

**HEAD OF THE STATE NUCLEAR POWER SAFETY
INSPECTORATE**

**ORDER
APPROVING NUCLEAR SAFETY REQUIREMENTS BSR-1.8.4-2018 "AGEING
MANAGEMENT OF STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO
SAFETY OF A NUCLEAR FACILITY"**

25 July 2018 No. 22.3-169
Vilnius

Pursuant to Articles 4(1) and 11(1) of the Republic of Lithuania Law on Nuclear Safety and Articles 22(1)(1) to (5) and 42(3) of the Republic of Lithuania Law on Nuclear Energy, I hereby:

1. Approve the Nuclear Safety Requirements BSR-1.8.4-2018 "Ageing management of structures, systems and components important to safety of a nuclear facility" (attached).
2. Establish that this Order shall enter into force on 1 November 2018.

Deputy Head for Radiation Protection,
Acting Head

Vidas Paulikas

APPROVED by
Order No. 22.3-169 of the Head of the State Nuclear
Power Safety Inspectorate of 25 July 2018

NUCLEAR SAFETY REQUIREMENTS BSR-1.8.4-2018

AGEING MANAGEMENT STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY OF A NUCLEAR FACILITY

CHAPTER I GENERAL PROVISIONS

1. The Nuclear Safety Requirements BSR-1.8.4-2018 "Ageing management structures, systems and components important to safety of a nuclear facility" (hereinafter referred to as the "Requirements") shall establish the requirements for the management of ageing of structures, systems and components important to safety of a nuclear facility, including physical security structures, systems and components, to be assessed during the design and construction of a nuclear facility and to be carried out during the lifetime of a nuclear facility.

2. These Requirements shall be binding on persons holding licences referred to in Article 22(1)(1) to (5) of the legal act referred to in subparagraph 3.2 of the Requirements (hereinafter referred to as the "license holder") and on the suppliers of products important to safety to the license holder.

CHAPTER II REFERENCES

3. The Requirements contain references to the following legal acts:
 - 3.1. Republic of Lithuania Law on Nuclear Energy;
 - 3.2. Republic of Lithuania Law on Nuclear Safety;
 - 3.3. Nuclear Safety Requirements BSR-1.4.1-2016 "Management System", approved by Order No. 22.3-56 of the Head of the State Nuclear Power Safety Inspectorate (hereinafter referred to as "VATESI") of 21 June 2010 approving the Nuclear Safety Requirements BSR-1.4.1-2016 "Management System";
 - 3.4. Nuclear Safety Requirements BSR-1.4.4-2019 "Use of experience of persons operating in the nuclear power sector", approved by Order No. 22.3-148 of the Head of VATESI of 4 July 2019 approving the Nuclear Safety Requirements BSR-1.4.4-2019 "Use of experience of persons operating in the nuclear power sector";
 - 3.5. Nuclear Safety Requirements BSR-1.4.3-2017 "Human resources of organisations carrying out licensed activities in the sphere of nuclear power", approved by the Order No. 22.3-160 of the Head of the VATESI of 20 September 2017 approving the Nuclear Safety Requirements BSR-1.4.3-2017 "Human resources of organisations carrying out licensed activities in the sphere of nuclear power";
 - 3.6. Nuclear Safety Requirements BSR-1.6.1-2019 "Physical security of nuclear power facilities, nuclear power facility sites, nuclear and nuclear fuel cycle materials", approved by Order No. 22.3-37 of the Head of the State Nuclear Power Safety Inspectorate of 4 April 2012 approving the Nuclear Safety Requirements BSR-1.6.1-2019 "Physical security of nuclear power facilities, nuclear power facility sites, nuclear and nuclear fuel cycle materials".

CHAPTER III DEFINITIONS

4. 10. For the purposes of the Requirements:
 - 4.1. **Degradation** of structures, systems and components important to safety of a nuclear facility shall mean the deterioration of the physical, chemical and/or mechanical properties of structures,

systems and components important to safety of a nuclear facility due to the ageing of these structures, systems and components.

4.2. **Ageing** of structures, systems and components important to safety of a nuclear facility shall mean the gradual change in the properties of structures, systems and components important to safety of a nuclear facility over time and/or during operation.

