

NUCLEAR POWER PLANT KRŠKO

TECHNICAL DIVISION
TO. VZISI / PRSI / KM

TECHNICAL SPECIFICATION

TS TO - 25/01

FOR
NPP KRŠKO RSG's ASSESSMENT STUDY AND
IMPLEMENTATION OF CHEMICAL CLEANING (CC)
IN OUTAGE 2027

(IN 8251/38)

Revision 0

CLASSIFICATION: SR (Safety Related)

Prepared by:

(A. Vučajnk, R. Kelavić, S. Smirić)

Date: 09/05/2025

Reviewed by:

(M. Simončič – Chemistry Superintendent)

Date: 9/5/2025

Reviewed by:

(M. Habinc – Maintenance Manager)

Date: 09/05/2025

Reviewed by:

(M. Razpotnik – Production Manager)

Date: 12/05/2025

Reviewed by:

(B. Bogнар - QA Engineer)

Date: 13/05/2025

Approved by:

(M. Gluhak – Technical Director)

Date: 14/05/2025

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1. Activity

This Technical Specification defines requirements for developing the Study entitled: “Replacement Steam Generator (RSG) Assessment Study 2027” and for implementing chemical and mechanical cleaning on NEK Steam generators in the outage 2027. The potential work to be performed based on this technical specification (IN _____) is split into these parts, which shall include:

- 1.1 Krško RSG Chemical Cleaning Assessment Study, which shall identify an optimum cleaning strategy to be performed in outage 2027 and later to regain the optimum SG performance level for a long-term plant operation. The most important goal is to clean the TTS and tube to the TTS crevice to stop DENTING. The study shall include recommendations for a future cleaning strategy (RSG Remedy Strategy), which shall also include analysis of chemical and mechanical cleaning procedures or a combination of both, to stop and eliminate DENTING as a degradation process for good.
- 1.2 Implementation of the Chemical Cleaning (CC) project during the 2027 outage, including all necessary preheating and chemical heating steps, as well as the supply of all required auxiliary systems and equipment, such as heating units (e.g., boilers, chemical heaters), energy sources (e.g., fuel, technical gases), piping and connection systems (e.g., hoses, fittings, valves), and any other tools, materials, or utilities necessary for the proper execution of the chemical cleaning process. Chemical Cleaning implementation shall be performed on both RSGs using a chemical solution heated to above 100 °C and shall include steps to induce turbulent flow to maximize cleaning efficiency at the Tube-to-TTS crevice.
- 1.3 Mechanical cleaning activities (SL-Sludge Lancing & IBL-Inner Bundle Lancing) will be performed with another subcontractor under the scenario proposed by the main contractor of CC. Waste disposal after chemical cleaning will be the responsibility of NEK.

2. Scope of service

Scope of service by this Technical Specification shall include development of the study and implementation of study proposals in the outage 2027 and forward.

2.1 RSG Chemical Cleaning Assessment Study shall include the following:

- propose an optimum cleaning strategy for NEK RSG design* (72W-D4/2, triangular pitch, ¾" OD, I690TT) to be performed in outage 2027, referencing EPRI reports when available.
- RSG Remedy Strategy, which identifies the recommendations for a future cleaning strategy:
 - Chemical Cleaning Programs for NEK RSG design:
 - Strategy of future SG Mechanical Cleaning (TTS SL lancing and IBL, etc.)
 - Conditioning of secondary system during future operating cycles (FFA, PAA, ...)
- the process to clean the SG Top of Tube Sheet (TTS). The process shall be recognized by the EPRI/SGOG qualified process,
- a detailed explanation of a Tube-to-Tube Sheet (TS) crevice cleaning step,
- define all necessary chemical cleaning and mechanical cleaning equipment required for the

operation,

- address approved procedures to control installation, operation, and removal of chemical cleaning equipment and systems,
- address trained and qualified personnel to implement / operate the chemical cleaning equipment during the outage 2027,
- address corrosion monitoring system during CC based on the conducted corrosion test,
- address the effectiveness of CC process with their equipment based on the predicted amount of Fe deposits (NEK SG Sludge profiling reports are available),
- assign and provide personnel for the installation and removal of the chemical cleaning system,
- provide a list of essential spare parts and other critical systems to prevent unacceptable delays of the chemical cleaning process system due to equipment failure,
- mechanical cleaning and televisual activity sequence (SL, IBL, VT), which shall be the responsibility of another subcontractor,
- chemical waste disposal plan with projected chemical volumes and composition after CC.

Chemical waste disposal shall be the responsibility of NEK. MSDS (Material Safety Data Sheet) of the used chemicals shall be provided by the supplier prior implementation of CC.

2.2 The scope of service under this technical specification shall also include the implementation of the chemical cleaning process proposed in the study during the outage in 2027. Mechanical cleaning processes during the predefined outage duration (Att.1) shall be specified, but another contractor will be responsible for implementation which includes sludge lancing (SL) on secondary side of NEK steam generators (RCPCSGN1 and RCPCSGN2), inner bundle lancing (IBL) on both SG's (if applicable) and 100% remote visual inspection (VT) of both SG's tube sheet with FOSAR during regular plant outage 2027.

