TECHNICAL SPECIFICATION

NEK Prerequisites for Subsequent License Renewal (60 to 80 years)

Non-Nuclear Safety related

Specification Number
SP-ES1443
Rev. 1

KRŠKO NUCLEAR POWER PLANT
January, 2025

Written by: _____ Date: 21/01/2025
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Reviewed by: _____ Date: 21/1/2025
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Approved by: _____ Date: 22/1/2025
(B. Krajnc)

1. BACKGROUND

1.1 In 1983, NEK obtained a license for regular operation and went into commercial operation. At the time of construction, the minimum design life span of the facility was projected at forty years, however, many safety and other upgrades have been carried out and numerous analyses conducted to date.

1.2 In 2006 to 2009 the Krško NPP Aging Management Review Project goal was to reevaluate and verify the available systems, structures, and components (referred to as: SSC) for the intended extension of plant operating life for 20 additional years, i.e. overall 60-years of operation. The evaluation and revalidation were performed and documented, in accordance with the US NRC 10CFR54 requirements. In 2010, NEK implemented the equipment aging program (referred to as: AMP) to monitor SSCs during the operation of the power plant through the basic (40 years) and long-term operation (60 years) until 2043. The AMP consists of various NEK programs, procedures and activities, which ensure that all planned functions of SSCs managed by the AMP are identified and properly reviewed in terms of aging effects. Aging effects are closely monitored, based on which certain actions are determined that enable the SSC to fulfill their intended function by the end of NEK operational life span. The NEK AMP is designed and compliant with the NUREG-1801 – Generic Aging Lessons Learned (GALL) Report and all NRC License Renewal Interim Staff Guidance documents. The NEK programs were also checked to be aligned with IGALL, which is the International Generic Lessons Learned prepared by the IAEA. The AMP program thus comprehensively covers the plant aging control of mechanical, electrical and civil SSCs, and systematically recognizes the aging mechanisms and their effects on the SSCs of significance for safety, identification of possible consequences arising from aging and for determination of emergency measures towards maintaining SSCs operability and reliability.

1.3 NEK operation is based on operating license (ref. 4.3), which is directly related to the NEK Safety Analysis Report (ref. 4.1), containing all the conditions and limits for the safe operation of the nuclear power plant. NEK has a valid open-ended operating license, meaning it is technically capable of operating at least until 2043, provided that, in accordance with the applicable legislation, it performs a Periodic Safety Review (referred to as: PSR) every ten years and obtains approval by the regulator, Slovenian Nuclear Safety Administration (referred to as: SNSA). NEK shall ensure all aspects for the safe operation of the nuclear power plant.

1.4 Owing to continual upgrades and modifications that have been carried out, the ensured safety level is significantly higher than at the time when the Krško NPP was built. With the completion/implementation of the Safety Upgrade Program (referred to as: SUP (ref. 4.7)), NEK is comparable to the new 3rd generation nuclear power plants.

1.5 In 2017, the "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (NUREG-2191) is issued. GALL-SLR provides guidance to nuclear power plant licensees for developing their applications for subsequent license renewal. The report describes AMPs necessary for all nuclear plants during the 60-80 year operating period, as well as enhancements to existing AMPs implemented during the 40-60 year period.

1.6 Krško NPP has already implemented a series of modifications all of which also support long-term operation and are listed in program MD-6; NEK Long term operation.

1.7 For the Krško NPP, the end of 2023 meant the transition point to an extended lifetime of additional 20 years. Safe and reliable operation stays a main goal of the Krško NPP future operation. The power plant's ambition is to be proactive in implementing the latest AMP regulatory requirements and recommendations issued that can improve the safety and reliability of the power

plant's operation. Plant's ambition can be fulfilled by the Subsequent License Renewal (SLR) requirements.

2. SCOPE OF WORK

The Contractor's scope of work is to develop a technical report that must contain an assessment of NEK's readiness for SLR. This study shall contain the following sections:

2.1 Design and history of NPP Krško (e.g. already implemented actions/upgrades) up to end of 2024 – summary will be provided by NEK.

2.2 Industrial operating experience in terms of equipment use, replacement of large components, service intervals required for operation beyond 60 years – based on US already approved PLEX from 60 to 80 years. This includes an overview of specific examples of U.S. nuclear plants and the modifications they implemented to achieve SLR such as: examples of large components replacements, equipment upgrades, changes in operational practices, adjustments to service intervals and inspection frequencies, material upgrades and enhancements to extend component lifespan, measures to comply with stricter environmental and seismic safety standards, etc.