4.3. **Ageing management of structures, systems and components important to safety of a nuclear facility** shall mean the application of organisational and/or technical measures to ensure the performance of the functions of structures, systems and components important to safety of a nuclear facility, as envisaged in the design of this facility, as these structures, systems and components age.

4.4. Other terms used in these Requirements shall correspond to the terms defined in the legal acts referred to in paragraph 3 of these Requirements and other legal acts of the Republic of Lithuania regulating activities in the field of nuclear power.

CHAPTER IV GENERAL PROVISIONS FOR THE AGEING MANAGEMENT OF STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY

5. In order to ensure the nuclear safety and radiation protection and physical security of a nuclear facility (hereinafter referred to as "NF") during the design, construction, commissioning, operation and decommissioning of a NF, and during the maintenance of structures, systems and components important to safety (hereinafter referred to as "IS SSC") of closed disposal facilities, the license holder shall manage the ageing of IS SSC referred to in paragraph 19 of the Requirements.

6. The license holder shall describe the ageing management of IS SSC as one of the NF processes, in accordance with the provisions of paragraphs 40 and 78 of the legal acts referred to in subparagraph 3.3 of the Requirements.

7. The documents of the ageing management system for IS SSC shall include:

7.1. the IS SSC ageing management policy, objectives and resources (human, material and financial) for the implementation of the SS SSC ageing management policy;

7.2. a procedure for the collection, recording, analysis and retention of data necessary for the IS SSC ageing management;

7.3. a procedure for selecting IS SSC for ageing management;

7.4. a procedure for the preparation of reports on the technical condition and remaining lifetime estimation and assessment for IS SSC subject to ageing management in accordance with the selection criteria, included in the list referred to in paragraph 22 of the Requirements (hereinafter referred to as the "Report on the technical condition and remaining lifetime estimation and assessment for IS SSC", and a procedure for the extension of the design lifetime of IS SSC;

7.5. a procedure for the development, implementation and improvement of the Ageing Management Programme (hereinafter referred to as the "AMP") for IS SSC subject to ageing management;

7.6. links between the IS SSC ageing management and other technical areas, existing programmes (e.g. operation, maintenance, monitoring, inspections of IS SSC);

7.7. the ageing management procedure for IS SSC during the design of the NF, the manufacture of the IS SSC, the construction and commissioning of the NF, and the aspects of the ageing management procedure other than those referred to in subparagraphs 7.1 to 7.6 of the Requirements.

8. It is recommended to take into account the recommendations of the International Atomic Energy Agency and the best practice of other countries that are managing the ageing of IS SSC in preparation of the documents referred to in paragraph 7 of the Requirements.

9. Effective ageing management of IS SSC shall be ensured by complying with the requirements for the ageing management of IS SSC set out in the design of NF and the license holder's normative technical documents and the conditions and limits of IS SSC operation, by carrying out maintenance, monitoring and inspections of IS SSC, by detecting and assessing the signs of ageing, and by introducing preventive or corrective measures (e.g. modifications, repairs and replacements of IS SSC).

CHAPTER V

IS SSC AGEING MANAGEMENT ASPECTS IN PREPARING THE DESIGN OF NF

10. The Initial Safety Analysis Report shall demonstrate that the design solutions for the NF IS SSC have taken into account the ageing management mechanisms of the IS SSC of NF and their causes throughout the life cycle of the NF. In preparing the design solutions for IS SSC:

10.1. all possible mechanisms of IS SSC ageing for passive and active IS SSC shall be identified and assessed;

10.2. the factors affecting the functionality of IS SSC (e.g. corrosion, creep, ionising radiation, material fatigue and settlement of structures) shall be assessed;

10.3. requirements and arrangements for monitoring IS SSC, testing, use of samples related to the ageing management of IS SSC and inspections, with a view to assessing the mechanisms of IS SSC ageing foreseen in the design of NF and identifying mechanisms of IS SSC ageing not foreseen in the design of NF, shall be established;

10.4. materials that are more durable and resistant to ageing shall be selected.

11. The design of NF shall define the life cycle of IS SSC during which the capability of IS SSC to perform the functions specified in the design of NF shall be ensured, taking into account the ageing and wear and tear processes of IS SSC during normal operation, testing, maintenance, shutdown, planned initial events and post-event states.

