



Technical Specification
NEK SAFETY UPGRADE PROJECT – PHASE 3

BB2 Project - Engineering, Design and Construction

SP- ES5115

Revision 0

KRŠKO NUCLEAR POWER PLANT
SAFETY RELATED

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TABLE OF CONTENTS

1	BACKGROUND AND DESCRIPTION OF THE PROJECT	4
1.1	BB2 building with support systems (1024-BS-L).....	4
1.2	Alternate Safety Injection (ASI) (1005-SI-L).....	4
1.3	Alternative Auxiliary Feedwater (AAF) (1010-AF-L)	5
1.4	BB2 Emergency Electrical Power Supply (1030-EE-L).....	5
2	SCOPE OF SERVICES AND DELIVERY	6
2.1	General.....	6
2.1.1	Design scope clarifications.....	7
2.2	Services to be supplied – detailed description	9
2.3	Project Coordination.....	9
2.4	Engineering, Design and Licensing Support.....	9
2.4.1	Engineering and Design	9
2.4.2	Equipment Qualification and Equipment Survivability	12
2.4.3	Licensing Support	16
2.5	Planning, scheduling and reporting – Project Management Manual	16
2.6	Procurement and Manufacturing inspection	17
2.7	Packaging, Handling, Storage and Shipping.....	17
2.8	Construction, Installation, and Commissioning.....	17
2.9	Revision of the documentation and project closure.....	19
2.10	Other Services	19
2.10.1	Clean Waste Removal.....	19
2.10.2	Hazardous Waste Removal	20
2.10.3	Radiological Waste Removal.....	20
2.10.4	Warehousing	20
2.10.5	Fire Protection.....	20
2.10.6	Training.....	20
2.10.7	Site Maintenance.....	20
2.10.8	Document Control.....	21
2.10.9	Machine Shop.....	21
2.10.10	Parking Shuttle.....	21
2.10.11	Medical.....	21
2.10.12	Sanitary Facilities.....	21
2.10.13	Health and Safety	21
3	SAFETY CLASSIFICATION OF CONTRACTED WORK	24
4	DESIGN INPUT.....	24
4.1	The Common General Design Inputs	24
4.2	Commercial Grade Dedication	24
4.3	Shelf Life	25
4.4	Modifications included	25
4.5	Definitions and Abbreviations	25
4.5.1	Abbreviations	25
4.5.2	Definitions.....	27
5	APPLICABLE NEK- CONTRACTOR DESIGN CONTROL PROGRAM	28
6	APPLICABLE CODES, STANDARDS AND DESIGN CRITERIA FOR THE WORK.....	28
6.1	Slovenian codes	29

6.2	General US codes.....	29
6.3	USNRC Regulatory Guides	29
6.4	Codes and Standards	30
6.5	Other Supplemental Criteria and Information	31
6.6	Other NEK Supplemental Criteria and Information	32
6.7	NEK Programs, Procedures and Licensing documents	32
7	AFFECTED SYSTEMS	33
8	IDENTIFICATION OF AFFECTED EQUIPMENT.....	33
9	REVIEW AND VERIFICATION OF THE WORK.....	34
10	SCHEDULE REQUIREMENTS.....	35
11	STATUS REPORTING REQUIREMENTS.....	35
11.1	NON-CONFORMING.....	35
11.2	10CFR21 Reporting.....	36
12	WORK OR INFORMATION TO BE PROVIDED BY NEK.....	36
13	CHANGES OF WORK SCOPE.....	37
14	DELIVERABLES TO BE PROVIDED BY THE CONTRACTOR.....	37
14.1	BID Phase	37
14.2	Project Execution Phase.....	37
14.3	Additional Requirements	40
14.3.1	General Requirements	40
14.4	Tools for mechanical design area.....	41
14.5	Structural analysis and design software.....	41
14.6	Tools for Electrical and I&C design area.....	42
15	RECORDS.....	43
15.1	Records System	43
15.2	Code Reports.....	44
15.3	Design Reports	44
15.4	Installation Records.....	44
15.5	Photographs and Video records	45
16	ORGANIZATIONAL CONTACT.....	45
17	CONTRACTOR TECHNICAL APPROACH TO THE WORK.....	45
18	ACCESS TO CONTRACTOR FACILITY AND DOCUMENTS.....	46
19	SUBCONTRACTED WORK.....	46
20	QUALITY ASSURANCE REQUIREMENTS.....	47
20.1	General.....	47
20.2	Quality Manual	47
20.3	Contractor's Responsibilities for Sub-contractors.....	47
20.4	Manufacturing and Inspection Plan	47
20.5	Project Quality Plan (PQP).....	48
20.6	Material Control and Identification	48
20.7	Inspections	49
20.7.1	Notification Points	49
20.7.2	Hold Points.....	49
20.7.3	Stop Work Action	49
20.7.4	Release for Shipment	50
20.8	Documentation.....	50
20.8.1	Certificate of Compliance	50
20.8.2	Records Systems	50
21	NEK PROPRIETARY DATA.....	51
22	APPENDICES.....	51

1 BACKGROUND AND DESCRIPTION OF THE PROJECT

Nuclear Power Plant Krško (NEK) has decided to take steps for the upgrade of safety measures to prevent severe accidents, and to improve the means to successfully mitigate their consequences. NPP Krško has prepared Safety Upgrade Program for the modernization. The content of the program for NEK Safety Upgrade is consistent with the nuclear industry response to the Fukushima accident. This includes plant upgrades/design changes to address Design Extension Conditions (DEC) and partially Beyond Design Bases Accident (BDBA).

Implementations of proposed Plant Safety Upgrade Project Phase shall be finished by the end of year 2021.

NEK Safety Upgrade Project, Phase 3 consists of following main projects:

- Safety Upgrade – BB2 building with support systems
- Safety Upgrade – Alternate Safety Injection (ASI)
- Safety Upgrade – Alternate Auxiliary Feedwater (AAF)
- Safety Upgrade – BB2 Emergency Electrical Power Supply

This specification is to be read in conjunction with the Conceptual Design Package: CDP 1024-BS-L Phase 3 Safety Upgrade Project Including Alternate Safety Injection System (ASI) Alternate Auxiliary Feedwater System (AAF) Bunkered Building 2 (BB2).

1.1 BB2 building with support systems (1024-BS-L)

The AAF and ASI systems are part of the NEK Safety Upgrade Program for the purpose of upgrading the plant's safety measures to lessen the chance of a severe accident and to improve the means to successfully mitigate the consequences should a severe accident occur.