2.3 Research and development (R&D) for PWR reactors which are indicating what components, materials are of critical importance for safe and reliable operation beyond 60 years.

2.4 Review of GALL-SLR implementation activities, supplemented with applicable IGALL requirements.

2.5 Review of US NRC specific licensing steps that US NPPs shall perform for PLEX from 60 to 80 years, including all licensing, equipment or operational changes/improvements which were implemented by US NPPs that have undergone US NRC SLR process.

2.6 NEK specific analysis of possible changes for PLEX from 60 to 80 years. This analysis must be based on expert elicitation, industry experience (preferable but not limited to similar reactor type PWR), specific understanding of the design and history of NPP Krško, Generic Aging Lessons Learned for SLR and all the work performed under 2.1, 2.2, 2.3, 2.4 and 2.5 above. Analysis shall provide an assessment of NEK which contains:

- 2.6.1 Recommendations about specific areas for which changes are needed to **maintain/improve reliability** of operation in accordance with US NRC requirements for Subsequent License Renewal (e.g. experience with CET seal assembly).
- 2.6.2 Recommendations for plant changes which **maintain efficiency** of operation.
- 2.6.3 Recommendations for plant changes which **assure/maintain safety** of operation as per US NRC Licensing Process requirements and good practices for Subsequent License Renewal and existing NPP Krško safety level.
- 2.6.4 Ranking of recommended actions from previous sections in terms of feasibility, applicability, and net benefit.
- 2.6.5 Timing or possible impact on duration of Planned Outages.
- 2.6.6 Estimated Cost of recommended actions implementation.
- 2.6.7 Timeline for the implementation of the activities listed above (excluding any national specific licensing requirements.

3. SAFETY CLASSIFICATION OF WORK

3.1 This work is classified as Non-safety related.

4. INPUT DATA

4.1 USAR, "Updated Safety Analysis Report", Rev. 30

4.2 MD-6, "NEK Long term Operation Program"

4.3 Operating License: Decision – Approval to Commence NEK Operation; Decision by the National Energy Inspectorate, No. 31-04/83-5, dated 6th of February 1984, and the URSJV Decision, No. 3570-8/2012/5, Amendment to the Operating License for NEK, dated 22nd of April 2013

4.4 MD-5, "NEK Aging Management Program", Rev. 7

4.5 MD-15, "NEK Aging Management Program for Active Components", Rev. 1

4.6 DCM-RP-083, "NEK Safety Upgrade Program (PNV)", Rev. 3, January 2017

4.7 ENCO-FR-(20)-13, "Possible Role of Nuclear in the Dutch Energy Mix in the Future (WEB)"

4.8 NEA No. 7299, "The Costs of Decarbonization: System Costs with High Shares of Nuclear and Renewables", OECD 2019 (WEB)

5. APPLICABLE WORK CONTROL PROGRAM

5.1 Each document and product shall be verified by the Contractor in accordance with their QA requirement.

6. APPLICABLE CODES, STANDARDS, AND CRITERIA FOR THE WORK

The following codes, regulations and standards shall be used as acceptance criteria for independent evaluation process:

6.1 10 CFR 50, "Appendix A, General Design Criteria for Nuclear Power Plants", US NRC

6.2 10 CFR 50, Appendix B, "Quality assurance criteria for nuclear power plant and fuel reprocessing plants", US NRC

6.3 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power"

6.4 NRC Reg.Guide 1.188, Rev. 1, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses", US NRC

6.5 NEI95-10 Rev. 6, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule", NEI

6.6 NUREG-1800 Rev. 2, "Standard Review Plan for Review of License Renewal Applications", US NRC

6.7 NUREG-1801 Rev. 2, "Generic Aging Lessons Learned (GALL) Report", US NRC

6.8 NRC LR-ISG-2011-01; "Aging Management of Stainless Steel Structures and Components in Treated Borated Water, Revision 1", License Renewal Interim Staff Guidance, US NRC

6.9 NRC LR-ISG-2011-02; "Aging Management Program for Steam Generators", License Renewal Interim Staff Guidance, US NRC

6.10 NRC LR-ISG-2011-03; "Generic Aging Lessons Learned (GALL) Report Revision 2 AMP XI.M41, "Buried and Underground Piping and Tanks", License Renewal Interim Staff Guidance, US NRC

6.11 NRC LR-ISG-2011-04; "Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors", License Renewal Interim Staff Guidance, US NRC

