

NEK

Nuklearna elektrarna Krško, d.o.o.
Vrbina 12, 8270 Krško
Slovenija

NUCLEAR POWER PLANT KRŠKO

TECHNICAL DIVISION
PRODUCTION DEPARTMENT (TO.PR)

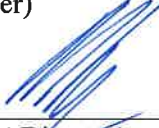


TECHNICAL SPECIFICATION FOR SLUDGE REMOVAL ACTIVITIES ON KRSKO NPP (NEK) STEAM GENERATORS

(IN 8242439)

Revision 0

CLASSIFICATION: SR (Safety Related)

Prepared by:	<u></u>	Date:	<u>17/10/2024</u>
	(R. Kelavić – System Engineer)		
Reviewed by:	<u></u>	Date:	<u>17/10/24</u>
	(Legal department)		
Reviewed by:	<u></u>	Date:	<u>22/10/2024</u>
	(M. Habinc – Maintenance Manager)		
Reviewed by:	<u></u>	Date:	<u>23/10/2024</u>
	(M. Razpotnik – Production Manager)		
Reviewed by:	<u></u>	Date:	<u>24/10/2024</u>
	(V. Čalić – QA Engineer)		
Approved by:	<u></u>	Date:	<u>28/10/2024</u>
	(M. Gluhak – Technical Director)		

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1. Activity

The scope of activity includes the performance of sludge lancing (SL) on steam generators (SG1 & SG2), inner bundle lancing (IBL) of the tube sheet of the secondary side of SG1 & SG2, and 100% remote visual inspection (RVI) of both tube sheets (SG1 & SG2) with FOSAR (Foreign Object Search and Retrieval). The activities shall be performed on both steam generators during regular refueling outage in Krsko NPP (NEK) in October 2025 (RE25) with the option of contract extension for performing sludge removal works in outages in April 2027 (RE27) and October 2028 (RE28).

2. Scope of service

The scope of service for the 2025 outage includes sludge lancing, SG2 inner bundle lancing, and a full 100% remote visual inspection of both SG tube sheets. In addition, the scope also includes FOSAR extraction of found critical objects during regular plant outage in 2025 on the secondary side of NEK steam generators (RCPCSGN1 and RCPCSGN2) without affecting the overall timeframe for the sludge removal works as defined in item 9.

The full scope of service for the outages in April 2027 and October 2028 shall be mutually agreed based upon the results from previous outage works and outcomes. Still, the preliminary scope for April 2027 and October 2028 outage works shall include at least the same type of activities defined in the scope of work for the 2025 outage with the possibility of interchanging IBL work between SG1 and SG2.

The contractor shall perform the following activities in the RE25:

- 2.1 Provide proven and qualified equipment needed for sludge lancing and inner bundle lancing at NEK steam generators Type 72W/D4-2 - triangular pitch 3/4" tube diameter.
- 2.2 Test the equipment for sludge lancing and inner bundle lancing of NEK steam generators before usage at NEK and provide assurance that steam generator cleaning methods have no detrimental effect on the steam generators, especially on the integrity of steam generator tubes. The test shall show that equipment can be inserted into the steam generator (available space from the handhole flange to the closest object – walls and available space in no-tube lane) and withdrawn at the end of operation without any detrimental effects to SG tubes. The test shall also show the efficiency of the cleaning. The contractor shall invite the Purchaser to witness the demonstration test if time permitting or such a test shall be made during the regular audit.
- 2.3 Perform the following activities necessary for lancing and inspection of both SGs which include:
 - transport of the equipment and crew, to and from the site,
 - set-up, operation, and final disassembly of the equipment,
 - FOSAR activities,
 - changing of filters,
 - sludge weighing,
 - maintaining the FME logbook and establishing FME controllers.

- 2.4 Provide all necessary equipment and consumables for the sludge lancing and inner bundle lancing activities including filters, nuclear grade cation, and anion (or mixed bed) ion exchange resin with suitable operating limitations for temperature, flow and pressure (e.g., AMBERLITE IRN150, NRW3560, Lewatit® MonoPlus SM 1000 KR), vinyl sleeving for flexible pipes protection, etc. For consumables which will enter the Reactor Building provide certificates about physical and chemical characteristics.
- 2.5 Provide all necessary equipment and consumables needed for performing remote visual inspection of the tubesheet on the secondary side of both NEK steam generators. Provide statement that remote visual inspection activity and foreign material removal method has no detrimental effect to the steam generators, especially to the integrity of steam generator tubes.
- 2.6 Provide cleaning equipment with main parts (high-pressure pump, water reservoir, water filter, etc.) to be installed cca 30 m outside the Reactor Building and remote control station to be installed inside the Reactor Building. The remote control station shall have such dimensions and weight that could be transferred manually to the Reactor Building through the Personnel Airlock (approx. 1,2 m x 2,1 m [w x h]).
- 2.7 Provide adequate tools to extract foreign objects if found in steam generators. Decision of using tools to extract foreign object will be made after adequate on-site analysis and categorization of the foreign object is performed by the contractor. The supplier will prepare a recommendation for the extraction during the duration of the TV inspection. If needed, FOSAR will start immediately as the TV inspection ends. The decision for extraction will be made by the NEK coordinator based on supplier recommendation as a witness point (WP). FOSAR activities are expected to be completed in the timeframe defined in the item 9.
- 2.8 Provide tools for cleaning the possible dry sludge from the 'No-tube Lane' area and gutter in the peripheral lanes of SG's tube sheet. Criteria for cleanliness in the peripheral lanes are that sludge is removed and no loose sludge is present. Final confirmation of cleanliness in the 'No-tube Lane' area and the peripheral lanes shall be made by the NEK coordinator (WP).
- 2.9 All service activities on site shall be completed on schedule (details in item 9).
- 2.10 Preliminary Report on performed services in the outage shall be submitted by the Contractor in at least (1) original copy and on a USB drive at the final meeting before leaving the plant. The Final Close-out Report in (3) three original copies and one PDF version (USB stick or electronically) shall be submitted to NEK 30 days after receiving the comments of the Preliminary Report but **no more than 60 days** after the final meeting.

The scope of work for RE27 and RE28 is considered as optional scope. NEK has the right to decide whether to exercise this option. The criteria for the exercising option for the second and/or third outage are completion of the full scope of activities in the preceding outage within the approved timeframe and without delays impacting outage critical path extension for the

reasons solely attributable to the contractor and without deviations from the requirements from this TS.