The AAF and ASI pumps and tanks will be housed in a Seismic Category I building located at least 100 yards (91.44m) from the NSSS Island. Bunkered Building Two (BB2) will be constructed to withstand aircraft impact, extreme seismic events and extreme weather conditions as outlined in the NEK Safety Upgrade Project Design Inputs and Interfaces document (Appendix 22.1).

In addition to the BB2 building, a non-safety related, seismic category I water well will be installed to provide makeup water to the AAF and ASI systems during a Design Extension Condition event. An Emergency Diesel Generator DG No. 3 will provide power to BB2 critical loads via 6.3 kV switchgear MD3. In addition to DG No. 3, BB2 critical loads (with the exception of the recommended high head ASI pump) can be powered from a mobile generator and transformer which will be placed on a reinforced concrete slab outside of BB2 on grade.

1.2 Alternate Safety Injection (ASI) (1005-SI-L)

A postulated Design Extension Condition (DEC) could make the existing Safety Injection (SI) system incapable of performing its design function. The purpose of the proposed Alternate Safety Injection (ASI) conceptual design is to provide borated water to the Reactor Coolant System (RCS) during a DEC event. This will help ensure the capability to inject water to the primary system to compensate for inventory losses and to cooldown the RCS using the ASI system taking suction from the ABWT and allowing for the use of the PORVs for feed and bleed conditions. Design Extension Conditions consider a loss of both offsite and onsite electrical power and/or a loss of the safety injection piping and equipment. The ASI, in conjunction with the electrical power source Diesel Generator DG No. 3, consists of an intermediate pressure injection system with a dedicated Borated Water Storage Tank (ABWT). The ASI pump can provide borated water to the reactor vessel via the RCS. The water source, pump, valves, controls and electric power shall be separate and diverse from the existing SI system. The pump and the valves necessary to initiate injection have remote manual control from either the Main Control Room (MCR) or the Emergency Control Room (ECR) located in Bunkered Building 1 (BB1). The valves can also be operated via local handwheels at the valves. The ASI detailed design will install a new pump, piping, valves and water reservoir (ABWT) to inject borated water into the Reactor Coolant system in the event that the existing SI system is not available. The use of a lower head intermediate pressure ASI pump was initially

considered. Subsequently, the use of a higher head intermediate ASI pump was considered to copy the performance of the existing SI pumps. The higher head pump is the recommended option because it more closely mimics the existing SI system which will reduce operator burden and risk of operator error. The ASI pump size will be limited by the motor starting capabilities of DG3. A basic boration system will be installed to borate the water for the new ASI system. The new ASI system will function independently of the existing SI system and will not be used concurrently with the Safety Injection system. The ASI system will be physically located such that a single aircraft impact could not cause a loss of both the SI system and the ASI system.

1.3 Alternative Auxiliary Feedwater (AAF) (1010-AF-L)

A postulated Design Extension Condition (DEC) could make the existing Auxiliary Feedwater (AF) system incapable of performing its design function. The purpose of the proposed Alternate Auxiliary Feedwater system (AAF) design is to provide water injection into steam generators in case of an inoperable Auxiliary Feedwater System as a result of a DEC event. Design Extension Conditions consider a loss of both offsite and on-site electrical power and/or a loss of the Auxiliary Feedwater piping and equipment. The AAF, in conjunction with the electrical power source Diesel Generator DG No. 3, will provide high pressure water to the Steam Generators for reactor cooldown. The water source, pump, valves, controls and electric power shall be separate and diverse from the existing AF system. The pump and the valves necessary to initiate injection have remote manual control from either the Main Control Room (MCR) or the Emergency Control Room (ECR) located in Bunkered Building 1 (BB1). The valves can also be operated via local handwheels at the valves.

The AAF project will install a new high pressure pump, piping, valves and water reservoir (ACYT) to provide water to the steam generators for removing heat from the Reactor Coolant system in the event that the existing active Auxiliary Feedwater system is not available. The new AAF system will function independently of the existing active Auxiliary Feedwater components. The AAF system will be physically located such that a single aircraft impact could not cause a loss of both the Auxiliary Feedwater system and the AAF system.

1.4 BB2 Emergency Electrical Power Supply (1030-EE-L)

DG3 is a Class 1E electrical power source which is qualified for the increased seismic loads (0,45g PGA - Peak Ground Acceleration), and flooding levels up to 157.53 m. It is located in the seismically qualified Bunkered Building 1 (BB1).

The emergency diesel generator 3 (DG3) will provide an AC source via the existing 6,3 kV MD3 bus and 400 VAC Switchgear. A separate dedicated battery housed in BB1 building will provide DC source (125 V) for all BB2 loads and controls.

Additionally an existing mobile 400V DG with its corresponding mobile transformer (0,4/6,3 kV) shall be connected to the MD3 bus. The connection point shall be provided on the plateau of the BB2 within this project.

2 SCOPE OF SERVICES AND DELIVERY

2.1 General

The Contractor shall provide full scope of Engineering & Design Activities including Civil/Structural, Mechanical, Piping, HVAC, Electrical and I&C on a turn-key basis.

The scope of services/work and project delivery under this specification includes following activities but it is not limited to them:

1. Detailed Engineering and design of BB2 and water well (per ZGO and NEK ESD procedures),
2. Construction of BB2 building and underground water well,
3. Trenches Construction (BB2 to existing Plant and BB1 to BB2)
4. Construction supervision,
5. Preparation of Procurement and Design specifications
6. Supply of major and miscellaneous equipment,
7. Preparation of Installation Packages,
8. Equipment Installation,
9. Installation supervision,
10. Equipment Delivery under condition defined below,
11. Commissioning of BB2 Building (see attached CDP),
12. Existing mobile 2 MVA DG connection to the MD3 bus,
13. Training for NEK personnel.

Within the scope of BB2 Project the following major activities shall be implemented:

- Preparation of required documentation per Slovenian Construction Code – ZGO (to be able to obtain Construction Permit by the Purchaser; modification 1024-BS-L) for:
 1. Construction pit (protection diaphragm wall and excavation works) and
 2. Construction of BB2 building.
- Detail seismic analyses as defined in Appendix 22.6
- Design per ESP-2.602 (Plant Design Modification) for each of the above listed projects (1024-BS-L, 1005-SI-L, 1010-AF-L and 1030-EE-L)
- Project Implementation (construction, equipment installation)
- Project coordination & Quality Assurance
- Licensing Support
- Planning & Scheduling
- Project Closure

Procurement and Delivery of Equipment/Hardware shall be performed as follows:

- **Supply of Major Equipment** defined in Appendix 22.7 on a fixed and firm price basis
- **Supply of miscellaneous hardware** defined in Appendix 22.8 (cable trays, piping, piping supports etc.) and **Installation Work** on the cost per unit of measure basis. Miscellaneous hardware prices and installation work shall be specified based on best estimate scope/quantities.
- **Supply of other miscellaneous pieces of hardware** and installation needs unknown at the stage of Contract but are necessary to make the subject Project physically and functionally complete.