6.12 NRC LR-ISG-2011-05; "Ongoing Review of Operating Experience", License Renewal Interim Staff Guidance, US NRC

6.13 NRC LR-ISG-2012-01; "Wall Thinning Due to Erosion Mechanisms", License Renewal Interim Staff Guidance, US NRC

6.14 NRC LR-ISG-2012-02; "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation", License Renewal Interim Staff Guidance, US NRC

6.15 NRC LR-ISG-2013-01; "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers and Tanks", License Renewal Interim Staff Guidance, US NRC

6.16 NRC LR-ISG-2015-01; "Changes to Buried and Underground Piping and Tank Recommendations", License Renewal Interim Staff Guidance, US NRC

6.17 NRC LR-ISG-2016-01; "Changes to Aging Management Guidance for Various Steam Generator Components", License Renewal Interim Staff Guidance, US NRC

6.18 NRC Reg.Guide 1.188, Rev. 2, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses", NRC

6.19 NEI17-01, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 for Subsequent License Renewal", NEI, December 2017

6.20 NUREG-2191 Rev. 0, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report", US NRC US NRC

6.21 NUREG-2192 Rev. 0, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants– Final Report«

6.22 SLR-ISG-2021-01, "Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors of Subsequent License Renewal Guidance", US NRC

6.23 SLR-ISG-2021-02, "Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance", US NRC

6.24 SLR-ISG-2021-03, "Updated Aging Management Criteria for Structures Portions of Subsequent License Renewal Guidance", US NRC

6.25 SLR-ISG-2021-04, "Updated Aging Management Criteria for Electrical Portions of Subsequent License Renewal Guidance", US NRC

6.26 NUREG-2191 Rev. 1, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report, Draft report for comment", US NRC, July 2023

6.27 NUREG-2192 Rev. 1, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants, Draft Report for Comment", US NRC, July 2023

6.28 INTERNATIONAL ATOMIC ENERGY AGENCY, "Aging Management for Nuclear Power Plants: International Ageing Lessons Learned (IGALL)", Safety Report Series No. 82, Revision 2, Vienna (2024)

7. AFFECTED SYSTEM

7.1 No plant systems are directly affected with evaluation.

8. IDENTIFICATION OF AFFECTED EQUIPMENT

8.1 No plant equipment is directly affected with evaluation.

9. REVIEW AND/OR VERIFICATION OF THE WORK

9.1 The Contractor is required to provide preliminary reports, which will be reviewed by the NEK. The NEK will send the comments to the Contractor, who will issue a final version of the reports after the process of commenting is finished. There could be more than one iteration to finalize the report.

9.2 The Contractor shall provide a copy of all reference documents (pages) used in either calculations or assumptions as an appendix to complete work package. This will be needed for more expedient NEK review process.

10. FORMAT OF EVALUATION REPORT

10.1 Evaluation report shall be in format required per Contractor Quality Plan and Manual, as well as procedures, defined requirements for required Non-Safety Related analysis and documentation of work.

11. SCHEDULE REQUIREMENTS

11.1 Proposal required response date is **April 1st, 2025**.

11.2 Overall Schedule Requirements for project deliverables are as following:

T_0	Purchase Order / Contract Signed
T_0 + 2 weeks	All inputs received from NEK
T_0 + 6 months	Issuance of the Preliminary Report
T_0 + 7 months	NEK response on Preliminary Report
T_0 + 8 months	Issuance of Final Report - final documentation

12. STATUS REPORTING REQUIREMENTS

12.1 There are no special status reporting requirements.

13. WORK TO BE PERFORMED OR INFORMATION TO BE PROVIDED BY NEK

13.1 The NEK Project Manager will provide the overall project coordination from NEK side.

13.2 During the evaluation phase, NEK will provide all available plant documentation and plant design reference documents which will be needed.

13.3 NEK will perform review of all generated documents (technical reports) developed as an interim or final product.

13.4 NEK will support contractor experts with technical specialists on area where needed to describe, support or clarify opened technical issues.

13.5 NEK will prepare all required input data, for the analysis performed.

14. CHANGES OF WORK SCOPE

14.1 The Contractor shall identify any scope changes that could cause an impact the Contractor's cost or schedule of the project by the issuance of a Contractor Change of Work Scope Request. The Contractor shall not proceed with a change in the scope of the Work until written approval has been authorized by NEK. It is the Contractor's obligation to notify the NEK Responsible Commercial Person, writing of the noted scope change and it is the responsibility of the NEK Responsible Commercial Person to attempt to respond within 15 working days of the acceptability of the Contractors scope change request. Unauthorized work will not be reimbursed by NEK.