NEK will provide written notification to the contractor whether the option for RE27 and RE28 will be exercised at the least 10 months prior to the start of each outage. The final scope of work for RE27 and/or RE28 will be communicated on that occasion with the contractor.

3. Safety Classification

Steam Generator Sludge Lancing Service is classified as SAFETY RELATED (SR).

4. Service type

Service shall be performed under the contractor's QA plan/program and working procedures. NEK's coordinator from Production Department (TO.PRSI) with the help of coordinators from Operations (TO.PROB) will carry out supervision and coordination of work.

5. Codes, Standards and Procedures

- 10CFR50, Appendix B Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
- 10CFR21, Reporting of Defects and Noncompliance
- ASNT CP-189 or,
 EN ISO 9712 Standard for Qualification and Certification of Nondestructive Testing Personnel
- ASME Section V, Nondestructive Examination; Visual Examination
- ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components
- ASME NQA-1, 2008 Quality Assurance Requirements for Nuclear Facility Applications
 Add. 2009/2011
- EPRI TR 1020989 SGMP: Foreign Object Prioritization for Triangular Pitch SG
- QS-610 Generic Quality Assurance Program Requirements
- ISO 14001 Environmental management systems

5.1 Prior to the start of the work the Contractor shall get knowledge on NEK's internal rules for working inside the controlled area and will be obligated to pass the exam. The topics they have to understand are:

- 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 adjacent systems, structures, and components
- 10CFR21 Reporting of Defects and Noncompliance
- Entering and exiting of items in NEK and RCA
- Radioactive waste segregation

6. Identification of Equipment

All activities covered in this Technical specification are implemented on RCPCSGN1 and RCPCSGN2 NEK steam generators.

7. Technical Requirements

All services should not produce any foreign material. Qualified equipment shall be used for services at NEK.

Sludge removal during sludge lancing and inner bundle lancing service shall be done through four inspection ports on the steam generators.

Before the remote visual inspection starts, the steam generator tube sheet must be dried with a drying system (the contractor can use NEK drying equipment or shall provide his own). The contractor's personnel shall be familiar with how to use drying equipment. The drying system has to be connected to a filtration unit. Verification of drying system effectiveness shall be demonstrated to NEK (WP).

Remote visual inspection through inspection ports should verify the cleanliness of the whole tube sheet. With the results of the remote visual inspection, the contractor shall provide a comparison between the scope of the hard sludge area from previous and current outage data. Data on hard sludge areas from previous years shall be provided by NEK. Mapping of the hard sludge area shall be identified according to NEK-provided layouts of SG's tube sheet.

In case when foreign material is found in SGs, it shall be analyzed, measured, classified (type, size, ...) according to 'EPRI TR 1020989 SGMP: Foreign Object Prioritization for Triangular Pitch SG' and attempted to be removed with adequate tools. The location of foreign objects shall be identified according to NEK-provided layouts of SG's tube sheet.

Possible residual dry sludge in the 'No-tube lane' area and the gutter of the peripheral lanes of the tube sheet should be cleaned or vacuumed with adequate tools.

Equipment, tools, and auxiliary equipment used during the performance of the scope of this specification shall not have any detrimental effect on the steam generator, especially on the integrity of steam generator tubes (see item 2.5).

The supplier shall present a reference list for all SL, IBL, TVI, and FOSAR activities performed in the last decade in a table provided below for SG's with a 3/4" triangular pitch design only:

Site	Activity performed (SL, IBL, TVI, FOSAR)	Spacing between tubes [mm]	Month/year	Contact person at site plant for verification (e-mail and phone number)	Reference evidence (first page of final report, minutes of exit meeting, etc.)

8. Qualification Requirements

The contractor's personnel performing sludge lancing and inner bundle lancing activities should be qualified and experienced in sludge lancing and inner bundle lancing work activities. The experience with sludge removal activities at NEK is preferable.

The contractor's personnel performing remote visual inspection shall be qualified and certified in accordance with ASNT CP-189 or EN ISO 9712 Standard for Qualification and Certification of Nondestructive Testing Personnel (min. NDE level II) and experienced with FOSAR activities.

Work order/Shift leaders should have a good command of the English language. Key workers must submit evidence of a good command of written and spoken English if English is not their first language. Evidence can be in form of a written statement from the supplier or any other applicable institution.

Qualification of sludge removal activities by an independent body shall be performed to demonstrate that cleaning methods have no detrimental effect on the integrity of steam generator tubes. Qualification shall be applied to meet NEK steam generator requirements (Type 72W/D4-2 triangular pitch, Inconel 690TT tube material, and ¾" tube diameter). The qualification report shall be in English language or shall be officially translated into English language.

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

The 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 at least 90 days ahead of the outage start. Before the start of sludge removal activity (typically a day before), the contractor's personnel are required to pass a General Employee Training (GET) at NEK. For security vetting purposes the contractor shall make all arrangements with the purchasing department immediately after the contract is validated.

9. Detailed Schedule

The sludge lancing and remote visual inspection activities shall be performed during the refueling outage from 28th of September 2025 till 27th of October 2025. The time slot for SG1 is expected from 5/10/2025 14:00 till 12/10/2025 08:00. The total duration of the planned SG1 window is 162 hrs. The time slot for SG2 is expected from 5/10/2025 07:00 till 13/10/2025 17:00. The total duration of the planned SG2 window is 202 hrs. One month before the start of activities the purchaser will confirm the exact planned dates and times of each activity. Total duration in hours and time for individual activity is not subject to change by Purchaser. This inquiry must be demanded by the contractor via e-mail or any other written form of request. The contractor should be able to perform activities according to the following schedule for RB works and use all of the time available in the prescribed time slot – also see Appendix 1:

• equipment set-up (outside and inside RB – not connected)	24 hrs
• connecting/testing of SL equipment after the emergency door is open	6 hrs
• sludge lancing on SG2 (Actual Spraying Time Duration “ASTD”)	min. 20 hrs
• tube sheet drying of SG2	min. 6 hrs
• quick remote visual inspection of SG2 (+hard sludge mapping)	min. 16 hrs
• FOSAR (foreign object search and retrieval) of SG2	~ 10 hrs
• inner bundle lancing on SG2 at 150 °, 90 ° and 30 ° angle (ASTD)	min. 68 hrs*
• sludge lancing after IBL + tube sheet rinsing on SG1(ASTD)	min. 30 hrs
• final tube sheet drying of SG2	min 8 hrs
• 100 % remote visual inspection of SG2	min. 18 hrs
• FOSAR (foreign object search and retrieval) of SG2	~ 10 hrs
• tube sheet drying of SG2	min 8 hrs
• remote visual inspection of SG2	min. 18 hrs
• FOSAR (foreign object search and retrieval)	~10 hrs
• sludge lancing on SG1 (ASTD)	min. 90 hrs
• tube sheet drying of SG1	8 hrs
• 100 % remote visual inspection of SG1	20
• FOSAR (foreign object search and retrieval) of SG2	~ 10 hrs
• equipment disassembly inside RB	~12 hrs
• equipment disassembly outside RB	~24 hrs
• departure formalities	~24 hrs