2.3 Chemical waste disposal shall be the responsibility of NEK.

* RSG design – Similar design" meaning that the distance between the tubes shall not exceed more than 20 % of Krško RSG design.

3. Safety Classification

Activities listed in this technical specification are classified as SAFETY RELATED (SR).

4. Service type

Service shall be performed in accordance with contractor's QA plan/program and working procedures. NEK's coordinator from the Production Department (TO.PR), with the help of the Chemistry Department (TO.KM) and In-service Inspection Maintenance Department (TO.VZISI), will carry out supervision and coordination of work.

5. Codes, Standards, and Procedures

• NEI 97-06 rev.3;	Nuclear Energy Institute
• EPRI TR 3002007572; rev.8	PWR SG Examination Guidelines
• EPRI TR 1012987; rev.2	SG Integrity Assessment Guidelines
• EPRI TR 3002002197;	SGMP PWR SG TTS Denting History and Causes
• EPRI TR 3002010645; R8	PWR Secondary Water Chemistry Guidelines
• EPRI TR 1016555;	PWR Water Chemistry guidelines Rev. 7
• EPRI TR 1025127;	SGMP Asses. of Deposit Removal Frequency on Sludge Management
• EPRI NP-4600; (1986)	
• IAEA No. SSG-13	Chemistry Programme for Water Cooled NPPs
• TD-0H rev.6	Program uparjalnikov NEK
• NEER-G/2008/0100; rev. A	Operational & Maintenance Manual (SG 72 W/D4-2)
• KWU NW-C/99/e050	Chemistry Guidelines for Replacement SG
• 10CFR50, Appendix B	Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
• 10CFR21,	Reporting of Defects and Noncompliance
• ASNT CP-189,	Standard for Qualification and Certification of Non-destructive Testing Personnel
• ASME Section V,	Non-destructive Examination ; Visual Examination
• ASME Section XI,	Rules for Inservice Inspection of NPP Components
• ASME NQA-1, 2008	Quality Assurance Requirements for Nuclear Facility Add. 2009/2011 Applications
• EPRI TR 1020989	SGMP: Foreign Object Prioritization for Triangular Pitch
• ADP-1.6.701	Kontroliran vstop nevarnih kemikalij v NEK
• ADP-1.6.702	Ravnanje z nevarnimi kemikalijami NEK
• ADP-1.6.703	Ravnanje z nevarnimi odpadki
• UL RS 104/2009	Uredba o skladiščenju nevarnih tekočin v nepremičnih skladiščnih posodah

The latest revision of procedures applies where not explicitly specified.

5.1 Prior to the start of the work, the Contractor shall get knowledge of NEK's internal rules for working inside the controlled area. In addition, each shift shall have 1 individual with Work Order Shift Leader status. The topics they must understand are:

- Chemical control
- Foreign Material Exclusion – FME program
- Industrial Safety at NEK
- Entrance and movement in the technological area of NEK
- Access of subcontractors to NEK
- Fire protection program

- ALARA radiological protection program
- Protection of nearby systems, structures, and components
- 10CFR21 Reporting of Defects and Noncompliance
- Requirements for SG Assessments prescribed in this Technical Specification are defined in NEK SG Program: Program uparjalnikov TD-0H rev.6. Results and recommendations shall be considered and/or implemented in the subsequent outage 2027.

6. Identification of Equipment

All activities covered in this Technical Specification will be implemented on RCPCSGN1 and RCPCSGN2 NEK steam generators.

7. Technical Requirements

7.1 The potential bidder shall fulfil the following requirements:

- The potential bidder must be able to perform chemical cleaning of NEK RSGs in the 2027 outage. The duration of the available time is specified in paragraph 9. After the clean-up activities, the bidder must provide a Safety Certificate of WASTE. NEK will be responsible for waste disposal.
- All services should not produce any foreign material. Approved equipment shall be used for services at NEK.
- Sludge removal during the Chemical Cleaning process shall be done through four SG inspection ports.
- Chemicals, equipment, tools, and auxiliary equipment used during performance of the scope of this specification shall not have any detrimental effect to the steam generator, especially to the integrity of steam generator tubes.
- Equipment – reservoirs/tanks used at NEK should be of a double skin type, installed with retaining vessels to meet Slovenian regulations for hazardous chemical storage in stationary storage containers.

7.2 Technical description of the requested Chemical Cleaning technology

Chemical Cleaning performed in 2027 shall fulfil the following requirements and shall be carried out in the following steps:

0. Step: Sludge Lancing of both steam generators, to remove soft sludge and expose hard sludge area on TTS – to be performed by other contractor.
1. Step: Rinsing phase (use of, $\Delta p \uparrow$, SG heating, venting, water level: TTS+1m)
(amb-93-50-115-93 °C)
 - Drain water / inject solvent at a higher temperature

2. Step: Dissolving Fe hard sludge deposits on the TTS (solvent mixing) (~93 °C)
 - Partial drain at / raised temperature
3. Step: Tube to Tube Sheet crevice cleaning (venting/boiling/mixing) (~115 °C)
 - Cool down and drain again
4. Step: (SOAK / no recirculation); water level cca TTS+1m (~80 °C)
 - Drain
5. Step: Final Rinse at water level TTS + 2m (cooling to ~25 °C)
 - Final Drain
 - Air blowing
 - Post Sludge Lancing with the option of IBL on both steam generators (other contractor)
 - Final VT inspection (another contractor)

