and spent fuel storage, emergency cooling of the reactor core, and operation of the supplementary control room while emergency.
- ***Cooling of the reactor core:***
 - the design shall provide as much as possible for type of reactor the ***natural circulation of coolant when an emergency cooling regime happened (new)***.

Revision of NP-008-04 → NP-008-16 *(put in force in 2016)*



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- **Clarification of the external impacts:**
 - all **specific for the NRF site external impacts** of natural origin and human induced shall be taken into consideration **(updated)**;
 - the design (operational documentations) shall include analysis of response of the control and other systems important to safety to **combined impact of natural origin and human induced factors** specific for site of the critical stand **(new)**.

Revision of NP-049-03 → NP-049-XX (in progress) (1)



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The additional/updated safety requirements concern analysis of extreme events, their combination and consequences including:

- values of seismic impact requiring facility scram (**new**);
- response of the SSC to **impact of combination of external natural and human induced events** specified for facility site (**updated**);
- **expanded list of initial events** of DBAs and **expanded groups of BDBA (DEC)** (**updated**);
- accidents involving unauthorized insertion of positive reactivity due to the **superposition of a number of human errors or hardware failures causing core damage and fuel melting** (**updated**);
- accident in which initial event of DBA is accompanied by a complete failure of reactor safety system and accompanied by failure of any one element of confining system or human error in control of this system (**updated**);
- loss of off-site power accompanied by failure of any one element of confining system or human error in control of this system (**updated**);

Revision of NP-049-03 → NP-049-XX (*in progress*) (2)



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- **facility blackout** including emergency power supplies (**new**);
- loss of coolant accompanied by failure of one element of confining system or human error in control of this system (**updated**);
- loss of ultimate heat sink (**new**);
- accident caused by the simultaneous **effect of several external factors of maximum values** (**new**);
- **accidents caused by the personnel inability to implement emergency measures** during the initial events of DBA (**new**);
- description of systems and components including a special technical equipment (means) using to mitigate emergency in BDBA (**new**);
- description of **ageing management programme** (**new**);
- results of **periodic safety review** (**new**).

Revision of NP-075-04

→ **NP-075-XX** (*in progress*)



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The additional/updated safety requirements concern:

- size of the emergency planning zone (**new**);
- plan of emergency planning zone (**updated**);
- criteria to identify scenarios "Emergency preparedness" and "Emergency situation" (**updated**);
- templates of information (tables, forms ect.) that should be used in emergency (**new**);
- communication with technical support structure at the site in emergency (**updated**);
- managing the *interface between safety and security* (**new**).



«Arrangements for Notification, Prompt Information Transfer in Case of Emergency Situation at NRF» (new)

- Criteria for notification of “Emergency preparedness” and “Emergency Situation”.
- Requirements for technical support center (emergency center);
- Requirements for notification and information transfer during an emergency situation including:
 - classification of emergency within 15 minutes and notification of local authorities within 15 minutes after classification;
 - procedures for communication and information exchange with notification point and mass media.
- Requirements for urgent assistance to NRF personnel in case of emergency situation, if needed;
- Requirements for ***management between safety and security***.



Improvements of Licensing Procedures and Licensing Conditions (Validity Conditions)



Rostechnadzor issues licences to:

- **operating organizations including**
 - siting, commissioning, operation and decommissioning
 - radwaste management during storage, processing, transportation and disposal
 - using nuclear material and/or radioactive substances in research and development works;
- **organizations which perform works and render services (in particular, design services, engineering services, equipment manufacturing services) for operating organizations including**
 - design and engineering of nuclear installations, radiation sources, storage facilities;
 - design and production of equipment for nuclear installations, radiation sources, storage facilities;
 - safety review of nuclear facilities and/or types of activity.



Post-Mission 2013 (Mission 2009)



- Significant improvements in the legal basis for state nuclear safety regulation.
- Rostekhnadzor is an effective independent regulatory body reporting directly to the Government of the Russian Federation.
- Actions taken in the light of the F-D accident.

Self-Assessment (2017)

International Meeting on Application of the Code of Conduct on the Safety of Research Reactors, Vienna, Austria, 15-19 May 2017

- **ROLE OF THE STATE:** Russian Federation meets recommendations of the Code of Conduct on on the Safety of Research Reactors.
- **ROLE OF THE RB:** Rostekhnadzor implements the regulatory body role.
- **ROLE OF THE OO:** The authorization process forces a licensee to carry out role of the operating organization.

Main Observations of Licensing Procedures



- Self-assessment of the licensing procedures did not find out any gaps.
- A graded approach should be implemented in:
 - set of safety documents for licence application (RR, CS, SCS ect);
 - Safety Analysis Report depending on NRF type (RR,CS, SCS ect).



- Self-assessment of the licensing conditions identified a need to amend them with:
 - announcement Rostechnadzor's resident inspectors about planning and performing nuclear hazardous and other specific work important to safety;
 - informing Rostechnadzor's Region Inspectorate about the planning physical start-up of a critical stand after its modification.

About Safety Requirements for Test Reactors



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- New projects of test reactors use equipment for generation of heating and electricity to demonstrate application at NPPs of new generation.
- Test reactors do not meet safety requirements for NPPs, because they use new technologies and non-approved equipment.
- Neither the Convention on Nuclear Safety nor the Code of Conduct on the Safety of Research Reactors cover the facilities like test reactors.
- Experience of the Russian Federation (“The First in the World NPP”, AM-1, test reactor BK-50, 200 MW, test reactor BOR-60, 60 MW,) and some other countries (the US, France ect.) show that safety reference for test reactors may be clarified on the basis of a graded approach in application to the safety requirements.
- In light of the lessons learned from F-D accident the preventive actions should be made for future new projects of NRFs and test reactors.



- The Russian Federation performed safety reassessments of NRFs in light of feedback from the F-D accident.
- Rostechнадзор is improving the regulatory framework for NRFs safety to support regime of global safety and security.
- There are the following challenges in safety regulation of NRFs:
 - further development of methodology for implementation of a graded approach to enhance efficiency safety regulation (safety assessment, licensing, inspection, EPR of NRFs);
 - clarification of the safety references for test reactors.



Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostekhnadzor)



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