* - The IBL process shall use the tape to enter at 150 °, 90 °, and 30 ° cleaning angles of the tube bundle so it covers the i.e. shadow area behind the tube as well. The time range for IBL defined in the TS IN8242439 must be met. Deviation of the planned activity duration must be prior agreed upon between the contractor and NEK. For additional outage planned works the detailed schedule on each SG shall be agreed at least 90 days before the next outage upon a written request from the supplier.

ASTD means the time when the water from the SL or IBL manipulator is flowing and SGs are being cleaned. This time does not include the following manipulations with the manipulator but is not limited to a change of nozzle heads, tape replacements, head replacements, repositioning of the manipulator, removal, or setup times. All other times when the water is not flowing through the nozzles should be stated separately in the quotation and technical description of the spraying program.

Some of the equipment (hoses, pumps, etc....) can be inserted into the reactor building (RB) with a polar crane. The expected Window (SC41) for the insertion of the equipment will be on the 29th of September 2025 from 18:00 to 22:00. Expected Extraction of the equipment from RB (SC44) will be on the 14th of October from 19:00 to 23:00. The equipment for insertion and extraction must be delivered and prepared for lifting in advance, the contractor must provide adequate personnel outside and inside the RB for the equipment transfer. Supplier shall discuss the exact times for insertion and removal of equipment directly with NEK RB coordinator. NEK SL/IBL coordinators shall provide the necessary contact as well as rigging and safety equipment (safety belts, ropes, etc..) to the supplier. Supplier shall provide adequate personnel outside and inside RB for rigging operations. Specifics shall be coordinated after the contract is signed.

Schedule for Outages 2027 and 2028

In case of exercising optional scope, the detailed schedule for the scope of work to be performed in RE 27 and RE28 will be communicated with the contractor at the latest 10 months before the start of each outage.

10. Contractor Responsibilities

- 10.1 Preparation for sludge lancing, inner bundle lancing, and remote visual inspection with FOSAR of tube sheets of NEK Steam Generators. Equipment shall be of proper cleanliness before use at NPP Krško. Flushing of hoses and systems shall be prepared, approved, and implemented before onsite installation. The contractor's chemistry department or last site chemistry department shall issue a report that shall verify equipment cleanliness at the home base or prior last site departure. No traces of equipment contamination shall be present. A report of these preparation activities should be sent to NEK before the equipment arrives on site.
- 10.2 Contractor (Supplier) shall provide to NPP Krško:
 - Personnel with qualifications & performance records as prescribed in Section 8.
 - Time Schedule & Project Organization Chart during the bidding phase.
 - Completion of required scope within available time (Section 9).
 - Documents shall be handed over to the NPP Krško representative for review and comments.
- 10.3 All contractor's equipment shall be functionally tested before entering the facility at Krško. The test shall show that the equipment for sludge removal can be inserted into the steam generator (available space from the handhole flange to the closest object – walls and available space in no-tube lane) and withdrawn at the end of operation without any detrimental effects

to SG tubes and without any foreign objects left. The test shall also show the efficiency of the cleaning method. The contractor shall invite the purchaser as a witness to the demonstration test if time permits. All major contractor's equipment (pumps, safety valves...) shall be preventively checked and maintained before entering the facility at Krško. Contractor shall submit evidence of such checks to NEK **60 days** prior arrival.

- 10.4 If any problems occur during installation (calibration) or start-up of equipment for sludge lancing, inner bundle lancing, or remote visual inspection the qualified contractor's personnel must have an adequate and quick solution (< 30 min) for resolving the problem. All important equipment shall have adequate spare parts inside RB or AB for fast changing in case of problems. All delays or deviations must be immediately reported to NEK support team members.
- 10.5 Remote visual inspection through inspection ports shall be performed on the whole top of SG's tube sheet with the possible exclusion of the columns with tie-rods. The row/column counting tool shall be made fully automatic with the operator as an independent check for the software. Prior to TVI setup, a calibration check of TV tools must be performed and the position established with NEK-provided SG layouts in Appendix 3.
- 10.6 With the results of the remote visual inspection, the contractor shall provide a comparison between the scope of the hard sludge area from previous and current outage data. Data on hard sludge areas from previous years shall be provided by NEK. Mapping of the hard sludge area shall be identified according to NEK-provided layouts of SG's tube sheet. Mapping of the hard sludge area shall be identified according to NEK-provided layouts of SG's tube sheet in Appendix 3.
- 10.7 The 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 especially on the integrity of steam generator tubes and can't produce any foreign objects inside steam generators.
- 10.8 Sludge Lancing, inner bundle lancing, and remote visual inspection are to be performed on top of tube sheet on the secondary side of NEK steam generators and include:
 - transport of the equipment and crew, to and from the site,
 - set-up of the equipment,
 - enter of equipment in the reactor building
 - filter and resin delivery, resin filling, and circulation,
 - operation of sludge removal equipment,
 - operation of drying equipment,
 - perform hard sludge mapping and comparison to previous outages,
 - operation of remote visual inspection equipment,
 - FOSAR activities,
 - sludge weighing and filter change,
 - disassembly of the equipment.