CHAPTER VI

IS SSC AGEING MANAGEMENT DURING IS SSC MANUFACTURE, CONSTRUCTION AND COMMISSIONING OF NF

12. The license holder shall make the IS SSC design solutions available to the license holder's suppliers of products important to safety and ensure that the suppliers of the license holder's products important to safety inform the license holder of the implementation of the IS SSC design solutions.

13. During the manufacture, installation of IS SSC and construction and commissioning of the NF:

13.1. the latest knowledge of the mechanisms and effects of IS SSC ageing and measures to mitigate such ageing shall be used;

13.2. measures to mitigate the IS SSC ageing shall be provided for and implemented, taking into account the factors influencing the IS SSC ageing;

13.3. specimens needed to monitor the IS SSC ageing shall be manufactured and installed in accordance with the design of NF solutions;

13.4. baseline data for the management of IS SSC ageing, including data on working environment conditions (e.g. ambient temperature, humidity and ionising radiation levels) shall be collected and documented.

CHAPTER VII

IS SSC AGEING MANAGEMENT DURING OPERATION OF NF

SECTION ONE

ORGANISATIONAL MEASURES FOR IS SSC AGEING MANAGEMENT

14. The license holder shall designate persons responsible for the IS SSC ageing management of the NF. Those responsible for the IS SSC ageing management of the NF, shall:

14.1. in accordance with the requirements of Chapter IV of the legal act referred to in subparagraph 3.4 of the Requirements, select and analyse operational experience of NF and apply it to the IS SSC ageing management;

14.2. ensure cooperation with technical groups within the organisation and with external organisations to address the IS SSC ageing;

- 14.3. identify and ensure the implementation of learning needs in the field of IS SSC ageing management, in accordance with paragraph 23 of the legal act referred to in subparagraph 3.5 of the Requirements;
- 14.4. carry out a performance self-assessment of the IS SSC ageing management;
- 14.5. improve the IS SSC ageing management activities.

SECTION TWO COLLECTION, RECORDING, REGISTRATION, ANALYSIS AND STORAGE OF DATA NECESSARY FOR IS SSC AGEING MANAGEMENT

- 15. The license holder shall have a system for the collection, recording, registration and storage of data necessary for the IS SSC ageing management.
- 16. A system for the collection, recording, registration and storage of data necessary for the IS SSC ageing management shall be in place before the commissioning phase of NF, in order to make use of the initial information obtained for:
 - 16.1. identifying and assessing changes, failures and malfunctions in the parameters of IS SSC due to IS SSC ageing;
 - 16.2. defining the methods and frequency of maintenance, monitoring and inspections of IS SSC, including their calibration, repair, refurbishment and replacement;
 - 16.3. mitigating the effects of IS SSC ageing by optimising operating limits and conditions;
 - 16.4. identifying IS SSC aging mechanisms not foreseen in the design of NF.
- 17. The system for collecting, recording and storing the data required to manage the IS SSC ageing shall ensure that the information is available for other operational activities of NF, such as maintenance, monitoring and inspection programmes, and the preparation and development of the IS SSC operational documents.
- 18. The data required for the IS SSC ageing management of the NF are specified in Annex 1 to these Requirements.

SECTION THREE SELECTION OF IS SSC SUBJECT TO AGEING MANAGEMENT

- 19. It shall be required to manage the ageing of IS SSC whose ageing may have a negative effect on the safety of the NF.
- 20. IS SSC whose ageing may affect safety shall be selected for ageing management if they meet the following criteria:
 - 20.1. the IS SSC perform safety functions;
 - 20.2. the deteriorating features of IS SSC due to ageing will not allow the safety functions to be fulfilled;
 - 20.3. the IS SSC are included in the in-service monitoring and maintenance tools that detect the deterioration of IS SSC features before they fail;
 - 20.4. the IS SSC performing the physical security system functions provided for in subparagraphs 7.2 and 7.3 of the legal act referred to in subparagraph 3.6 of these Requirements, where the loss of any of these functions would prevent the physical security objectives provided for in Article 33 of the legal act referred to in subparagraph 3.1 of the Requirements from being achieved.
- 21. the selection of IS SSC for ageing management shall make use of the full range of knowledge on IS SSC ageing management (theoretical knowledge and data on IS SSC ageing and on the use of measures to mitigate IS SSC ageing).
- 22. The selection process shall produce a list of IS SSC whose ageing must be managed.
- 23. The license holder shall submit the IS SSC list for ageing management and changes to the list to the VATESI for review, assessment and agreement.
- 24. The VATESI shall take a decision to harmonised the list of IS SSC of the NF subject to ageing management and amendments thereto, in accordance with the deadlines set out in Article 34(2) of the legal act referred to in subparagraph 3.2 of the Requirements, if the IS SSC on this list meet the selection criteria referred to in paragraph 20 of the Requirements.