Chemical Cleaning shall use applicable solvent and nitrogen (N₂,) to increase pressure with the purpose of elevating temperature of the chemicals inside the SG. Solvent efficiency shall be increased by using a pressure drop (venting), to cause boiling / mixing of solvent during the second (Fe TTS cleaning) and third cleaning step (CREVICE cleaning). Process solvent heating shall be provided with external heaters (ex. boilers or electrical heaters) and temperature range specified in the steps above shall serve as a guideline values. Residual Heat during plant shutdown is not acceptable. Piping shall use the Inspection Ports connection because the diameter is bigger than on the BD system. In this way more turbulent flow will be achieved.

The supplier shall provide a statement that the chemical cleaning process shall not cause any detrimental effect on the steam generator secondary side materials and piping beyond predicted corrosion test criteria.

Only Technology with at least 2 implemented references will be considered. 5-step process shall have references with POSITIVE results/impact on DENTING and SCC mechanism. BD - Bidding Documentation regulate this as Bid condition or Bid-criteria.

8. Qualification Requirements

Bidder performing RSG Chemical Cleaning Assessments Study shall be familiar and experienced with SG regulation, which can be justified by a reference list of documents for:

- SG Design Know How
- PWR Water Chemistry Expertise
- Secondary Side Water Chemistry Expertise, specifically with respect to the applied H-AVT Hydrazine/Ammonia Chemistry treatment as used in NPP Krško
- Chemical Cleaning Procedures
- SG Tube ECT data assessment

A reference list of Chemical Cleaning field application at NPPs (for at least 15 years) is also required within the proposal of the potential Bidder. The field application reference list shall contain at least the data specified in the section 7.

Contractor's personnel performing chemical cleaning should be qualified and experienced in said work activities. Personnel should also have knowledge of chemical waste treatments to prepare a comprehensive waste treatment disposal plan. Contractor's personnel performing remote visual inspection shall be qualified and certified in accordance with ASNT CP-189 Standard for Qualification and Certification of Non-destructive testing Personnel (min. NDE level II) and experienced with FOSAR activities – if applicable.

All contractors' personnel should have a good command of the English language. The potential supplier must submit a statement or present evidence on a good command of written and spoken English if English is not their first language for their workers.

Qualification of Chemical Cleaning activities shall demonstrate that cleaning methods have no detrimental effect on the integrity of Steam Generators tubes. Qualification shall be applied to meet NEK steam generators requirements (Type 72W/D4-2 triangular pitch, Inconel 690TT tube material, and 3/4" tube diameter). The qualification report shall be in English or shall be officially translated into English.

The use and handling of chemicals within the European Union must be governed in accordance with Regulation EU No. 1907/2006 (REACH). Hazardous chemicals (e.g., carcinogenic, mutagenic, or toxic for reproduction (CMR) substances) may be classified according to this EU regulation as substances of very high concern (SVHC). Substances are listed in the "candidate list" as all substances placed on it are candidates for inclusion in Annex XIV of REACH. Chemical cleaning solutions shall avoid SVHC chemicals or shall not contain substances listed in Annex XIV of REACH. Substances listed in Annex XIV are labeled with a "latest application date" and a "sunset date". The sunset date is the date after which the substance cannot be used or imported into the EU without authorization from the European Chemical Agency (ECHA).

ANEX XIV: <https://echa.europa.eu/authorisation-list>

SVHC: <https://echa.europa.eu/sl/candidate-list-table>

Software shall be applied to meet the requirements of ASME NQA-1, Part II, Subpart 2.7, if software application could cause detrimental impact on steam generators internals.

Contractor shall provide relevant documentation for granting access to NEK for the contractor's personnel at least 90 days ahead of the anticipated start of the outage. Personnel qualifications and certificates for job performance, together with health reports, should be supplied to the NEK procurement department. Before the start of the sludge removal activity (typically 2 days before), the contractor personnel are required to pass a general employee training at NEK.

9. Detailed Schedule (Att. 15.1)

RSG Chemical Cleaning Assessment Study shall be completed by December of 2025.

The chemical cleaning, sludge removal and remote visual inspection activities shall be performed during the refueling outage in April 2027 (the provisional date for SG1 is set from 8th of April 15:00 till 20th of April 07:00 and for SG2 from 8th of April 21:00 till 21st of April 05:00). Contractor will get confirmation of the exact times two months before the outage starts upon written request. The contractor should be able to perform activities according to the following schedule:

First SL1 on both RSG's	24 hrs
Time for CC with empty RCS loops (5 steps)	~120 hrs
IBL, SL2, tubesheet drying, TV1 (100%) and FOSAR1 on both SGs	123 hrs

10. Contractor Responsibilities

10.1 The potential bidder shall prepare a technical and commercial proposal for the preparation of the RSG Chemical Cleaning Assessment Study under the terms and conditions specified in this document.