Plant Design Modifications - Engineering and design (per NPP Krško ESD procedures including ESP-2.602) of Safety Upgrade Systems per attached CDP which shall include (4) individual DMP's as follows:

- 1024-BS-L – Construction of BB2 building with support systems
- 1005-SI-L – Alternate Safety Injection (ASI)
- 1010-AF-L – Alternate Auxiliary Feedwater (AAF)
- 1030-EE-L – BB2 Emergency Electrical Power Supply

Procurement and supply of all required equipment and material, manufacturing and licensing assistance. The Contractor shall present to Purchaser at least two competitive bids for the following items from the Attachment 22.7: AAF pump, ASI pump, Well pump, ABWT Tank, ACY Tank and HVAC System. Purchaser will make decision/selection before the final bid.

Contractor/Bidder shall provide fix and firm price for offered scope of equipment supply defined in Appendix 22.7, with clear identification of required/recommended spare parts. Required/recommended spare parts and consumables for the period of 10 years after SAT shall be included in to the scope of hardware delivery defined by this specification..

BB2 construction procurement and contracting is within the Contractors scope.

Contractor shall provide information about major equipment maintenance cost for period of 10 years after successfully performed Site Acceptance Test (SAT).

2.1.1 Design scope clarifications

Control for the new installed modification equipment is shall be ensured from ECR or MCR. Control transfer switches will be located on DEC Transfer Panel in BB1 building.

- By mod. 1007-XI-L, installed EMCB and MCR DEC Section F ensure also control switches for the modification 1010-AF and 1005-SI. Control equipment is positioned, installed and internally prewired to the terminal block within EMCB and MCR DEC Panel. In the same way also the DEC Transfer panel have been installed and internally prewired to the terminal block. Based on the existing spare control modules and transfer switches the control logic (from EMCB and MCR) shall be designed and implemented within this project. Implentation of logic and the connection to the breakers (provided by Purchaser) for the particular DEC equipment are are within the base scope of this project. Full operability of the DEC components shall be achieved from both location (ECR and MCR)
- Previously mentioned EMCB and MCR DEC Section F is equipped also with all required indication, status and alarming capability. Particular DEC systems field XMTR shall be wired to the (by 1007-XI installed) DEC cabinet. DEC cabinet powered form BB1 UPS 240 VAC ensure standard elements of I&C loop including power supply, alarming, loop isolation cards and the transfer to the Process Information System (PIS)) and the EMCB and MCR indications. Within the particular BB2 modification XMTR itself and field wiring to cabinet shall be ensured. They are spare flow, pressure, RTD and level loops available in the DEC cabinet. Particular loop shall be also wired on the exit side by connecting the:
 1. isolated NSR outputs to the PIS, recorders and PLC and
 2. uninsulated SR signal to the spare reserved indication on EMCB.
- The following status signals from DEC components shall be wired to the ECR DEC AS PLC to enable component status control to the PIS:
 - Transfer switch signals for Pumps and Valves (ECR/MCR)
 - Pumps running status (running/stop)
 - Valves status indication (open/close)

Adequate design solutions shall be taken into consideration to prevent failure of the new installed modification equipment due to the combinations of fire hazard and other postulated events in the listed below areas:

- CB-1, Main Control Room,
- CB-3B, 6.3 kV Switchgear Room B
- CB-8A, Train A Electrical Cable Chase
- CC-1, Component Cooling Building
- IB-2, CRDM Room
- IB-3, Instrument and Service Air Compressor Area
- IB-11, Intermediate Building Basement

Fire in the above listed areas in the NSSS island shall not jeopardize operation of BB2 equipment, controlled from EMCB located in BB1 building. Fire in those areas could

inadvertently start pumps or change the position of the valves, but design shall assure that equipment will be fully functional after control circuits for that equipment that goes to MCR will be disabled and control of that equipment assured from EMCB in BB1 building. No damage of the equipment due to inadvertent start or valve stroke should occur. Specifically fire in any of the above defined areas in existing plant, concurrent with extreme earthquake as defined for DEC conditions, shall be considered in the design. As a consequence of large commercial aircraft crash to the site, same assumption, fire in any of the above defined areas in existing plant, shall be considered in the design.

NOTE:

1. Safety classification suggested/provided in the attached CDP shall be verified and approved based on detailed design verification taking into account applicable codes and standards.
2. Design concepts presented in the attached CDP shall be verified and approved via detailed design. Issues such as existing train separation from new alternative systems with suggested MOV powered from DEC power source (MD3), number of instruments, location, as well as interlock and alarms have to be verified and developed during detailed design to assure that the existing safety systems will in no case be potentially degraded during design bases events.

Nothing shall relieve the Contractor of the responsibility to perform, in addition to the established scope, analyses, tests, inspections and other activities that through the process become necessary to ensure that the design and materials, as well as the product quality, shall be satisfactory for the intended service, or as may be required by common usage or good practice.

All engineering, design work, associated equipment installation and commissioning shall be scheduled in accordance with the overall Project Schedule (see Appendix 22.3) to fulfill requirements for execution of the BB2 Project. Installation and Commissioning work which interface with existing plant systems and components shall be scheduled with cooperation of NEK planning department to meet required systems conditions (i.e. Train A or B related works, outage or non-outage works, ...).

The Contractor shall be responsible for compliance with all the detailed requirements of this Specification and its referenced documents. There shall be no deviation from this Specification or its references without prior written authorization by Purchaser.

The Contractor shall perform the necessary reviews to assure that the supplied items, services etc. will comply with all interface requirements of the existing plant systems, as mentioned in this Specification and related Conceptual Design Package. All technical solutions required for a safe, reliable and efficient operation of the new installed systems shall be considered and provided.