24¹. In accordance with the management system documents referred to in subparagraph 7.4 of the Requirements, the license holder shall carry out an assessment of the technical condition and remaining lifetime of the IS SSC subject to ageing management, which are included in the list referred to in paragraph 22 of the Requirements, and shall draw up the reports on the assessment of the technical condition and the remaining lifetime of the IS SSC, and shall submit them to the VATESI for review and assessment.

24². The VATESI shall issue a conclusion on the acceptability of the report on the technical condition and remaining lifetime of the IS SSC within 20 working days of receipt of the relevant report on the technical condition and remaining lifetime of the IS SSC, after having assessed that:

24^{2.1}. The assessment of the technical condition and remaining useful life of the IS SSC has been carried out by analysing the data specified in Annex 1 to these Requirements;

24^{2.2}. the necessary preventive or corrective measures (e.g. modifications, repairs or replacements of IS SSC) have been put in place, based on the signs of IS SSC ageing identified and assessed.

24³. The operation of IS SSC that have reached the end of their lifetime shall be prohibited. If the license holder decides to extend the design lifetime of IS SSC, it shall analyse the technical condition of the IS SSC and justify on the basis of this analysis that the IS SSC will be able to perform the functions foreseen in the design of NF during the proposed additional lifetime. The decision to extend the design lifetime of IS SSC and the related safety documents shall be submitted by the license holder and agreed with the VATESI.

24⁴. The VATESI shall take a decision to accept the license holder's decision referred to in paragraph 24³ of these Requirements within 20 working days from the date of receipt of the relevant decision, after having satisfied itself that the license holder meets the requirements referred to in paragraph 24³.

SECTION FOUR PREPARATION AND IMPLEMENTATION OF AMP AND IMPROVEMENT OF IS SSC AGEING MANAGEMENT

25. The AMP shall be prepared for IS SSC or their group on the list referred to in paragraph 22 of the Requirements.

26. The main tasks of the AMP shall be to:

26.1. determine the frequency of maintenance, monitoring and inspection of the IS SSC;

26.2. clarify the deterioration of the IS SSC characteristics through inspection and monitoring;

26.3. evaluate the data from IS SSC inspections and IS SSC monitoring and take corrective or mitigating actions.

27. The following performance indicators for the IS SSC ageing management process shall be defined and used under the AMP:

27.1. the number of IS SSC failures due to IS SSC deterioration over the year;

27.2. the number of recurrent failures due to IS SSC deterioration;

27.3. the number of non-conformities identified during independent inspections of maintenance, monitoring and inspection processes related to the IS SSC ageing management process.

28. The license holder shall be responsible for the implementation and enforcement of the AMP, the periodic assessment of the IS SSC ageing processes, the obtainment and documentation of data, and the use of the data to select measures for the IS SSC ageing management.

29. The effectiveness of the AMP shall be assessed in the light of the available information on the IS SSC ageing management, by assessing compliance with the indicators on the IS SSC ageing management, and the AMP shall be improved on the basis of the results of this assessment.

CHAPTER VIII RELATIONSHIP OF IS SSC AGEING MANAGEMENT PROCESSES WITH OTHER TECHNICAL SPHERES

SECTION ONE

RELATIONSHIP OF IS SSC AGEING MANAGEMENT PROCESSES WITH IS SSC MAINTENANCE, MONITORING AND INSPECTIONS

30. The license holder shall use the data obtained during the maintenance, monitoring and inspection of the IS SSC subject to ageing management in order to monitor and manage the IS SSC ageing processes.

