

Translated from Russian

**Russian Federal Nuclear and Radiation Safety Inspectorate
(Gosatomnadzor)**

**FEDERAL RULES AND REGULATIONS
ON THE USE OF NUCLEAR ENERGY**

APPROVED BY
Gosatomnadzor Resolution No. 4
of 18 September 2000

Basic Requirements for Power Unit Lifetime Extension of Nuclear Power Plant

NP-017-2000

EFFECTIVE AS FROM
1 November 2000

Moscow 2000

UDC 621.039

BASIC REQUIREMENTS FOR NUCLEAR POWER PLANT UNIT LIFETIME EXTENSION

Gosatomnadzor
Moscow 2000

These Federal Rules and Regulations (NP-017-2000) set out the main criteria and requirements relating to nuclear power plant unit lifetime extension and apply to all nuclear power units currently in operation.

This is the first issue of the Regulations.

These Federal Rules and Regulations have been drawn up by a board of contributors headed by I.V. Kaliberda of Gosatomnadzor's Scientific and Technical Centre of Nuclear and Radiation Safety and consisting of specialists from Gosatomnadzor's central office, its interregional territorial subdivisions, the Scientific and Technical Centre of Nuclear and Radiation Safety, Rosenergoatom, the Leningrad, Kola and Novovoronezh NPPs and the Information Centre at the Ministry of Nuclear Energy.

In drawing up the Rules and Regulations, the authors took into account the comments and suggestions made by the Kurchatov Research Institute, the All-Russian NPP Research Institute, the Power Engineering Technology Research and Development Institute, Gidropress, Atomenergoproekt and Atomenergoproekt of St. Petersburg.

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DEFINITIONS

1. **Nuclear Power Plant (NPP) unit**¹ - That part of an NPP carrying out the NPP functions assigned to it by plant design.
2. **Safety deficiency** – Inadequate provision for a specific safety function, falling below the level required by current rules and regulations governing the use of nuclear energy.
3. **Extension period** – A calendar period of power operation of an NPP unit, extending beyond its designated service life.
4. **Compensating measures** – Technical and organisational measures aimed at a partial or complete elimination and/or limitation of the impact of safety deficiencies on safety
5. **Designated operating (service) life**² - A calendar period of operation of a NPP specified by its design. Once this period has expired, the NPP may only continue in operation on the basis of a special decision made after an assessment of its safety and cost effectiveness.

Notes:

1. For first-generation units, the designated service life is 30 years.
2. A special decision is a decision to grant an NPP unit an operating licence in accordance with the existing procedure.
6. **Non-repairable component**³ - A component not specified by the standard and/or design documentation as suitable for repair in the circumstances under review, or one whose repair is economically unjustified.
7. **Residual life**⁴ - Total component operating time from the date of its status check until the time it reaches its boundary condition
8. **Boundary condition**⁵ - Component condition making its continued operation impermissible or inappropriate, or making its repair impossible or inappropriate
9. **Lifetime extension** – Work aimed at preparing an NPP unit for operation during an extension period
10. **Engineering status** – A set of a component's (a facility's) properties subject to change in the course of its manufacture or operation, which can be described at any specified point of time in terms of its features specified in its technical documentation and/or in terms of the outcomes of component reliability (service life) management operations.
11. **Components**⁶ - Equipment, instrumentation, pipelines, cables, structural elements and other items able to perform specified functions independently or as part of a system, regarded by the plant design as structural units for the purpose of reliability and safety assessments.

¹ Taken from OPB-88/97, "Basic Principles of Nuclear Power Plant Safety"

² Taken from GOST 26291-84 "The reliability of nuclear power stations and their equipment"

³ Taken from GOST 27.002-89 "Reliability in engineering. Basic concepts. Terms and definitions"

⁴ Taken from GOST 27.002-89 "Reliability in engineering. Basic concepts. Terms and definitions"

⁵ Taken from GOST 27.002-89 "Reliability in engineering. Basic concepts. Terms and definitions"

⁶ Taken from OPB-88/97, "Basic Principles of Nuclear Power Plant Safety"

1. THE DESIGNATION AND SCOPE OF THE REGULATIONS

- 1.1 These Federal Rules and Regulations have been drawn up with due regard for the provisions of the Federal Act on the Use of Nuclear Energy and the Federal Act on the Radiation Safety of the Population, as well as the Basic Principles of Nuclear Power Plant Safety and The Principles of Installation and Safe Operation of Nuclear Power Plant Equipment and Pipelines. They build on the specific provisions of these documents as they relate to extended operation of NPP units.
- 1.2 These Federal Rules and Regulations establish the main criteria and requirements governing decisions on the feasibility of lifetime extension of NPP units and on the measures required to ensure their safety during the extension period.
- 1.3 These Federal Rules and Regulations apply to all operating NPP units.