15. DELIVERABLES TO BE PROVIDED BY THE CONTRACTOR

15.1 The Contractor will be required to furnish the following deliverables according to the schedule as outlined below:

Deliverable Item	Number of Copies
Preliminary Report with all used references essential for review (see 15.2 b)	1 (Adobe pdf)
Final Report (final documentation)	1 (hard copy) 1 (Adobe pdf) 1 (Word docx)

15.2 Other types of documents to be provided by the Contractor:

a. Schedule update;

b. Copy of all used references, calculations, detailed evaluation worksheets and other documents essential for review, verification or approval of work been performed. Deliverables should be sent to the NEK Project Manager according to the schedule.

15.3 NEK will provide comments/approval on the preliminary work reports within one month after delivery.

15.4 Contractor shall resolve all potential open items from NEK comments and issue the Final work report within two weeks after receipt of NEK comments.

Word Processor:	Microsoft Word 97, Excel 97 (For figures and tabulated data)
Paper:	A4
Margins:	Top, Bottom, Left, Right – 2.54 cm (1 inch)
Font:	Calibri 11 pt (text)
	Calibri 14 pt Bold (Chapter Title – i.e. Chapter or Chapter 2.0)

15.5 All documentation shall be written in English.

16. DOCUMENTS AND RECORDS

16.1 All the final and interim documents in connection with the work implementation shall be delivered to NEK in the prescribed format and time.

16.2 Verification and validation records shall be performed in accordance with applicable Contractor procedures (QA manual).

17. ORGANIZATIONAL CONTACT

17.1 The Contractor shall coordinate all technical and schedule matters with PM.

17.2 Technical items are to be addressed to the NEK Engineering representative.

NEK Project Manager (PM):
Stanko Manojlović
Phone: +386 7 4802 527
E-mail: stanko.manojlovic@nek.si

17.3 Commercial items are to be addressed with the NEK Commercial Department representative.

At NEK the following is commercial contact:

NEK Commercial Representative:
Janja Švajger
Phone: + 386 7 48 02 327
E-mail: janja.svajger@nek.si

18. CONTRACTOR TECHNICAL APPROACH TO WORK

18.1 The Contractor is fully responsible for organization and performance of work in the scope and requirements of the given specification. Plan of the Contractor technical approach and developed schedule should be agreed and submitted to the NEK before the start of the project work.

19. ACCESS TO CONTRACTOR FACILITY AND DOCUMENTS

19.1 For the purpose of reviewing the quality and the amount of the work being performed, a Contractor will provide access to Contractor's or to its Authorized Sub-contractor's working process to NEK. A Contractor will introduce to NEK Contractor's/Sub-contractor's personnel assigned to contracted work.

20. SUBCONTRACTED WORK

20.1 The Contractor could subcontract any portion of the Work. The subcontracted work could not be subcontracted without the written approval of the NEK Project Manager. Subcontractors will be required to be technically qualified to the satisfaction of NEK criteria.

21. QUALITY ASSURANCE REQUIREMENTS

21.1 The work shall be performed in accordance with Contractor's QA Program, which complies with ISO 9001 or a comparable standard, and relevant requirements of NEK QS 610.

21.2 A record system shall be established and maintained by the Contractor to provide documentary evidence of the quality of performed activities. Records shall, as a minimum, identify the Purchaser's name, Purchaser's order number, inspector or data recorder, inspection date, type of observation, procedures used, results, acceptability, and action taken with any deficiencies noted. Records of inspection shall also include identity of drawings and procedures utilized, along with the revision level. All quality verification records, procedures, and qualifications shall be identifiable to the activity involved.

21.3 If the Contractor's QA Program Manual has not been previously accepted by NEK, it shall be submitted to NEK as part of Proposal.

22. NEK PROPRIETARY DATA

22.1 NEK has a proprietary interest in all of the drawings, designs, specifications, documents, information or know-how that may be furnished pursuant contract execution. Also, NEK has a proprietary interest in any know-how, improvement, discovery or invention which may be made, developed, or conceived in the performance of work hereunder or which may arise or result there from (hereinafter collectively referred to as the "Information"). All such information shall be considered to be proprietary to the NEK. The right to use of all such Information shall be transmitted to the Contractor only for its personnel use and shall be entirely restricted to the performance of the Contract and subject to the confidentially provision.