After the contract is awarded, but prior to the preparation of all subprojects DMP documents, mandatory detailed walk-downs shall be performed by Contractor and his subcontractors. Detailed walkdowns shall be documented in a formal walkdown report submitted to the Purchaser for approval. The main purpose of the detailed walk-down is to confirm the design inputs and to confirm that the As-Built status in the plant is same as it is shown in the existing NEK documentation (DCM items). If during that walk-down or during the DMP development any discrepancies are found between actual As-Built status in the field and the existing NEK documentation or if appropriate As-Built documentation does not exist at all, it is the Contractor's obligation to perform a detailed walk-down/As-Built process and to prepare needed As-Built documentation for the project purposes. This As-Built documentation shall be used in the project design and in preparation of the Design Modification Package.

As a consequence of this walk-down process and possible discrepancies found, Contractor and his subcontractors are requested to report found discrepancies to NEK, but they are not requested to correct NEK DCM documents and drawings. All findings shall be reported in the

walk-down report issued. The subject walk-down/As-Built shall be performed prior to the development of the DMP.

The walk-down shall result with verified design input data in the form of verified As-Built drawings as stated above. Formal walk-down report should be prepared and submitted to the Purchaser for review and concurrence.

Within the proposal potential Contractor shall submit Detail Contractor Approach to work describing technical solution and how the scope is understood. Compliance with the Technical Specification shall be also delivered within the proposal demonstrating the compliances/non-compliances with the NEK requirements.

For the design and approach to the work the potential Contractor is encouraged to propose alternate or different solutions as described in the CDP based on the latest industry practice and on its own experience.

2.2 Services to be supplied – detailed description

The Contractor's scope of services shall include all required engineering and labor necessary to perform the design, all required reviews and design verifications, procurement, BB2 construction, installation, installation supervision and testing supervision (startup and performance), and project closure. The Scope of Services shall be completed physically and functionally in a way which will achieve and meet all performance criteria and other requirements of this specification and documentation referenced by it.

2.3 Project Coordination

- Prepare the Project Management Manual per template from Attachment 22.9 (draft to be provided in the bidding phase).
- Develop an interface management plan that establishes an interface management process to facilitate the timely identification and resolution of technical interfaces during the implementation of the project.
- Manage the interfaces between NEK, equipment suppliers, and other sub-contractors for the project completion. This involves assistance to assure the flow of information is timely to support the critical schedule requirements.
- Assure integration and that the flow of the required technical and engineering information between equipment suppliers and contractors is timely and effective.
- Perform Risk Management planning and evaluation of schedule and cost risks throughout the project.
- Partial handover protocol could be proposed in the PMM for certain completed parts of the project if delivered ahead of the schedule.

2.4 Engineering, Design and Licensing Support

2.4.1 Engineering and Design

Within the proposal, a separate technical approach section is expected which will describe how the Contractor understand the NEK requirements and scope of this specification. Technical proposal shall be based on the set of the individual Design modifications per ESP-2.602. The scope of the BB2 project is provided in one Attached CDP (1024-BS-L), however the design and engineering shall be performed in four individual DMP's (1024-BS-L, 1005-SI-L, 1010-AF-L and 1030-EE-L).

The particular DMP scope could be optimized by the Contractor (interactions with the existing system, time of the installation (outage/non-outage)) which shall be clearly demonstrated in this technical proposal. Another goal of the technical proposal is to demonstrate how the Contractor will fulfill the requirement from the CDP.

The Contractor shall furnish adequate information to the Purchaser to allow the Purchaser to evaluate the Contractor's proposed design. The information submitted by the Contractor in response to requests throughout the specification shall be included in the purchase documents as a firm commitment of what the Contractor shall furnish. The inclusion of the information in the proposal shall in no way release the Contractor from its responsibilities for subsequent submittals as set forth in this Specification.

Construction of all new equipment shall conform to the greatest extent possible to the existing plant structure and equipment layout. Consideration shall be given to the existing location of walls, support pads, columns, access platforms, instrument cable routing and any other interface, which may affect the existing plant structure and equipment layout. Any modification to the existing plant structure and equipment layout determined to be unavoidable shall be clearly specified and described to allow for planning and implementation of modifications in a timely manner.

Design Engineering includes the activities required to address the design control process for the project. The Design Process and Outputs shall comply with the ZGO, NEK-ESD Procedures, NEK QA Program, USAR and the codes and standards specified by the Purchaser or proposed by the Contractor and approved for use by Purchaser. The codes and standards are specified under Chapter 6 in this Specification.

The Contractor shall prepare detailed engineering drawings, plans, procedures (including Contractor's work procedures), and Technical specifications for procurement of equipment (as required by this Specification). The documents prepared by the Contractor shall be submitted to the Purchaser for approval and inclusion of notification hold points in accordance with the design interface procedure.

The Contractor is responsible for compliance with all of the detailed requirements presented in this Specification and its Appendixes. Review and/or approval of any drawings, specifications and/or tests by Purchaser shall in no way relieve the Contractor from his responsibilities. There shall be no deviations from this Specification or its references without prior written approval from the Purchaser. Nothing in this Specification shall relieve the Contractor of the responsibility for performing, in addition to the requirements of this Specification, such analyses, tests, inspections and other activities which the Contractor considers necessary to provide that the installation activities and workmanship are satisfactory for the service intended, or as may be required by past experiences or good practice. The Contractor services shall include:

- Identifying project standards for engineering documents and assure that standards are communicated to the responsible organizations
- Review Vendor and Contractor drawings and documents for compliance to the Specification and contract documents requirements. Assure that the appropriate parameters and design information are being used by all the parties.
- Perform all the necessary engineering, design and supporting calculation activities necessary to develop the detailed design modification packages.
- Identify the design information that will be used during the project and assure that engineering activities are performed with a consistent set of assumptions and data among the contractors.
- Perform detailed site walk-downs and the evaluation of current as-built conditions in support of the detailed engineering and design effort.
- Provide technical overview of designs and review engineering documents for consistency with the project documents requirements.
- Identify interface points and ascertain if design input information is contained in the documents that need to be forwarded to another group and assure that the information is provided to the other group(s).
- Design and engineering of new seismically qualified BB2 building, underground well, following the Construction Code of the state of Slovenia (ZGO). The design shall include provisions for structural connections to all the existing structures and equipment and all

functional systems such as: lighting, heating, cooling, ventilation, communication (telephone, NEK page, sound powered and wireless), fire detection, fire protection, physical protection (security) as described in the CDP.