- 10.9 The contractor shall have his procedures for performing sludge lancing, inner bundle lancing service activities, and remote visual inspection (with FOSAR) of the tube sheet. All work shall be done following the Contractor's QA program requirements. The contractor's procedures shall be presented to NEK. Procedures shall be provided to NEK at least **60 days** before the start of the outage on September 28th, 2025. Provisional dates for RE27 and RE28 are April 1st, 2027, and October 1st, 2028.
- 10.10 The contractor shall provide all necessary equipment and spare parts for the sludge lancing, inner bundle lancing, and remote visual inspection activities. Supplier shall have twofold crucial equipment such as SL, IBL, or TVI/FOSAR manipulators, computer screens, connectors, etc. This spare equipment such as SL, IBL, or TVI/FOSAR manipulators, computer screens, connectors, etc. shall be inserted into the RB or AB so it can be replaced easily if some of the equipment fails. On-shift personnel shall be trained in quick repairs of essential equipment.
- 10.11 All equipment that will be used in radiological 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 colored vinyl sleeving provided by the contractor. In case that equipment came to NEK contaminated it will not be retained by NEK and shall be taken care of and shipped along with other equipment by the supplier. The cleanliness of equipment must be proven by prior delivery reports. NEK can retain used filters and resins from sludge lancing. Hoses shall be laid according to the route marked in Appendix 2.
- 10.12 The contractor shall provide any equipment that needs to be inserted into the RB with a crane at least 2 full days in advance according to schedule details in the section 9. The equipment will be transferred out of the RB again according to the schedule details in the section 9 upon job completion. For the equipment entry, a sufficient workforce of people must be provided as well.
- 10.13 The contractor shall prepare and deliver the FOSAR (Foreign Object Search and Retrieval) tool for possible foreign object(s) removal, and train personnel on mock-up before on-site arrival. Evidence of said training shall be sent to NEK **60 days** before arrival.
- 10.14 In agreement with NEK, the contractor can use NEK equipment for drying SG tube sheets. The contractor's personnel shall be familiar with and perform functional testing of drying equipment which will be demonstrated to the NEK coordinator (WP).
- 10.15 Provide all necessary equipment for establishing conditions for sludge removal, drying of SG tube sheet, and equipment for the performance of the remote visual inspection. Provide adequate methods and tools for cleaning or vacuuming the dry sludge from the NO-tube lane and the gutter in the peripheral lanes of the tube sheet.

- 10.16 Contractor shall provide requirements for air supply (pressure demands, flow capacity, air quality), electrical power, demi water demands, ... for equipment **three months before** the outage starts. NEK uses 1" Twist-Claw Hose Coupling connectors for air and water.
- 10.17 The contractor shall provide a list of equipment by each container before arrival on site, a separate list of the equipment entering the RB, and a list of equipment to be used inside the SG's cubicles for control of items by contractors and NEK FME controllers. The contractor shall provide their own FME supervisor, with a LOG IN/LOG OUT list of all of the equipment that enters the SG cubicle. The responsibility for an updated LOG IN/LOG OUT list shall rest with the supplier. The job of suppliers FME coordinator shall also be to keep an updated list of people entering and exiting the SG's cubicles. NEK FME controllers as well as NEK coordinators will check the list periodically according to the prepared FME Project Plan to minimize FME risks. The final signed list will be included in the final report.
- 10.18 The contractor shall promptly report to the NEK coordinator (**within 30 minutes**) any deviation or nonconformance when performing sludge lancing, inner bundle lancing, drying of SGs, remote visual inspection activities, and/or FOSAR.
- 10.19 The contractor shall present references concerning sludge lancing, inner bundle lancing, remote visual inspection, and FOSAR performance at other plants as prescribed in the item 0.
- 10.20 The contractor shall start with foreign object retrieval after NEK approval of the retrieval method. Classification and recommendation for foreign object extraction must be done in parallel/on-site during the duration of TVI inspection for each quarter segment of SG. FOSAR activities are expected to be completed in the timeframe defined in the item 9.
- 10.21 The contractor's personnel performing sludge removal activities shall be trained and experienced to perform sludge removal of the NPP Krško model 72W/D4-2 Steam generator.
- 10.22 The contractor personnel performing nondestructive examinations (remote visual inspection) shall be qualified and certified under ASNT CP-189 or EN ISO 9712 Standard for Qualification and Certification of Nondestructive Testing Personnel (min. NDE level II) to meet NEK's requirements and conditions.
- 10.23 The contractor shall obtain any Slovenian labor permit or any other Slovenian authorization such as a security vetting certificate required by Slovenian authorities to allow Contractors personnel to perform the contracted services.
- 10.24 The contractor shall submit to NEK all necessary personnel data for access formalities at **least 90 days** before the arrival of the contractor's personnel onto the NEK site.

- 10.25 The contractor shall submit to NEK all necessary work certificates, equipment certificates, M&TE certificates, training certificates, complete quality/inspection plan, organizational chart, etc. **90 days** before arrival.
- 10.26 The contractor shall submit a detailed schedule of defined operations in the section 9 as a part of an offer. The schedule must not extend the overall time slot for the work planned on SGs as defined in the section 9.
- 10.27 The contractor's personnel who will perform services in the 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 their HP-responsible technician on-site during the performance of sludge removal activities.
- 10.28 The contractor shall secure a work order leader during all times on-site works are performed outside and inside the RB. Work order personnel must first finish a 2-day course at NEK. The detailed schedule of the course will be coordinated between the supplier and NEK training personnel after the contract is signed.
- 10.29 All personnel working in the technological area must wear protective eye equipment. The supplier shall provide their eye protective equipment.
- 10.30 The contractor shall bring their electrical cable for connection to the NEK Power cabinet. The cable should be at least 20 m long.
- 10.31 **Status reporting requirements**
- The contractor shall provide brief daily written status reports for the performed work, containing all information regarding the job. The daily report shall consist of the written status of completed tasks including percent of completeness, problems that have occurred from the last meeting with stated delays, and present a plan for the next day, QA/QC issues, etc. These reports shall be included in the Preliminary and Final report. NEK coordinator and QA representative shall approve each report at a daily meeting.
 - A Preliminary Report shall be written upon the service completion and given to NEK at the Exit meeting. Preliminary Report shall include chapters as minimum for NEK review:
 - Summary of the performed work,
 - sludge weighing results,
 - remote visual inspection analysis report along with found foreign objects in SGs with the appropriate classification (type, size, class, ...) according to EPRI SGMP TR1020989: Foreign Object Prioritization for Triangular Pitch SG for all found foreign objects inside SGs,
 - comparison of hard sludge area regarding previous data,
 - recommendation of sludge removal/mitigation techniques for the future,
 - nonconformance and deviation reports (if any) with anticipated dates of corrective actions,
 - summary of the internal audits performed on the site and home base,