2. GENERAL PROVISIONS

- 2.1 Before the end of an NPP unit's designated operating (service) life, the Operator shall assess its safety, using the results of the assessment to reach a decision on whether to allow it to continue power operation or to shut it down.
- 2.2 The length of the extension beyond the designated service life shall be determined on the basis of a range of technical and economic considerations, including:
 - The ability to ensure and maintain operational safety
 - Sufficient residual service life of the unit's non-repairable components
 - The availability of temporary storage facilities for the additional spent nuclear fuel, or the possibility of its transport off-site
 - The ability to ensure safe handling of the radioactive waste generated during the extension period
 - The ability to ensure safe decommissioning of the unit.
- 2.3 To extend the lifetime of an NPP unit, the Operator shall take the following essential steps:
 - Carry out a comprehensive survey
 - Draw up a programme of preparation for lifetime extension
 - Prepare the unit for operation during the extension period. This process shall include confirmation of component safety and residual service life, replacement of equipment which has reached the end of its service life, and where necessary, upgrading or reconstructing the unit
 - Carry out the necessary tests
- 2.4 The comprehensive survey shall be carried out in accordance with a programme approved by the Operator.
- 2.5 The programme of preparation for lifetime extension shall include:
 - Carrying out studies to determine the residual service life of non-repairable unit components, structural elements, foundations, buildings and installations, and determining and implementing the steps required to extend their residual service life;
 - Carrying out additional studies⁷ to determine the residual service life of repairable components and taking steps to restore this length of service life;
 - Drawing up technical and organisational measures to eliminate and/or limit the impact of safety deficiencies on safety

⁷ If required

- Preparing design documentation
 - Preparing⁷ a work programme
 - Preparing⁷ timetables for specific jobs, listing their content and naming those responsible for their completion
 - Drawing up a quality assurance programme
 - Drawing up acceptance requirements for the completed work and the various implemented measures
 - Carrying out tests
 - Updating existing safety documentation in line with the actual status of the NPP unit, or preparing new documents demonstrating the safety of the unit.
- 2.6 The safety assessment forming the basis of the decision to extend the lifetime of NPP units shall itself be based on the criteria and requirements contained in the current rules and regulations governing the use of nuclear energy, and on the criteria set out in these Federal Rules and Regulations.
- 2.7 Conservative methods shall be selected for the assessment of safety, so as to compensate for the uncertainty of the initial information, and the software used for assessment purposes shall be certified.
- 2.8 The Operator shall base the proposed extent of the work required to bring the NPP unit into line with the criteria and requirements of current nuclear energy standards on the results of a comprehensive survey of the actual status of the unit and on the safety documentation.
- 2.9 All work on the elimination or compensation of safety deficiencies which requires modification of unit design and involves the implementation of new design and structural solutions shall be carried out in accordance with duly prepared and approved design and engineering documentation.
- 2.10 If the safety assessment reveals factors which prevent the safe operation of the unit during its extended lifetime and which cannot be cost-effectively eliminated, the Operator shall prepare the unit for decommissioning.

3. THE COMPREHENSIVE SURVEY

- 3.1 The purpose of the comprehensive survey shall be to assess the actual status of the NPP unit and to determine the length of the residual service life of its components, and to use the results to draw up a programme of its preparation for a lifetime extension.
- 3.2 Those involved in the comprehensive survey shall include organisations responsible for the original unit and reactor design, as well as other organisations as required:
- Organisations which had participated in designing the unit or reactor and its operation
 - Design organisations and manufacturers responsible for the design and manufacture of unit components (or specialising in the development and manufacture of components being surveyed, and holding the relevant Gosatomnadzor licence);
 - Specialist materials science organisations
 - Other specialist organisations holding the relevant Gosatomnadzor licences
- 3.3 The principal regulations governing the scope of work to be carried out during the comprehensive survey, the composition and purpose of comprehensive survey

programmes, the scope of engineering status and residual service life analyses and the presentation of the results of the survey will be found in the Appendix.

4. EXTENSIBILITY CRITERIA

- 4.1 The power operation of an NPP unit beyond its designated service life may take place subject to the implementation of the necessary technical and organisational measures required to bring the unit into line with the criteria and requirements of current rules and regulations governing the use of nuclear energy.
- 4.2 The engineering status of an NPP unit during the extension period must meet the requirements of its technical (design, engineering or manufacturer's) documentation.
- 4.3 During the extension period, ongoing work must be conducted on enhancing the safety of the unit, with due regard to the requirements of regulatory documents dealing with nuclear, radiation, technical, fire and environmental safety.
- 4.4 The length of the residual service life of non-repairable safety-significant components (an NPP unit's equipment, buildings, installations and structural elements) must be demonstrated, and must be sufficient to last through the extension period.
- 4.5 Provision must be made for the reliability (service life) management of the unit's equipment, buildings, installations and structural elements, based on the implementation of a specially drawn up service life management programme.
- 4.6 The methods and means of monitoring the engineering status of the unit's equipment, buildings, installations and structural elements must be sufficiently effective to allow identification and prevention of design-basis initiating events.