- Design and engineering of the new systems, associated equipment, new electrical distribution and all connections to the existing systems.
- Determine DEC parameters needed for the equipment survivability.
- Perform Equipment Qualification, Equipment Survivability, Seismic and Dynamic Qualification and Electromagnetic and Radiofrequency Qualification equipment assessment against regulatory requirements including equipment classification (with detailed documented technical basis) related to equipment function, location and interfacing to related systems (to define qualifications/survivability requirements where applicable) and finally provide detailed qualification/survivability documentation packages.
- Development of Basic Design Documentation (in the form of Design Inputs and DICS for particular modification per ESP-2.604). After the NEK review, the Design Review Meeting will be organized and both parties will participate to achieve approval of the Basic Design before starting with detail design.
- Development of the Design Modification Package(s) - (DMP) as outlined in section 14.2 of this Specification, and according to NEK ESD procedures, for new systems based on the attached CDP.
- Development of Detailed Procurement Specification for all major equipment and other associated equipment.
- Development of Detailed Procurement Specification for all other relevant items from BOM if required.
- Development of the detailed work instructions for the modification installation work separately for pre outage and outage scope for each modification package.
- Preparation of Installation Packages per ESP-2.619.
- Preparation of all necessary temporary modifications required for successful implementation of this project.
- The Contractor will specify in the Detailed Procurement Specification all the requirements for the manufacturing inspection plans and testing. The Contractor will develop all needed FAT and SAT procedures and perform all the tests.
- Assure that all engineering has been completed meeting the licensing, basic and detailed engineering requirements and by utilizing the appropriate design inputs to satisfy the project requirements.
- Provide NPP Krško required licensing support in front of Slovenian Nuclear Safety Administration and provide assistance to NEK with the development of licensing information and in presentations to the licensing authorities. Establish the basis for the configuration management to document the as-designed versus the as-built conditions.
- Equipment Number Coding for new systems, structures and components shall be performed according to the procedure ESP-2.113 "EAM MECL EQUIPMENT NUMBERING SYSTEM"
- Preparation of Safety Plan in accordance with "Uredba o zagotavljanju varnosti in zdravja pri delu na začasnih in premičnih gradbiščih" (Uradni list RS št. 83/2005)

NOTE:

In preparation of the procurement specifications the Contractor shall work closely with NEK in order to standardize the equipment and vendors to match already installed equipment at NEK as practically possible. The SR equipment suppliers shall be qualified per 10 CFR 50 Appendix B and such recognized as NUPIC or NEK supplier. Commercial Grade Dedication can be used in case that qualified equipment is not available.

2.4.2 Equipment Qualification and Equipment Survivability

The Contractor shall evaluate system functions and related equipment determined for Design Basis Accidents (DBA) and Design Extension Conditions (DEC) environment under which safety function is required to be accomplished or equipment shall not fail in the manner to prevent the mitigation of the accident or shall not progress the accident consequences.

General requirements applicable to this section are defined in section 3.13 of document DCM-DI-001 "NEK Safety Upgrade Project Design Inputs and Interfaces" (Appendix 22.1).

The Contractor is responsible for the compliance with all of the detailed requirements presented in this part of Specification and its Appendices.

The following evaluations are requested to be performed where applicable:

2.4.2.1 Electrical and I&C Equipment Environmental Qualification (EQ)

NEK is performing environmental qualification requirements according to 10CFR50.49 US code and NUREG 0588. NEK program is prescribed in the document ED-12 and its lower level procedures.

New equipment and the existing modified equipment shall be evaluated to comply with ED-12 program requirements (where applicable).

Environmental parameters for DBA for NEK locations are defined in document ZVNE/SA/EQ-TR Rev.6.

The qualification of particular existing equipment being involved or impacted by any of before listed projects (1024-BS-L, 1005-SI-L, 1010-AF-L and 1030-EE-L) has been already done within the NEK EQ Program. It is assumed that the qualification level of the modified (if any) equipment will not be changed. However if the changes (such as configuration changes: orientation; conduits/cable connections; etc.) will be done, such modification shall be described in EQ Design Impact Evaluation forms (ESP-2.651 Appendix 6.1; Item 1.1). The equipment environmental qualification shall be preserved and qualification documentation shall be revised (as applicable: PQE and EQWS mark-up; EQ block diagrams SS-250 revision).

On the other hand it is the Contractor obligation to evaluate new Major equipment functions to determine the need for the Equipment Environmental Qualification.

Contractor shall perform new equipment function and location assessment and based on it perform equipment EQ classification (equipment EQ "classification" Yes/No) with detailed documented description. This task shall be accomplished by completing EQ Design Impact Evaluation forms (ESP-2.651 Appendix 6.1; Item 2.1) for all Major electrical and I&C equipment located in DBA Harsh environment.

In case that new Major equipment will be classified as EQ equipment then environmental qualification evaluation shall be performed in accordance with EQ-12 and corresponding EQ procedures requirements. Contractor shall prepare EQ Documentation Packages (EQDP) for relevant equipment which will be classified as EQ equipment.

The EQDP level of details shall be on the same level as NEK qualification documents prepared per ED-12 program requirements (PQE series of documents) if otherwise not approved by NEK. EQDP shall be part of DMP section B (calculations). Applicable EQ Test Reports shall be part of EQDP or EQDP shall refer EQ Test Reports in case that it is stand-alone document delivered separately from DMP. DMP section E shall define all applicable EQ installation requirements with the level/scope of information comparable to NEK EQWS series of documents (orientation, EQ configuration, electrical conduit sealing, supporting EQ BoM such as cables, splices, terminal blocks, etc.). DMP drawing section H shall contain EQ block diagrams (series SS-250) showing new EQ equipment and its supporting EQ equipment.

It is Contractor's obligation to certify new EQ equipment qualification to IEEE 323-1974 (or newer version of standard) and equipment specific IEEE environmental qualification daughter standards (as applicable: IEEE 382, IEEE 383, IEEE 334, etc.).

2.4.2.2 Mechanical Equipment Environmental Qualification (MEQ)

New mechanical safety related Major equipment shall be evaluated to assure that subject active mechanical equipment will perform designated safety related function under Design Basis Accident (DBA) in Harsh environment.

Environmental parameters for DBA for NEK locations are defined in document ZVNE/SA/EQ-TR Rev.6 (defines Harsh environment locations and parameters).

Contractor shall perform function and location assessment for new Major mechanical equipment and based on it shall determine equipment MEQ classification (equipment MEQ “classification” Yes/No) with detailed documented description.