10.2 Contractor (Supplier) shall provide to NPP Krško:

During the bidding phase:

- Personnel with qualifications & performance record as prescribed in Section 8.
- Time Schedule & Project Organization Chart
- Documents shall be handed over to the NPP Krško representative for review and comments.
- The supplier shall provide the references, that their Chemical/Mechanical Technology did not affect replacement SG warranties granted by manufacturer (OEM Siemens) of Replacement Steam Generators. RSG Cleaning Assessment Study results shall address that particular item.

After the contract signature:

- Completion of the required scope within the available time (Section 9)
- One (1) "Hard copy" and "pdf" of documents prescribed in Section 2.

10.3 Equipment for the chemical cleaning process of NEK Steam Generators shall be of proper cleanliness before use at NPP Krško. Flushing of hoses and system procedure shall be prepared, approved and implemented. Contractor's chemistry department shall verify equipment cleanliness at home base during preparation. No traces of equipment contamination shall be present. Report of these preparation activities should be sent to NEK prior to equipment arrival at NEK.

10.4 Upon awarding the contract, the supplier shall propose to NEK the potential injection pathways for chemical injection. If special adapters for injection are needed, the type and quantity must be specified and provided by the supplier. NEK suggests using Inspection ports openings as injection points on the SG.

- 10.5 If any problems occur during installation (calibration) or start-up of equipment for chemical cleaning or waste treatment equipment the qualified contractor's personnel must have adequate and quick solution for resolving the problem. All-important equipment shall have adequate reserves for fast changing in case of problems during an outage to prevent outage delay.
- 10.6 Contractor shall provide a statement that the steam generator cleaning method and 100% remote visual inspection with FOSAR has no detrimental effect on the steam generators and especially to the integrity of steam generator tubes and cannot produce any new foreign objects inside steam generators.
- 10.7 Chemical cleaning is to be performed on TTS (Top of the Tube sheet) on the secondary side of both NEK steam generators, and includes:
- transport of the equipment and crew, to and from the site,
 - set-up of the equipment, outside and inside RB,
 - entry of equipment in the reactor building,
 - operation of chemical cleaning and chemical heating equipment,
 - installation of drying equipment,
 - sludge weighing and filter change (another contractor),
 - disassembling of the equipment.
- 10.8 Contractor shall have their procedures for performing chemical cleaning, sludge lancing, inner bundle lancing service activities, remote visual inspection (with FOSAR), and waste treatment of used chemicals and water. All work shall be done in accordance with the Contractor's QA program requirements. Contractor's procedures shall be reviewed by NEK. **Procedures** shall be provided to NEK **at least 90 days** prior to the start of the outage on the 1st of April 2027.
- 10.9 The contractor shall provide all necessary equipment such as tanks, reservoirs, heaters, chillers, hoses, valves, fuel and technical gas, collecting containers, pumps, crawlers, control units, and spare parts for chemical cleaning operations, sludge lancing, inner bundle lancing, and remote visual inspection activities. All equipment that will be used in radiologically controlled area must be appropriately protected from radiological contamination by the contractor. All hoses that will be used in the reactor building have to be sleeved with coloured vinyl sleeving **provided and applied by the contractor**. Used filters from sludge lancing will be retained by NEK. All other contaminated equipment will not be retained by NEK and shall be taken care of and shipped along with other equipment by the supplier.
- 10.10 In agreement with NEK contractor can use NEK equipment for drying SG tube sheet. Contractor's personal shall be familiar and perform functional testing of drying equipment which will be demonstrated to NEK coordinator. NEK has the equipment to dry one SG at a time.
- 10.11 Provide all necessary equipment for establishing conditions for chemical cleaning and waste disposal process. Contractor shall provide requirements for equipment needed outside RB and inside RB with regard to the electric power, DD water supply, area needed for containers, service air, etc. Contractor shall define appropriate connection points for chemical injection into SGs and connection points for chemical drain/rinsing operations. The contractor shall define and provide necessary adapters as well.