- proposed technical improvements along with analysis of original scheduling and possible delays.
 - As an attachment to the final report a filled-out quality/inspection plan, applicable documents such as dose rate measurements, water analysis reports, FME log IN/OUT lists, organization chart, Personal qualification/training records, equipment/process performance test reports and qualifications, equipment lists, a punch list of any obligations not fulfilled, etc. shall be attached.
 - Detailed Job Close-out Report shall be prepared and sent to NEK **max. 30 days** after receiving comments on the Preliminary report from NEK. The 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.
- 10.32 The contractor's personnel shall follow the rules and requirements for radiation protection established by NEK HP department personnel.
- 10.33 The contractor shall agree with and qualify for General Terms for Implementation of Outage Works and other services in NEK.
- 10.34 All contractor documents shall be in English language.
- 10.35 The contractor shall provide a simplified and/or detailed flow diagram of the equipment planned for sludge removal activities with a list of all automatic start/stop interlocks for the said equipment. Diagram shall be made visible inside equipment containers as well as in procedures. The said diagram shall be part of the technical description of the cleaning process provided during the bidding phase of the project.
- 10.36 The contractor shall perform classification of foreign material according to EPRI TR 1020989 SGMP: Foreign Object Prioritization for Triangular Pitch SG for all found foreign objects inside SGs. Classification and recommendation for foreign object extraction must be done in parallel on-site during the duration of TVI inspection for each quarter segment of SGs. The location of foreign objects shall be identified according to NEK-provided layouts of SG's tube sheet in Appendix 3.
- 10.37 The contractor shall be prepared to modify the work schedule upon request from NEK due to parallel work inside the SG and RCP cubicles without additional costs if the overall duration of contractor activities does not change.
- 10.38 The contractor shall not use any clear vinyl or plastic foil inside or outside the Reactor Building (RB) and is obligated to uphold the rules of the FME program.
- 10.39 The contractor must be alert on sensitive NEK equipment installed inside RB and especially SG cubicles (such as DMIMS sensors, snubbers, other instrumentation, ...). The contractor's equipment or personnel must not damage any NEK equipment.

- 10.40 To prevent a possible spread of the SARS-CoV-2 virus in NEK the contractor shall be obligated to comply with all rules and instructions which may be applicable during the execution of work at NEK site.
- 10.41 Due to the experience of stuck TVI tape, the supplier shall supply a TVI inspection tape that is less or equal to 2,4 mm thick. During the inspection, TIE-rod zones must be avoided.
- 10.42 The contractor shall be able to perform IBL cleaning in 30 °, 90 °, and 150 ° directions to cover the shadow zones of the SG tube bundle. IBL program description with proposed spraying times shall be prepared upon completion of Hard sludge mapping of the SG. Template program shall meet minimum requirements set in paragraph 9 and shall be sent with the offer during the bidding process.

11. NEK Responsibilities

- 11.1 Provide the overall activity supervision.
- 11.2 Provide the overall activity coordination.
This includes:
- communication with NEK departments involved in the service,
 - deliver DD water, 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.
- 11.3 Provide Plant's Specific training for contractor personnel including all topics as requested by item 5.1.
- 11.4 Provide necessary equipment information and documentation needed for service to the contractor:
- Crucial as-built drawings & technical design data of Replacement Steam Generators.
 - Sludge Lancing & Scale profiling results if needed.
 - Visual inspection results of the last inspections for comparison analysis.
 - Any additional technical details if necessary.
 - NPP Krško operational data needed for assessments.
 - Codes, standards, procedures, and guidelines as stated in the section 5.
 - Plant layouts, isometric drawings, 3D plant models, etc...
- Documents, ECT reports & drawings will be available on the NPP Krško site only.
- 11.5 Check the cleanliness of equipment before sludge lancing, inner bundle lancing, and remote visual inspection activity start.
- 11.6 Provide Health Physics supervision and support for contractor's personnel during the performance of sludge removal and remote visual inspection.

- 11.7 Approve foreign objects retrieval method before the start of retrieval.
- 11.8 Approve cleanliness in the 'No-tube Lane' area and the peripheral lane before closing the inspection holes on steam generators (WP).
- 11.9 Approve nonconformance or deviation resolution and resulting corrective action to be taken.
- 11.10 Provide an ON-SITE PREE JOB briefing to contractors' personnel and documents/presentation material, so that a contractor can conduct a presentation to the additional personnel if their arrival differs from the rest of the crew.
- 11.11 Provide an office space for the contractor personnel, with internet and phone connection.

12. Special Requirements

12.1 Organizational contact

The contractor shall coordinate all technical and schedule matters with the assigned NEK coordinator from the Production department, all commercial aspects with the assigned NEK coordinator from the Procurement department and all QA-related topics with the assigned NEK coordinator from the Quality Assurance department.

12.2 Terms and Conditions

- 12.2.1 All documents, daily sheets, logbooks, reports, etc. shall be written in English.
- 12.2.2 The contractor's supervisor will be familiar with contract contents, and commercial and technical agreements and will be involved in bidding procedure discussions.
- 12.2.3 The contractor's supervisor will be present at all meetings with NEK.

12.3 Working conditions

- 12.3.1 Planned sludge removal and TVI activities will overlap with some maintenance work on both RCP's and Eddy current inspection of SGs. During this time HP protection will be obligatory for all elevations of the SG cubicle and specified in advance. Maintenance personnel from other teams shall be allowed to enter the SG cubicle during the execution of sludge removal and TVI activities upon prior agreement.
- 12.3.2 The contractor shall ensure safe working conditions for all other interconnecting workers inside same steam generator cubicle. The contractor shall prevent any water spillage to the steam generator surroundings and/or lower elevations. During sludge removal and water spraying process the inspection holes on the steam generator shall be seal tight closed to such extent that the water spillage is minimized or completely prevented.