This task shall be accomplished in section B in continuation to EQ Design Impact Evaluation forms. MEQ classification form is not pre-defined, therefore following aspects shall be considered and documented to classify MEQ:

- MEQ is limited only to safety-related active mechanical equipment (a component that must perform activation, isolation or repositioning during the course of accomplishing its function;
- MEQ equipment must perform safety related functions during and/or after a postulated DBA (only equipment located in Harsh environment).

All new Major mechanical equipment located in Harsh environment shall be evaluated.

Mechanical Equipment safety function description and Post Accident Operating Time (PAOT; consistent to ED-12 time categories) shall be defined for MEQ classified equipment as part of MEQ classification forms.

MEQ classification shall be accomplished in design input documents which shall be prepared in accordance with the valid revision of NEK procedure ESP-2.604. MEQ classification shall be reviewed and approved by Purchaser.

If any equipment will be classified MEQ “Yes”, DMP A section Traveler, 9.a (Question: ENVIRONMENTAL QUALIFICATION REVIEW REQUIRED?) shall be designated with “Yes” to involve NEK EQ engineer in DMP review.

Mechanical equipment shall be qualified per one of following two methods:

- Preferred approach: qualify equipment in accordance to ASME QME-1-2007, “Qualification of Active Mechanical Equipment used in Nuclear Power Plants” by equipment qualification testing and supporting analyses.
- Alternative approach: Qualification of active mechanical equipment by analysis based only on identification of non-metallic parts which perform safety-related function during and after being exposed to a hostile environment. Non-metallic material properties are preferably based on materials testing. ASME QME-1 Non-mandatory Appendix QR-B Guide may be used for Qualification of Non-metallic Parts. ASME QME-1 QR-B may be considered as guidance (not as a mandatory requirement). Therefore other similar approaches based on non-metallic material tests and analyses may be applied.

MEQ classified equipment environmental qualification evaluation shall be performed and documented in MEQ Documentation Packages (MEQDP). The MEQDP should be supported with test reports, certificates, calculations or analyses which confirm that the equipment will perform its safety function at the end of the design life, including exposure to a DBA harsh environment. The MEQDP shall confirm the equipment qualification, determine the equipment qualified life and define preventive MEQ maintenance and surveillance activities.

The MEQDP shall be part of the DMP in section B (calculations). Applicable MEQ Test Reports and analysis shall be part of the MEQDP. If the MEQDP is stand-alone document, separate from the DMP, The MEQDP shall refer to the MEQ Test Reports.

It is the Contractor’s obligation to certify all new MEQs to ASME QME-1-2007 (preferred approach) or to certify that the equipment will perform its safety related function in Harsh environment (alternative approach).

2.4.2.3 Mechanical, Electrical and I&C Equipment Survivability Evaluations (ES)

New equipment shall be »qualified« also to »Design Extension Conditions« (DEC) environmental parameters caused by Severe Accidents. Qualification is not right term for evaluations which addressing equipment availability under Design Extension Conditions – therefore “Equipment Survivability Evaluation (ES)” will be used in continuation.

Environmental parameters for Severe Accidents (DEC) at NEK locations resulting in Harsh environment, are defined in document EQTR-18 Rev.0 (defines Harsh environment locations and DEC parameters). Locations not shown in EQTR-18 are considered Mild (also BB2 is considered Mild location).

To perform ES classification and later survivability evaluation, Contractor shall determine equipment safety function, required operational time and equipment location with corresponding DEC environmental parameters.

Equipment Survivability shall be performed only for equipment located in a “harsh” environment. The definition for harsh environment is consistent with EQ definition of ED-12 program: an environment in any plant area in which there is a significant increase above the normal plant environmental conditions, in one or more environmental parameters as a direct or indirect result of a severe accident.

A harsh environment occurs when one (1) OR more of the following parameter changes occur as a result of a severe accident:

- Temperature: A significant temperature rise (usually 8,30C (15F)) above normal environmental conditions.
- Pressure: A harsh pressure environment exists when a pressure rise above normal plant environmental conditions by more than 10 kPaas a result of a severe accident.
- Humidity: A relative humidity of 100% and exposure to condensation because of exposure to saturated steam.
- Chemical spray: The initiation of chemical spray in containment.
- Submergence: Flooding.
- Radiation: The Total Integrated Dose (TID) exceeds 100 Gy (10⁴ rads) or 10 Gy (10³ rads) for electronic equipment. TID is the sum of the whole period of plant design lifetime during normal operation and post-accident for the required operational time.

The contractor shall complete form “Guideline for ES Impact Evaluation” (Appendix 22.4 to this specification as it is not part of ESP-2.624 procedure) to summarize the data and demonstrate final equipment ES classification (Equipment Survivability assessment required: Yes/No). Completed equipment forms shall be delivered to NEK as part of design input document. It shall be attached to DMP (section B) as a continuation to EQ Impact Evaluation forms. ES Impact Evaluation forms shall be completed for all new equipment located in a Harsh environment (DEC environment) as identified above excluding equipment which by nature does not require ES (piping, supports, cable trays, etc.). DEC A or DEC B classification shall be determined.

If any equipment is as classified ES “Yes”, DMP A section Traveler, 9.a (Question: “ENVIRONMENTAL QUALIFICATION REVIEW REQUIRED?”) shall be designated with “Yes” to involve NEK EQ engineer in DMP review.

Contractor shall prepare ES Documentation Packages (ESDP) for all subject equipment which is classified as ES equipment.

ESDP should provide a sufficient level of details supported with test reports, certificates, calculations or analyses which confirm that equipment will perform its safety function at the end of design lifetime when the equipment may be exposed to Severe Accident harsh environment (DEC environment).

Equipment Survivability for electrical and I&C ES classified equipment shall be demonstrated in the same way and level of details as for EQ equipment (see 2.4.2.1).

Equipment Survivability for active safety related mechanical ES classified equipment shall be demonstrated in the same way and level of details as for MEQ equipment (see 2.4.2.2).

ESDP shall confirm qualification, determine equipment qualified life and define preventive maintenance and surveillance activates.

ESDP shall be part of DMP section B (calculations). Applicable qualification Test Reports and analysis shall be part of ESDP or the ESDP shall refer to the qualification Test Reports or qualification analyses in the event that it is a stand-alone document delivered separately from DMP.

It is the Contractor's obligation to certify that applicable DEC equipment survivability is assured for subject equipment function in DEC environment and through equipment design lifetime.