- 10.12 Provide all necessary equipment and methods for cleaning or vacuuming the dry sludge from Non-Tube Lane and from the gutter in the peripheral lanes of the tube sheet. Contractor shall provide **requirements** for air supply (pressure demands, flow capacity, air quality, electrical power, ...) for equipment **three months before** outage start. NEK uses Express connectors for the air supply.
- 10.13 Contractor shall provide a list of equipment by each container prior to arrival on site, a separate list of the equipment entering the RB, and a list of equipment to be used inside the SG cubicles for control of items by the contractor and NEK FME controllers.
- 10.14 Contractor shall promptly report to NEK coordinator (within 1/2 hour) any deviation or nonconformance when performing chemical cleaning, sludge lancing, inner bundle lancing, drying of SGs, remote visual inspection activities, and/or FOSAR.
- 10.15 The Contractor shall present references regarding chemical cleaning, performance at other plants, as prescribed in item 7.
- 10.16 Contractor's key personnel performing chemical cleaning and sludge removal activities shall be trained and experienced on the same or similar NPP Krško 72W/D4-2 Steam Generator type.
- 10.17 Contractors personnel performing non-destructive examinations shall be qualified and certified in accordance with ASNT CP-189 Standard for Qualification and Certification of Non-destructive testing Personnel (min. NDE level II) to meet NEKs requirements and conditions if performing remote visual inspection.
- 10.18 The contractor shall obtain any Slovenian labour permit, or any other Slovenian authorization required by Slovenian authorities to allow the contractor's personnel to perform the contracted services.
- 10.19 Contractor shall submit to NEK all necessary personnel data for access formalities **at least 90 days** before arrival of contractor's personnel to NEK.
- 10.20 Contractor shall submit to NEK all necessary work certificates, equipment certificates, M&TE certificates, training certificates, complete quality/inspection plan, organizational chart, time schedule, etc., **3 (three) months** prior to arrival.
- 10.21 Contractor's personnel who will perform services in Radiological Controlled zone shall be qualified for such work and shall have appropriate documentation (Health Certificate/Dose Certificates, Personal Qualification Records, etc.). The Contractor is welcome to have own HP responsible technician on site during the performance of sludge removal activities.
- 10.22 Status reporting requirements
- 10.23 The contractor shall provide brief daily written status reports for the performed work, containing all information regarding the job. Daily report shall consist of written status of completed tasks, including percent of completeness, problems that have occurred from the last meeting with stated delays, and

presented plan for the next day, QA/QC issues, etc. These reports shall be included in the Preliminary and Final report. The NEK coordinator and QA representative shall approve each report at a daily meeting.

- 10.24 A Preliminary Report shall be written upon the service completion and given to NEK at the Exit meeting. Preliminary Report shall include as minimum: performed tasks (scope of work), list of applicable documents, nonconformance and deviation reports (if any), corrections of applicable documents, technical improvements, sludge removal report, recommendation of sludge removal techniques for the future, completed and filled out quality/inspection plan, organization chart and a punch list of any obligations not fulfilled with anticipated dates of corrective actions, analysis of equipment status trends and recommendations, internal audits summary.
- 10.25 Detailed Job Close-out Report shall be prepared and sent to NEK max. 30 days after received comments of the Preliminary report from NEK.
- 10.26 Contractor shall provide a written report of Chemical cleaning and chemical treatment of waste with temporary storage and safe disposal. Contractor shall provide the Material Safety Data Sheet Chemical waste (MSDS) of the chemicals used in the process, which NPP Krško needs to negotiate with the company handling chemical waste. The stated chapters shall be included in the Preliminary and Final Report. Report shall include records from the video system on a computerized version (USB stick), and at least a *.pdf or Word *.docx version of the report shall be available to NEK.
- 10.27 Contractors personnel shall follow the rules and requirements for radiation protection established by NEK HP department personnel.
- 10.28 Contractor shall agree with and qualify for the General Terms for Implementation of Outage Works and other services at NEK.
- 10.29 All contractor documents shall be in the English language.
- 10.30 Contractor shall provide a simplified and/or detailed flow diagram of the equipment planned for chemical cleaning and waste treatment activities with a list of all automatic start/stop interlocks for the said equipment.
- 10.31 Contractor shall be prepared to modify work schedule upon request from NEK due to changes in outage schedule without additional costs if the overall duration of contractor activities does not change.
- 10.32 Contractor shall not use any clear vinyl or plastic foil inside or outside Reactor Building (RB) and obligates to uphold the rules of FME program.
- 10.33 Contractor shall provide their own FME supervisor in each shift. The FME supervisor shall have a LOG IN/LOG OUT list of all the equipment that enters SG cubicle. The responsibility for an updated LOG IN/LOG OUT list shall rest with the supplier. The job of the supplier FME coordinator shall also be to keep an updated list of people entering and exiting the SGs cubicles. NEK FME controllers, as

well as NEK coordinators, will check the list periodically to minimize FME risks. The filled-out list will be included in the final report.

- 10.34 Contractor shall submit a qualification report about the adequacy of the chemical cleaning process and waste treatment process **90 days prior to operation start**.
- 10.35 Chemical cleaning solutions shall avoid SVHC chemicals or shall not contain substances listed in Annex XIV of REACH. Substances listed in Annex XIV are labeled with a “latest application date” and a “sunset date”. The sunset date is the date after which the substance cannot be used or imported into the EU without authorization from the European Chemical Agency (ECHA).
- 10.36 During preparation for CC, the contractor is obligated to schedule a site visit at NEK, where technical and logistical details will be agreed upon. The contractor must also perform a walk-down (Outage in October 2025) for successful preparation.
- 10.37 Contractor must be aware of sensitive NEK equipment installed inside SG cubicles (such as DMIMS sensors). The contractor’s equipment or personnel must not damage any NEK equipment.
- 10.38 For the Chemical cleaning and waste treatment process, the potential contractor must enable a partial QA audit from NEK.