13. QA Requirements

- 13.1 Service shall be performed following the Contractor's Quality Assurance Program which complies with 10CFR50 Appendix B and NEK QS 610 requirements, and which had been previously evaluated and accepted by NEK.
- 13.2 Reporting of defects and noncompliance under 10CFR21 requirements shall be implemented by the Contractor. This shall apply to all activities affecting the quality of the supplied service.
- 13.3 Site organization chart shall be presented and personnel duties and responsibilities shall be defined to satisfy 10CFR50 Appendix B requirements.
- 13.4 The contractor shall provide QA and QC coverage for the full scope of the job. QA and QC personnel notifications shall be submitted. QA and QC personnel will be present at meetings with NEK, when necessary. QA/QC activities will be performed per the Quality Plan/Control Plan, the contractor's internal technical and quality control procedures, which must be approved by the purchaser beforehand; and under the surveillance of NEK and the contractor's qualified QA/QC personnel.
- 13.5 Contractual work will be performed following legal requirements, required standards, and technical regulations in such a manner as to comply with requirements of the environmental management system as per ISO 14001 and occupational health and safety at work system as per ISO 45001.
- 13.6 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, 2.4, 2.5, 2.6, 2.7, 2.8 and 10.17 with supporting data.
 - Test report including data as required by item 2.2.
 - Include a statement on no detrimental effect of all equipment involved on the steam generators as required by items 2.5 and 10.7.
 - Listing of essential data on the equipment as required by item 2.7.
 - Evidence of 10CFR21 requirements implementation on the NEK site (procedure, personnel indoctrination, poster, responsible officer for evaluation and reporting).
 - Statement/report proving Drying system effectiveness as required by item 0 (N/A when using NEK drying equipment).
 - Presentation to NEK of all documents as required by item 8 in due time.
 - Statement on cleanliness check of the equipment before use within NEK area as required by item 10.1.
 - Report on performed tests, and preventive maintenance checks as required by item 10.3.
 - Work instructions/procedures for activities as required by item 10.9.
 - References for requirements as defined by item 10.19.

- List of instrumentations and relevant valid calibration reports, certificates, and documents as required by item 10.25.
 - Daily reports, Preliminary report, and Final report as required by item 10.31.
 - Flow diagram as requested by item 10.35.
 - Procedure for control of nonconformances including provision for reporting to the Customer.
 - Records of any non-conformance found during the activities per this specification and resulting corrective actions taken.
 - 10CFR21 evaluation and reporting.
 - 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.
- 13.7 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.
- 13.8 A copy of the contractor's QA Program (see 13.1) shall be supplied to NEK along with the bidding documents. Program review and acceptance by the Purchaser shall be prerequisites for the selection of a supplier as a contractor. If the supplier already submitted to NEK the current revision of the QA Manual, a written statement about the present status (title and revision number) and applicability of the QA Program & Software shall also be handed over in the proposal. All proposed changes to the program shall be submitted to and accepted by the Purchaser before implementation.
- All other documents needed to perform the scope of this specification and mentioned under 13.6 shall be made available to NEK at **least 60 days before** the start of outage activities (unless otherwise specified in previous chapters) to allow NEK to comment and get the documents properly corrected and be ready before the start of field activities.
- 13.9 The Final Report shall be written following QA requirements for the contractors of outage works in NEK.
- 13.10 As supporting information there is an appendix concerning QA requirements attached to Bid documentation:
- QS 610 Rev.2 »Generic Quality Assurance Program Requirements«