Electrical and I&C ES equipment shall be certified to IEEE 323-1974 (or newer version of standard) and equipment specific IEEE environmental qualification daughter standards (as applicable: IEEE 382, IEEE 383, IEEE 334, etc.).

Mechanical equipment shall be certified to ASME QME-1-2007 (preferred approach) or to certify that MEQ equipment will perform its safety related function in Harsh environment (alternative approach).

2.4.2.4 Seismic and Dynamic Equipment Qualification (SQ)

The new safety electrical, I&C and mechanical equipment shall be qualified to seismic loading as defined in Specification SP-S702 and the new BB2 FRS to be computed via the requirements of Appendix 22.6. Qualification requirements shall be also applied to the associated existing systems/equipment with the new systems/equipment and interconnections. Qualification shall be performed in accordance with prescribed methodologies in SP-S702 Technical Specification "Seismic Analysis, Testing and Documentation", Rev.10, resp. Regulatory Guide 1.100, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants".

Contractor shall perform equipment function and location assessment and based on it define seismic classification with detailed documented description. This task shall be accomplished in design input documents which shall be prepared in accordance with the valid revision of NEK procedure ESP-2.604. Classification shall be approved by Purchaser.

Contractor shall prepare Seismic Qualification Documentation Package (SQDP) for subject equipment. SQDP should provide sufficient level of details supported with test reports, calculations or analyses which confirms equipment seismic qualification for subject seismic load. Suppliers shall provide SQDP for NEK review and approval.

It is the Contractor's obligation to certify that applicable equipment qualification is assured for subject equipment function for specified seismic load.

Seismic requirements for equipment design are given in the Appendix 22.6.

2.4.2.5 Electromagnetic and Radiofrequency Equipment Qualification (EMQ)

New Safety Related electrical and I&C Major equipment in general shall be qualified in accordance with RG-1.180 Rev.1 "Guidelines For Evaluating Electromagnetic and Radio-frequency in Safety-Related Instrumentation and Control Systems" regarding radiofrequency, electromagnetic interfaces and power (voltage) surges where applicable.

Contractor shall perform equipment function and location assessment and based on it define equipment EMQ requirements (applicability or classification) related to RG-1.180.

This task shall be accomplished in design input documents which shall be prepared in accordance with the valid revision of NEK procedure ESP-2.604. Classification shall be approved by Purchaser.

Contractor shall develop equipment specification including requirement to equipment for vendor to certify that equipment qualification per RG-1.180 is ensured.

Contractor shall prepare Electromagnetic and Radiofrequency Equipment Qualification Documentation Package (EMQDP) for subject equipment. EMQDP should provide sufficient level of details supported with test reports, calculations and analyses which confirms equipment qualification for subject equipment function and EMI/RFI plant environment resp. RG-1.180 generic EMI/RFI plant envelopes. Contractor shall provide EMQDP for NEK review and approval.

It is the Contractor's obligation to review applicable equipment qualification for subject design equipment function and EMI/RFI plant environment resp. RG-1.180 generic EMI/RFI plant envelopes.

2.4.3 Licensing Support

The licensing scope of work consists of the preparation of required licensing documents changes, safety evaluation preparation, and development of required supporting analyses and necessary support during licensing at regulatory bodies per NEK procedures ESP-2.301, ESP-2.302, ESP-2.303 and ESP-2.307. The last part includes potential iterative answers on open questions and presentations if required during the licensing process.

The licensing documents are USAR, TS, and new NEK DEC TS document. Each modification will potentially change the description of the existing systems in USAR and if the existing equipment is affected, also TS changes. New DEC systems, structures and components shall be described in new USAR chapter 20. The NEK DEC TS (NEK DEC Technical Specifications) represent similar document as Technical Specification for these new DEC SSC defining the mode of applicability, technical requirements, action statements etc. The rest of the licensing process is covered by supporting analyses and calculations as a part of each DMP and SES/SE documents, which are already part of standard DMP.

The Purchaser will be responsible for arranging and conducting any management, regulatory, licensing, or other presentations that will be required to support the project activities. The Contractor shall provide technical support and attend meetings and presentations as requested by the Purchaser.

2.5 Planning, scheduling and reporting – Project Management Manual

The NE Krško Safety Upgrade Project is scheduled to be completed till the end of the year 2021.

After the Contract award, the Contractor shall finalize Project Management Manual with integrated detailed schedule with milestones and reports for Purchaser's approval of overall schedule (design, BB2 building construction, fabrication and delivery, installation, testing) for all new systems and modifications, which will be provided under this Specification. Project Control includes provision of personnel, supplies, software, and equipment necessary to perform all planning and schedule functions for the project. The objectives of the Project Control functions are:

- Overall project control from the Contract award to the TOP handover to NEK
- Integrated site-wide Outage Management for the NEK outages in 2019 and 2021 (connections to the existing plant systems).
- Performance of project related non-outage activities during OL-30, OL-31 and OL-32 (construction of BB2 building and water well and theirs auxiliary systems, equipment installation,...).

All project scheduling shall be performed on project management software (PRIMAVERA P-6 or similar).

The Contractor's Project Controls scope shall include provisions of personnel, supplies, software, and equipment necessary to perform all schedule functions for the Contractor's scope

of supply and to integrate Suppliers and construction sub-contractors activities into a master schedule with the following major provisions:

- Develop and maintain integrated project schedule based on schedules provided by the Contractors and the Purchaser
- Provide requirements for schedule to contractors (schedule software, template coding structure, etc.)
- Provide schedule updates
- Perform critical path analyses and what-if scenarios
- Recommend planning corrective actions
- Project progress and status shall be reported within the Monthly Progress Report

2.6 Procurement and Manufacturing inspection

Major tasks in the Procurement and Manufacturing inspection process shall include:

- Develop and provide procurement documents, manufacturing inspection plans, test procedures, and test certificates to ensure that the Contract requirements are complied with this technical specification and appropriate standards.
- Provide information of Supplier's capabilities and manufacturing techniques to NEK.
- Assure that required equipment data will be provided consistent with the equipment specification requirements and interfaces.
- Assure that the required drawings and information are submitted and request any that are missing.
- Material and equipment shall be purchased by Contractor and approved by Purchaser.
- Witnessing of critical manufacturing processes and Factory Acceptance Tests. The Factory Acceptance Test procedure will be prepared by the main equipment vendor, reviewed by the Contractor and approved by the Purchaser.
- Verify that contracted test requirements are met, and tests demonstrate equipment & component capabilities performance requirements.
- Ensure that suppliers compile properly the required reports and manufacturing certificates.
- Contractor/Purchaser will participate at the inspections and testing during the equipment manufacturing.
- Perform all the above actions and supply all the equipment parts, spare parts and consumables for 10 years of normal operation in order to make the systems fit for function and maintainable by plant maintenance crews.