5. PREPARATION OF NPP UNITS FOR OPERATION DURING THE EXTENSION PERIOD

- 5.1 To prepare an NPP unit for a lifetime extension, the Operator shall carry out a comprehensive programme of preparation, which shall include:
 - Taking steps to eliminate or compensate safety deficiencies
 - Determining the residual service life of those safety-significant components whose residual service life could not be established during the comprehensive survey
 - Taking steps to replace equipment and components which had come to the end of their service life
 - Carrying out adjustment and testing procedures where necessary
 - Updating operating documentation where necessary
 - Retraining employees (personnel) where necessary
- 5.2 If a lifetime extension requires the unit or its systems (components) to be upgraded or reconstructed, this work must be carried out in accordance with working design and engineering documentation.
- 5.3 Design and engineering documentation should be prepared in accordance with a duly drawn up and approved quality assurance programme.
- 5.4 Provision must be made for monitoring the service life of components which the Principal Regulations Governing Comprehensive Surveys of NPP Units classify as belonging to Safety Classes 1 and 2, during the extension period.

- 5.5 The Operator shall demonstrate the safety of the unit in accordance with the current rules and regulations governing the use of nuclear energy, taking into account the unit's actual status.
- 5.6 The Operator shall carry out the tests required to confirm that the operation of the unit's systems (components) meets its specified design criteria and characteristics.
- 5.7 The preparation of NPP units for lifetime extension should not lead to any damage and/or loss of efficiency of their operating systems (components).
- 5.8 Tests shall be conducted in accordance with programmes drawn up and approved by the Operator and agreed in the prescribed manner.
- 5.9 When the length of a unit's new service life has been determined, the procedures for monitoring the engineering status of its components must be updated and approved, with due regard to equipment ageing considerations.
- 5.10 The Operator shall amend the existing operating regulations, system (component) operating manuals and the manuals and instructions describing the action to be taken by employees (personnel) in the event of design-basis and beyond-design basis accidents, in line with changes in the design of the NPP unit.
- 5.11 The Operator shall complete a certificate setting out the results of the above work.

Appendix

Principal Regulations Governing Comprehensive Surveys of NPP Units

1. Comprehensive surveys of NPP units shall establish and identify:
 - The engineering status of safety-significant components
 - Safety-significant components which have come to the end of their service life and need to be replaced
 - Safety-significant components whose service life can be extended by regular servicing and repair
 - Non-repairable components, with a preliminary assessment of their residual service life
 - Safety-significant components with sufficient remaining residual service life whose life can be extended by a specified period of time
 - The availability of storage for the spent nuclear fuel and radioactive waste generated during the extension period
 - The ability to ensure safe handling of radioactive waste
2. The comprehensive survey shall be based on an overall comprehensive survey programme and individual component survey programmes.
 - 2.1 The overall comprehensive survey programme shall specify the components to be inspected, the stages of the survey, its methods, the scope of preparatory work and the facilities required for its completion, as well as the content of the individual component survey programmes.
 - 2.2 The individual component survey programmes shall be approved by the Operator.
3. Assessments of the residual service life of safety-significant components of NPP units shall take into account changes in process parameters throughout the entire operating period, and their actual status at the time of the survey.
4. The residual service life of equipment, buildings, installations, structural components and foundations of NPP units which the Principal Regulations Governing Comprehensive Surveys of NPP Units classify as belonging to Safety Classes 1 and 2 must be demonstrated by means of methodologies drawn up and

approved by the Operator and accepted by Gosatomnadzor in the prescribed manner.

5. The results of the comprehensive survey of systems (components) should be presented in the form of a report containing the following information:
 - A brief description of the systems (components) and their functions
 - A list of the documents examined by the survey
 - The scope and results of checks, tests, measurements etc.
 - A statement of the results of an expert assessment of residual service life, including a list of components which have come to the end of their service life
 - A statement of the actual status of the systems (components), based on the results of checks, tests and investigations undertaken during the survey
 - An opinion on the status of the systems (components) and recommendations on the measures required to ensure their efficiency and reliability
 - Suggestions on programmes of additional work required to determine the residual service life of the unit's systems (components).