31. During the commissioning phase after entry into service and during the phase where ageing and deterioration of the IS SSC may compromise the performance of the IS SSC functions, the license holder's maintenance, monitoring and inspection plans shall include maintenance, monitoring and inspection in sufficient numbers to prevent IS SSC deterioration, taking into account that these phases are more prone to deterioration and/or failures than the other phases.

32. During the maintenance, monitoring and inspections of the IS SSC and the management of the IS SSC ageing process:

32.1. the IS SSC characterised by deterioration of their properties due to IS SSC ageing shall be identified;

32.2. records shall be compiled, kept and stored to monitor and analyse IS SSC ageing processes;

32.3. preventive and corrective measures to mitigate and/or avoid the effects of IS SSC ageing shall be applied;

32.4. amendments to the IS SSC maintenance, monitoring and inspection programmes shall be drawn up, taking into account the results of maintenance, monitoring and inspections related to the IS SSC ageing management.

SECTION TWO

IS SSC TECHNICAL QUALIFICATION ASSESSMENT

33. The license holder shall, as part of the equipment qualification assessment during the design of NF, also assess the IS SSC ageing management and justify that:

33.1. the potential effect of IS SSC ageing has been assessed;

33.2. preventive or corrective measures to mitigate the effects of IS SSC ageing are being or were used;

33.3. the IS SSC ageing processes are monitored by monitoring the environmental and operational conditions of the IS SSC, which enables the detection of deviations from the values of the environmental and operational conditions set out in the design of NF and in the license holder's normative technical documents;

33.4. the possibility to modify the remaining lifetime of the IS SSC in the event of an increase in the frequency of failures or a change in the conditions set out in the license holder's normative technical documents exists.

SECTION THREE

ASSESSMENT OF THE IS SSC AGEING EFFECTS OF NF DURING PERIODIC SAFETY ANALYSIS AND ASSESSMENT

34. The license holder shall, at the frequency specified in Article 32(7¹) of the legal act referred to in subparagraph 3.2 of the Requirements, conduct a periodic safety analysis and assessment of the NF, prepare a periodic safety assessment report and, taking into account the requirements of Article 32(7)(1) of the legal act referred to in subparagraph 3.2 of the Requirements, assess the IS SSC ageing.

35. In the part of the periodic safety assessment report dedicated to ageing management, the license holder shall provide:

35.1. a description of the IS SSC ageing management at the NF;

35.2. the results of the measures set out in the AMP for the IS SSC;

35.3. The results of analysis of IS SSC ageing processes;

- 35.4. controlled parameters and indicators;
- 35.5. the methods used to monitor IS SSC ageing;
- 35.6. mechanisms, defects and root causes of IS SSC ageing identified during the implementation of the AMP for the IS SSC;
- 35.7. methods for assessing predicted IS SSC failures;
- 35.8. estimation of the remaining lifetime of the IS SSC;
- 35.9. assessment of the effectiveness of the IS SSC ageing mitigation methods using control samples;
- 35.10. IS SSC ageing mitigation measures, if foreseen;
- 35.11. assessment of the IS SSC ageing management results against the criteria set out in the AMP;
- 35.12. the envisaged follow-up measures for IS SSC ageing management to ensure safe operation during the period until the next periodic safety analysis and assessment.

CHAPTER IX SUBMISSION OF DOCUMENTS RELATED TO IS SSC AGEING MANAGEMENT TO THE VATESI

36. In accordance with Article 42(3) of the legal act referred to in subparagraph 3.2 of the Requirements, the license holder shall submit to the VATESI, once a year, information on the assessment of the implementation of measures for the IS SSC ageing management surveillance, inspection and assessment activities and AMP improvement.

CHAPTER X FINAL PROVISIONS

37. A person who violates the Requirements shall be liable in accordance with the procedure established by the Republic of Lithuania Law on Nuclear Safety or the Republic of Lithuania Code of Administrative Offences.