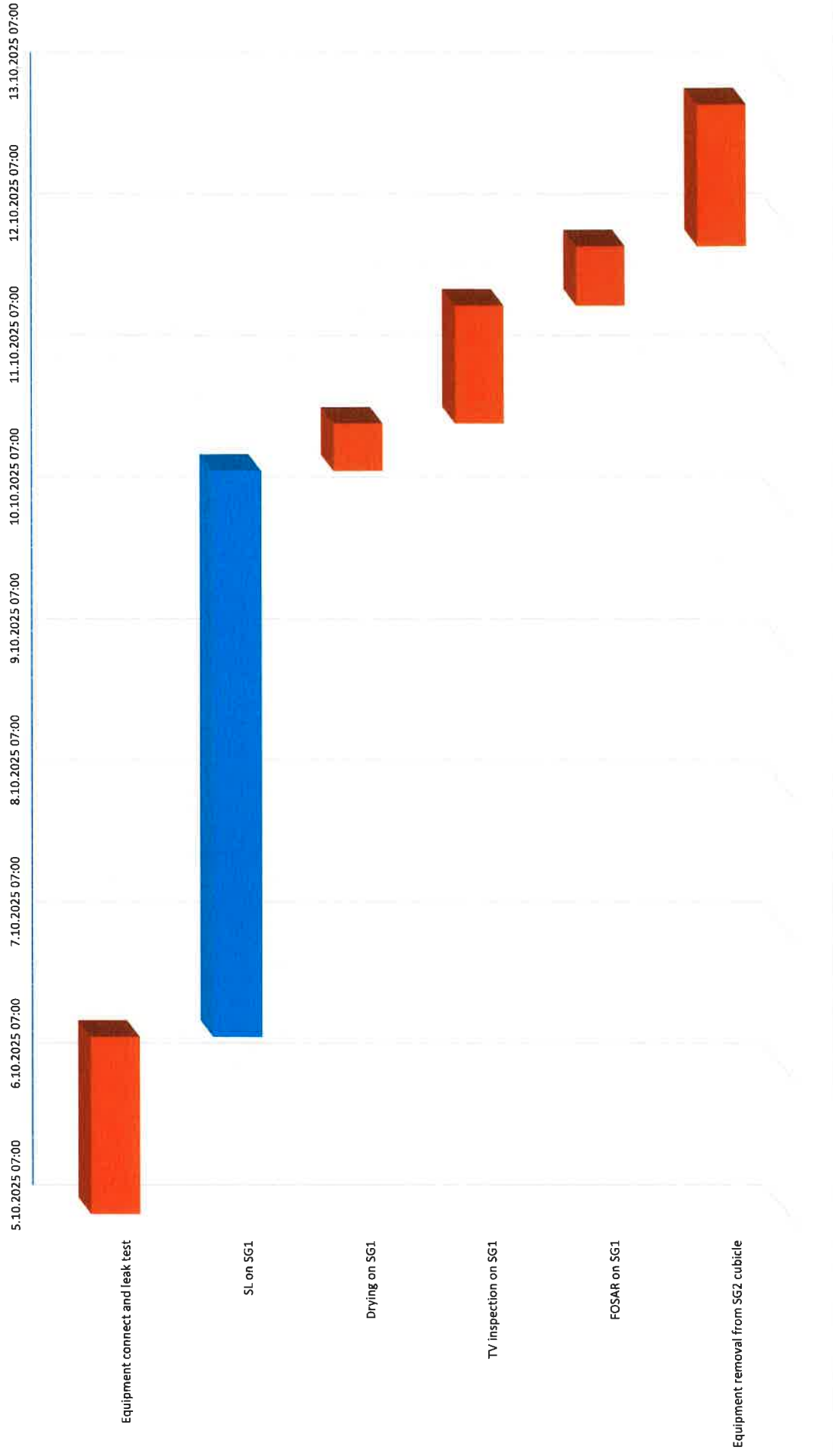
14. Abbreviations

AB	Auxiliary Building inside RCA
ASTD	Actual Spraying time duration for SL/IBL inside SG's
Bidder	Company bidding on the scope of service
Contractor	Company supplying the service, also; Supplier
EPRI	Electric Power Research Institute
FME	Foreign Material Exclusion
FOSAR	Foreign Object Search and Retrieval
IBL	Inner bundle lancing
NEK/NPP Krško	Nuklearna elektrarna Krško
NEK Coordinator	A member of the NEK team in charge of SL, IBL, and TVI of SG's
Purchaser	NEK, the company ordering the service
QA/QC	Quality Assurance/Quality Control
RB	Reactor Building (controlled access area)
RCP	Reactor Coolant Pump – also the primary pump
RCA	Radiologically Controlled Area
RVI/TVI	Remote Visual Inspection/Televisual Inspection
SG1 (RCPCSGN1)	Steam Generator one
SG2 (RCPCSGN2)	Steam Generator two
SL	Sludge Lancing
Sludge removal	Meaning SL or IBL or both when applicable
SR	Safety Related
TO.PR(SI/OB)	Technical Division – Production department (System Engineering/Operations)
TR	Technical Report
WP & HP	Witness Point and Hold Point – NEK representative (coordinator, QA, etc.) must be present during these activities.