11. NEK Responsibilities

- a. Provide the overall activity supervision.
- b. Provide the overall activity coordination.
This includes:
 - communication with NEK departments involved in the service,
 - deliver: DD water, electrical power, service air supply, drying equipment, etc.,
 - opening and closing of SG's secondary side inspection holes (all 4) and one SG manway on each SG.
 - coordination between the contractor and planned activities occurring in the same SG cubicle (on all elevations) at the time of sludge removal and TVI and/or FOSAR activities
- c. Provide Plant’s Specific training for contractor personnel, including all topics as requested by the item 5.1.
- d. Disposal of chemical waste after the CC process.
- e. All the necessities according to the TS IN8242439 regarding the execution of SL and IBL activities.
- f. Provide necessary equipment information and documentation needed for service to the contractor. After the contract awarded, NPP Krško will provide the following:

- i. As-built drawings & technical design data of Replacement Steam Generators.
- ii. ECT Data from previous inspection (2001-2024) for NEK Steam Generators.
- iii. ECT Final Reports of ECT SG in the past (2001-2024).
- iv. SG Assessments prepared for SG ECT in R'24
- v. DNT Re-evaluation on DATA from R'24
- vi. Efficiency Assessment of CC preformed in NEK in 2019
- vii. Sludge Lancing & Scale profiling results.
- viii. Visual inspection results of some last inspections if necessary.
- ix. Any additional technical details if necessary.
- x. NPP Krško operational data needed for assessments.
- xi. Codes, standards, procedures and guidelines as stated in section 5.
- xii. Available Water Chemistry data, including Hide Out return measurement, sludge analysis and operation history.
- xiii. Detailed videos of last FO 202 retrieval attempt from 2018 outage.
- xiv. Plant layouts, isometric drawings, 3D plant models, etc...

Documents, ECT reports & drawings will be available on the NPP Krško site only.

- g. Check cleanliness of equipment before chemical cleaning, sludge lancing, inner bundle lancing, remote visual inspections and waste removal activities start.
- h. Provide Health Physics supervision and support for contractor's personnel during performance of chemical cleaning, sludge removal and remote visual inspection + FOSAR.
- i. Provide Systems conditions to enable chemical cleaning process, sludge removal activities and TVI with FOSAR in agreed schedule as defined per item 9.
- j. Approve foreign objects retrieval method before start of retrieval.
- k. Approve of cleanliness in 'No-tube lane' area and in the peripheral lanes prior to closing the inspection holes on steam generators (WP).
- l. Approve nonconformance or deviation resolution and resulting corrective action to be taken.

12. Special Requirements

a. Organizational contact

- The contractor shall coordinate all technical and scheduling matters with the assigned NEK coordinator from the Production department.

b. Terms and Conditions

- All documents, daily sheets, logbooks reports etc. shall be written in English
 - Contractor's supervisor will be familiar with contract contents, commercial and technical agreements and will be involved in pre-order discussions.
 - Contractor's supervisor will be present at all meetings with NEK.
- c. Working conditions
- Planned chemical cleaning, sludge removal and TVI activities will overlap with maintenance work inside Reactor building. During this time, special HP protection will be obligatory in SG cubicle which will be specified by NEK HP department. Upon request other maintenance personnel shall be allowed to enter the SG cubicle during the execution of chemical cleaning, sludge removal and TVI activities.
 - Due to overlapping activities inside SG cubicles most of the equipment (chemical cleaning hoses, suction hoses, HP hoses, and power,...) will enter the SG cubicle on elevation 100 and will be raised to the platform of SG on elevation 107, to avoid potential equipment damage and allow unobscured pathway for maintenance personnel on upper elevations.

13. QA Requirements

- a. Service shall be performed in accordance with Contractor's Quality Assurance Program, which complies to 10CFR50 Appendix B and NEK QS 610 requirements, and which had been previously evaluated and accepted by NEK. Reporting of defects and noncompliance in accordance with 10CFR21 requirements, shall be implemented by Contractor. This shall apply to all activities affecting the quality of the supplied service.. Site organization chart shall be presented, and personnel duties and responsibilities shall be defined to satisfy 10CFR50 Appendix B requirements. Current version of the QA Manual shall be submitted with the Proposal. If Supplier already submitted to NEK current revision of the QA Manual, written statement about present status (title and revision number) and applicability of QA Program & Software shall also be handover in the proposal. QA Manual review and acceptance by the Purchaser shall be prerequisites for selection of a Supplier as a Contractor. All proposed changes to the program shall be submitted to and approved by the Purchaser prior to implementation.
- b. Contractor shall provide QA/QC coverage for full scope of the job. QA/QC personnel notifications shall be submitted. QA/QC personnel will be present at meetings with NEK, when necessary. Quality Plan/Control Plan shall be sent to NEK for review, include Witness and Hold points, and approval, before any activity started. QA/QC activities will be performed in accordance with Quality Plan/Control Plan, contractor's internal technical and quality control procedures, which must be approved by purchaser beforehand; and under surveillance of NEK and contractor's qualified QA/QC personnel.