DATA REQUIRED FOR IS SSC AGEING MANAGEMENT OF A NUCLEAR FACILITY

1. The data required for the ageing management of (hereinafter referred to as "SC") structures, systems and components important to safety (hereinafter referred to as "IS SSC") of nuclear facilities (hereinafter referred to as "NF") are divided into three categories:
 - 1.1. baseline information, consisting of the design data and operating conditions of the IS SSC;
 - 1.2. operational history data, including IS SSC operational data, IS SSC inspection data, including data from commissioning tests and failures of the IS SSC;
 - 1.3. maintenance history data, including monitoring and maintenance data on the IS SSC operating conditions.
2. The data relevant for the IS SSC ageing management are:
 - 2.1. the operational functional characteristics of the IS SSC and their potential (current) variation in order to assess their remaining lifetime;
 - 2.2. operating limits and conditions, operating experience to minimise the deterioration of the IS SSC performance due to IS SSC ageing and to optimise the operation process;
 - 2.3. the maintenance methods and measures used;
 - 2.4. failures and malfunctions of the IS SSC during operation, their identification and analysis and IS SSC ageing assessment;
 - 2.5. identified IS SSC ageing mechanisms not foreseen in the design of NF, the timing of their identification and the implementation of the necessary corrective measures.
3. Baseline information includes:
 - 3.1. IS SSC marking, indicating the type/model and location of the IS SSC;
 - 3.2. the number and quantity of similar IS SSC;
 - 3.3. the IS SSC ageing mechanisms provided for in the design of NF;
 - 3.4. the IS SSC design data, including the limits and conditions of IS SSC operation and the operating cycles as foreseen in the design of NF;
 - 3.5. technical qualification data for the IS SSC (operating limits and conditions, required servicing, storage, technical data for operation and maintenance);
 - 3.6. conditions for testing the technical qualification assessment of the IS SSC;
 - 3.7. manufacturer's data for the IS SSC, including the data on the materials from which they are made;
 - 3.8. commissioning data (test and initial inspection data);
 - 3.9. the date of commissioning;
 - 3.10. data on changes/modifications made to the IS SSC design of NF.
4. Operational history data:
 - 4.1. operating conditions for the IS SSC:
 - 4.1.1. IS SSC marking, indicating the type/model and location;
 - 4.1.2. data on the operating media and chemical regime (including radioactivity) for the operation of the IS SSC;
 - 4.1.3. the nature of the IS SSC transition process (cyclic operation or start-up);
 - 4.1.4. the mode of operation (continuous, standby or intermittent);
 - 4.1.5. information on major changes in the IS SSC performance;
 - 4.2. operating conditions for the IS SSC:
 - 4.2.1. IS SSC marking, indicating the type/model and location;
 - 4.2.2. the surrounding environment (e.g. ambient temperature, humidity and level of ionising radiation);
 - 4.2.3. the transition process data;
 - 4.2.4. the mode of operation (continuous, standby or intermittent);
 - 4.2.5. downtime periods;

- 4.2.6. information on changes to the IS SSC;
- 4.3. test data for the period of the commissioning of NF:
 - 4.3.1. IS SSC marking, indicating the type/model and location;
 - 4.3.2. a description of the tests, including the frequency of testing;
 - 4.3.3. the date of testing;
 - 4.3.4. test results;
- 4.4. Data on IS SSC failures:
 - 4.4.1. IS SSC marking, indicating the type/model and location;
 - 4.4.2. the date of failure;
 - 4.4.3. the time of failure (hours or number of operating cycles before failure);
 - 4.4.4. the method of failure finding;
 - 4.4.5. a description of failure;
 - 4.4.6. the cause of failure;
 - 4.4.7. defective parts, if the component consists of several parts;
 - 4.4.8. the conditions of the SC system to which the SSC belong (abnormal loads, changes in temperature, pressure or chemical regime);
 - 4.4.9. environmental conditions of the IS SSC.
- 5. Historical maintenance data:
 - 5.1. data from monitoring the environmental conditions of the IS SSC;
 - 5.1.1. IS SSC marking, indicating the type/model and location;
 - 5.1.2. parameters monitored (e.g. vibration, temperature and chemical regime);
 - 5.1.3. IS SSC condition indicators (test, trial and maintenance results, including initial failures, their dates and operational time or cycles);
 - 5.1.4. information on changes in the monitoring of the operating conditions;
 - 5.2. IS SSC maintenance data:
 - 5.2.1. IS SSC marking, indicating the type/model and location;
 - 5.2.2. the purpose of maintenance;
 - 5.2.3. the type of maintenance (corrective or preventive);
 - 5.2.4. the date and duration of maintenance.