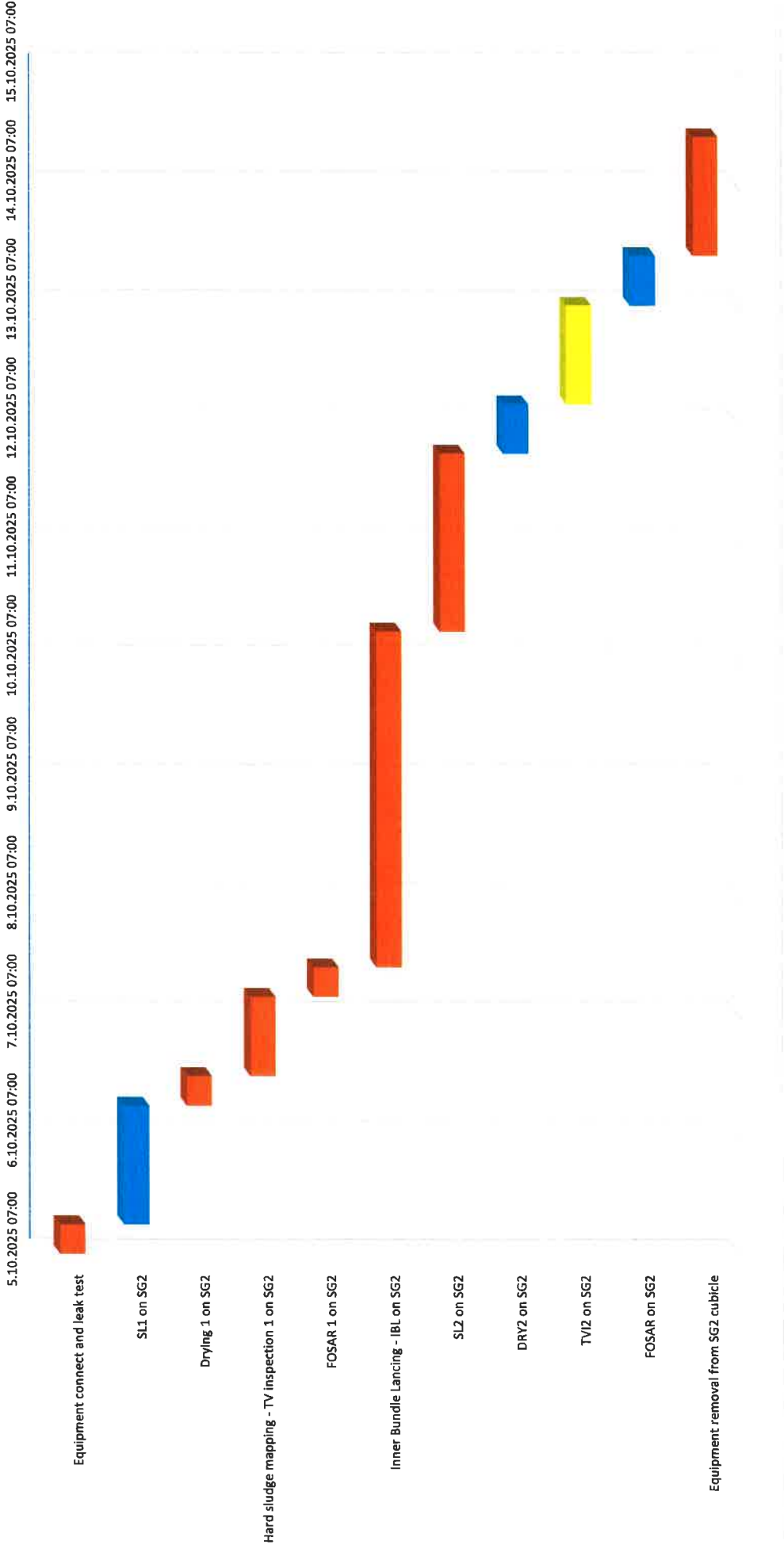
15. Attachments

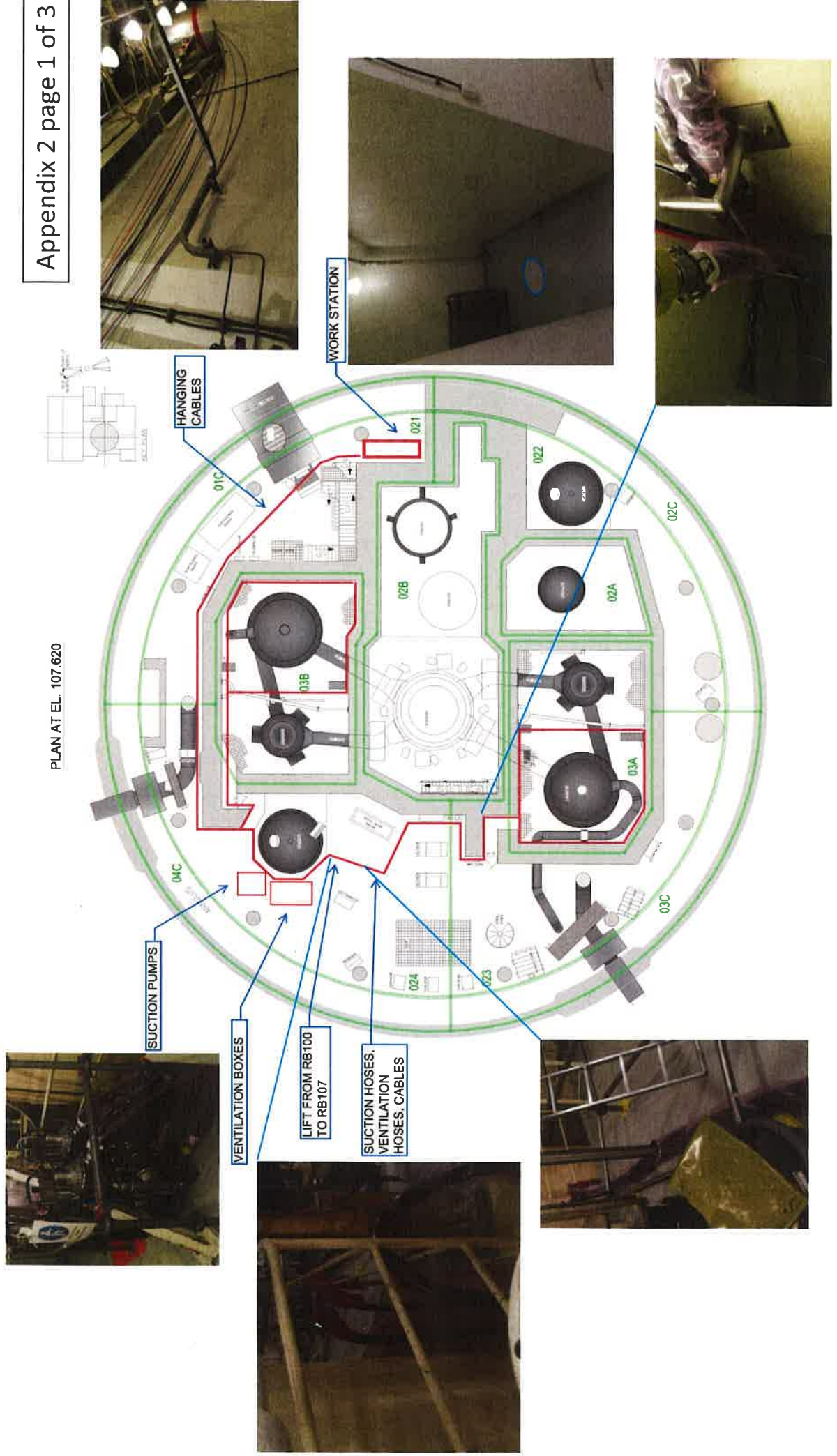
- Appendix 1: »Proposed work sequence plan for Sludge removal works in outage 2025«
- Appendix 2: »Cable and flexible pipeline route«
- Appendix 3: »Steam generator layout and tube sheet numbering«

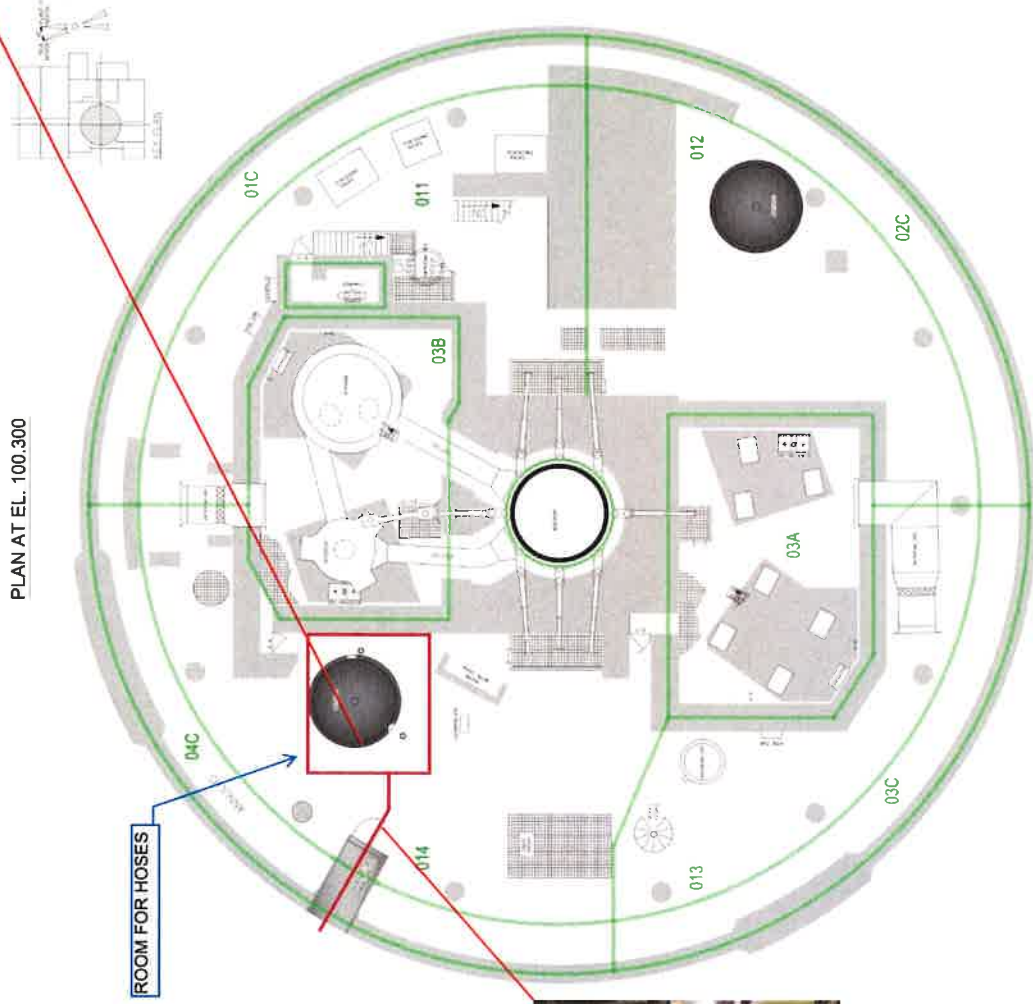
Outage RE25 SG1 proposed sequence plan



Outage RE25 SG2 proposed sequence plan







IB - el. 100.300 m