- c. Contractual work will be performed in accordance with legal requirements, required standards and technical regulations in such a manner as to comply with requirements of environmental management system as per ISO 14001 and occupational health and safety at work system as per ISO45001.
- d. Contractor shall provide sufficient documents and records to support all the activities as required by this specification. The following, but not limited to, shall be provided:
- List of equipment per item 2.1 and 10.13,
 - Test report including data as required by item 2.1
 - Include a statement as required by items 8., 10.2, 10.6, and 13. a,
 - Proof of implementation on NEK site of the 10CFR21 rules and reporting provision to NEK management,
 - General statement on no detrimental effect on the steam generator secondary side materials and piping as required by item 7,
 - Presentation to NEK of all documents as required by item 8 in due time,
 - Report on performed corrosion tests, as required by item 2.1,
 - Work instructions/procedures for activities as required by item 1.1, 2.1, 8., 10.3, 10.8 and 13.b,
 - References for equipment as required by item 7.,
 - Daily reports, Preliminary report and Final report as required by items 10.23, 10.26 and 12.b,
 - Flow diagram as requested by item 10.30
 - Procedure for control of nonconformances including provision for reporting to the Customer,
 - Records of any Nonconformance found during the activities per this specification and resulting corrective actions taken,
 - Report on actions taken to improve the activity efficiency and effectiveness, especially with regards to the Comments and Notes raised during the last campaign and the comments presented in the final report of the last CC and SL, IBL campaign,
 - Quality Plan(s) for the job scope with provision for inclusion of Witness and Hold points, approved by Contractor QA personnel and NEK QA personnel,
 - QA and QC personnel qualification records,
 - NDE personnel qualification records (NDE Level II as minimum),
 - Operational personnel qualification records,
 - Statement not to use clear vinyl or plastic foil inside and outside RB.
- e. The NEK shall have the right of access to enter the premises of the Contractor to witness inspection/test activities or to conduct surveillance or quality assurance audits. This right shall extend to the Subcontractors and will be coordinated through the Contractor.
- f. The copy of the QA Program (item a) shall be supplied to NEK along with the bidding documents. All other documents needed to perform the scope of this specification and mentioned under c shall be made available to NEK **at least 60 days prior** to start of outage activities (unless otherwise specified in previous chapters) to allow NEK to comment and get the documents properly corrected and be ready prior to start of field activities.

- g. Final Report shall be written in accordance with QA requirements for the contractors of outage works in NEK.
- h. As supporting information there is one appendix attached concerning QA requirement:
 - QS 610 Rev.2 »Generic Quality Assurance Program Requirements«

14. Abbreviations

Amb	ambient temperature [°C]
Bidder/& Supplier	Company bidding on the scope of service
CC	Chemical cleaning
Contractor	Company supplying the service, also; Supplier
ECT	Eddy Current Testing
FFA	Film Forming Amine
FOSAR	Foreign Object Search and Retrieval
IBL	Inner bundle lancing
MC	Mechanical Cleaning (IBL, SL)
NEK/NPP Krško	Nuklearna elektrarna Krško / Nuclear power plant Krško
NEK Coordinator	A member of NEK team in charge of SL, IBL and TVI of SG's
OEM	Original Equipment Manufacturer
PAA	Poly Acrylic Acid
Purchaser	NEK, company ordering the service
PWR	Pressurized Water Reactor
RB	Reactor Building (controlled access area)
RCP	Reactor Coolant Pump – also primary pump
SG1/RSG1	(Replaced) Steam generator one (RCPCSGN1)
SG2/RSG2	(Replaced) Steam Generator two (RCPCSGN2)
SGOG	Steam Generator Operating Guidelines
SL	Sludge lancing
SCC	Stress Corrosion Cracking
Sludge removal	Meaning SL or IBL or both when applicable
SR	Safety Related
TVI/VT	Tele-Visual Inspection
TTS	Top of Tube Sheet
WP & HP	Witness Point and Hold Point – NEK representative (coordinator, QA, etc.) must be present during these activities.
RSG's	Replacement Steam Generators
BD	Bidding Documentation

15. Attachments

- Appendix 1: QS 600 Rev.1 Generic Software Quality Assurance Program Requirements
- Appendix 2: QS 610 Rev.2 Generic Quality Assurance Program Requirements
- Appendix 3: Outage Plan Schedule
- Appendix 4: Steam generator layout and tubesheet numbering
- Appendix 5: Steam generator drawings:
 - NDM2E – 00 – 111402, rev. H - S.G. general assembly drawing
 - NDM2E – 00 – 112729, rev. B – S.G. dimensional drawing
 - NDM2E – 00 – 112750, rev. B – Shroud
 - NDM2E – 00 – 112751, rev. B – Shroud
 - NDM2E – 11 - 112741 – Handhole screw connection
 - NDM2E – 22 – 112744, rev. A – Stud and nut for handhole
- Appendix 6: Program uparjalnikov TD-0H rev.3
- Appendix 7: Agreement on Radiological Protection
- Appendix 8: Steam generator supporting data



Outage R27 'Outage Plan Schedule:

Activity ID	Sistemski Oznaka	Activity Name	Description	Original Duration	Technolog	Start	Finish	Mar 28							Apr 05							Apr 12							Apr 19								
								Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
Project: RE27 - RE2027 - Priprava plana remonta 2027																																					
OAU12000Y	UP12	Priprava opreme za SL brez vpliva na sisteme		516		02-Apr-27 03:00	23-Apr-27 15:00																														
OASC30000Y	SC30	Odpiranje, pregled zaslih vrat RB (Emergency Air Lock) v fazi H0		147	KELAVIČ ROBERT	02-Apr-27 03:00	08-Apr-27 06:00																														
OAU08000Y	UP08	Odpiranje SG1 inspekcijskih odprtin (vseh 4) (1. odpiranje)		3	BOŽIČ JOŽE	08-Apr-27 06:00	08-Apr-27 06:00																														
OAU08000Y	UP08	Odpiranje SG1 inspekcijskih odprtin (vseh 4) (1. odpiranje)		6	ŠTAMBUK DARKO	08-Apr-27 06:00	08-Apr-27 15:00																														
OAU01000Y	UP01	SL na SG1		24	KELAVIČ ROBERT	08-Apr-27 15:00	08-Apr-27 15:00																														
OAU08000Y	UP08	Odpiranje SG2 inspekcijskih odprtin (vseh 4) (1. odpiranje)		6	ŠTAMBUK DARKO	08-Apr-27 15:00	08-Apr-27 21:00																														
OAU02000Y	UP02	SL na SG2		24	KELAVIČ ROBERT	08-Apr-27 21:00	08-Apr-27 21:00																														
OARCS000Y	RCSS	Odpreti prim. manevr. SG1 in 2. postavitve nozle dam-ov	Priprava s polarizer. v sklopu akt. OASC42000Y	12	ŠTAMBUK DARKO	08-Apr-27 22:00	08-Apr-27 10:00																														
OAU04000Y	UP41	Zapiranje SG1 inspekcijskih odprtin (1. zapiranje)		6	ŠTAMBUK DARKO	09-Apr-27 15:00	09-Apr-27 21:00																														
OAU04200Y	UP42	Zapiranje SG2 inspekcijskih odprtin		6	ŠTAMBUK DARKO	09-Apr-27 21:00	10-Apr-27 03:00																														
OAU0C1000Y	UPC1	KEMICNO ČIŠČENJE SG1 in SG2		115	KELAVIČ ROBERT	10-Apr-27 03:00	14-Apr-27 22:00																														
OAU08000Y	UP08	Odpiranje SG1 inspekcijskih odprtin (vseh 4) (2. odpiranje)		6	ŠTAMBUK DARKO	14-Apr-27 22:00	15-Apr-27 04:00																														
OAU03000Y	UP30	Odpiranje SG1 sekundarnega vhoda (PC ni na voljo) (1. odpiranje)	Priprava s polarizer. v sklopu akt. OASC42000Y	4	ŠTAMBUK DARKO	15-Apr-27 04:00	15-Apr-27 08:00																														
OAU01000Y	UP11	IBL, SL, sušenje, TVI in Fosar na SG1		123	KELAVIČ ROBERT	15-Apr-27 04:00	20-Apr-27 07:00																														
OAU032002R	UP32	Premestitev opreme za odpiranje sek. vhoda SG-jev iz SG1 na SG2		1	ŠTAMBUK DARKO	15-Apr-27 08:00	15-Apr-27 06:00																														
OAU082000Y	UP82	Odpiranje SG2 inspekcijskih odprtin (vseh 4) (2. odpiranje)		6	ŠTAMBUK DARKO	15-Apr-27 20:00	16-Apr-27 02:00																														
OAU032000Y	UP32	Odpiranje SG2 sekundarnega vhoda (PC ni na voljo) (1. odpiranje)	Orodje pripravljeno v sklopu akt. OAU030000Y	4	ŠTAMBUK DARKO	18-Apr-27 02:00	18-Apr-27 06:00																														
OAU020000Y	UP02	IBL, SL, sušenje, TVI in Fosar na SG2		123	KELAVIČ ROBERT	18-Apr-27 02:00	21-Apr-27 05:00																														
OARCV000Y	RC2V	Odmik testnih polkovov iz prim. koror SG1 in SG2		4	VOVČKO GREGOR	20-Apr-27 05:00	20-Apr-27 06:00																														
OAU04000Y	UP44	Zapiranje SG1 inspekcijskih odprtin (2. zapiranje)		6	ŠTAMBUK DARKO	20-Apr-27 07:00*	20-Apr-27 13:00																														
OAU07000Y	UP07	Zapiranje SG1 sekundarnega vhoda (PC ni na voljo)		6	ŠTAMBUK DARKO	20-Apr-27 13:00	20-Apr-27 18:00																														
OAU07002R	UP07	Premestitev opreme za zapiranje sek. vhoda SG-jev iz SG1 na SG2		1	ŠTAMBUK DARKO	20-Apr-27 18:00	20-Apr-27 20:00																														
OAU08000Y	UP18	Iznos opreme za SL iz RB		6	KELAVIČ ROBERT	21-Apr-27 05:00	21-Apr-27 11:00																														
OAU08000Y	UP08	Zapiranje SG2 inspekcijskih odprtin (2. zapiranje)		6	ŠTAMBUK DARKO	21-Apr-27 05:00	21-Apr-27 11:00																														
OASC32000Y	SC32	Zapiranje SC001HCH-001 Emergency Air Lock-a (v fazi H0)	Vzpostavitev normalnega odpiranja Emergency Air Lock-a	7	BOŽIČ JOŽE	21-Apr-27 10:00	21-Apr-27 17:00																														