2.7 Packaging, Handling, Storage and Shipping

Supplied equipment, disassembled appurtenances and spare parts shall be packaged and shipped in accordance with ASME NQA-1, or equivalent approved by the Purchaser.

A tag shall be attached to each package clearly enumerating the location and quantity of blocking or locking devices, shipping gaskets, packing, desiccant and lubricant to be removed prior to installation.

The Supplier shall include in the Instruction Manual sufficient information for safe handling of supplied equipment.

All components shall be stored to Level C requirements of ASME NQA-1.

2.8 Construction, Installation, and Commissioning

Major tasks in the Construction, Installation and Commissioning process shall include:

- Construction management and overview of construction pre-planning and Contractors' readiness to perform the work.
- Management and responsibility of construction and installation, ensuring compliance with technical scope, procedures, quality, and schedule.
- Preparation of Installation Packages per NEK procedure ESP-2.619 (Preparation of Installation Packages).

- Contractor shall provide all equipment, tools, materials, manpower, testing and inspection and other services necessary for the completion of the installation and construction work.
- Perform all installation activities (including civil/structural, mechanical, piping and electrical/I&C) which are necessary to make systems, components and structures fully operable and in accordance with design documents.
- On site responsible manager shall fulfill all requests in accordance with Slovenian law (Building code, safety on work) and have all documentation accordance with Slovenian law (Building code, safety at work) on site.
- Provide interface, integration and coordination for construction, installation, commissioning, licensing and safety.
- Perform constructability analyses, providing opinion on best options.
- SAT (Site Acceptance Test) at NEK Site. Contractor shall prepare a SAT procedures that shall be reviewed, commented and approved by NEK. Scope of Site Acceptance Testing shall envelope full scope of FAT already performed at equipment supplier's facilities. SAT shall exercise full scope of individual modification functional and performance testing, including performance testing, which may not have been possible during FAT.

INSPECTIONS and TESTS

The Contractor shall ensure that services, equipment and parts furnished under this Specification conforms to the procurement requirements stated and are suitable for the purposes outlined herein. The Contractor shall satisfy the test and inspection requirements of the ASME Code and other applicable documents, as well as the specific test and inspection requirements delineated herein.

An inspection report shall be prepared by the Contractor for each required NDE and in addition to the information required by ASME III shall include the following:

- a. Manufacturer's name
- b. Purchase order number
- c. Name of part and part identification number
- d. Method and procedure used
- e. NDE product batch numbers, where applicable
- f. Calibration records of equipment used
- g. Results of examination
- h. Personnel qualifications

Nothing in this Specification shall relieve the Contractor from performing, such analyses, tests, inspections and other activities which the Contractor considers necessary to ensure that the design, material and workmanship are satisfactory for the service intended, or as may be required by common usage or good practice.

Tests and inspections shall be performed in accordance with written procedures which have been reviewed and approved by the Purchaser.

Return-to-Service Inspection and Testing

Return-to-service (RTS) inspections and tests will be completed on new and affected structures and equipment to ensure compliance with the original design, safety, operation, and performance criteria. This scope of work includes:

- a. Hydrostatic tests of the primary and secondary systems.
- b. ASME XI baseline weld inspections will be done on all new pipe welds determined as requiring in-service inspection.
- c. System/Loop Functional Tests.
- d. Thermal Expansion Inspections.

The Contractor shall prepare all testing and inspection procedures required to fulfill the design and code requirements.

Nondestructive Test Requirements

General Requirements

Only personnel qualified and certified in accordance with the latest edition of SNT-TC-1A and with the requirements of ASME Section XI, IWA-2300 and Section III, NB-5000 shall perform NDE. Only personnel certified as Level II or III shall interpret the results of examinations. The Contractor shall submit, for Purchaser's approval, the NDE program it plans to implement to satisfy the requirements of ASME III, ASME XI, and this Specification.

This program shall consist of, as minimum, tables for both sections of the ASME Code which list components and weldments versus the type of examination to be made. The program shall be divided into two (2) parts, one for ASME III and the other for ASME XI.

The Contractor or sub-contractor shall submit all applicable nondestructive testing procedures, including examination report forms, for review and approval by the Purchaser prior to implementation. These procedures shall be submitted to the Purchaser after review and approval by the Contractor.

The Contractor shall submit procedures and techniques for performing both surface (magnetic particle and liquid penetrant) and volumetric examination (radiographic and ultrasonic) for the Purchaser's approval prior to use. Ultrasonic examination of welds shall not be substituted for radiographic examinations specified by ASME III without prior written approval by the Purchaser. The Purchaser will establish a hold point to verify the technique at the start of production testing and may witness production tests randomly (up to 100 percent).

2.9 Revision of the documentation and project closure

Contractor and/or its subcontracted architect engineering company for field installation activities shall provide needed activities to close project according to the requirements of NEK procedures. Project closure for each modification shall include the following activities:

- Preparation of As-Built essential drawings (before particular DEC system start-up)
- Technical Specification change package (licensing process for update will be performed by NEK)
- USAR update change package (licensing process for update will be performed by NEK)
- Preparation of all other As-Built drawings (to be completed in six (6) months after completion of modification)
- As-Built update of DCM
- As-Built update of MECL (eBS asset)
- Preparation of TOP per NEK procedure ESP-2.611
- Preparation of the System Design Description
- Project Closeout

2.10 Other Services

2.10.1 Clean Waste Removal

The Contractor shall provide all services as described in Section 2.1 to perform the following:

- Supply barrels, bags, containers, etc. for collection of the waste
- Transportation of the waste to collection points
- Processing/disposal of the waste at locations determined by the Purchaser
- Segregation of waste as required by the Purchaser (wood, metal, wire, etc)

2.10.2 Hazardous Waste Removal

The Contractor shall provide all services as described in Section 2.1 to perform the following:

- Adoption of program and procedures that will minimize or eliminate the generation of hazardous waste
- Supply barrels, bags, containers, etc. for collection of the waste, if required
- Transportation of the waste to collection points
- Obeying applicable NEK procedures

2.10.3 Radiological Waste Removal

The Contractor shall provide all services as described in Section 2.1 to perform the following:

- Adoption of program and procedures that will minimize or eliminate the generation of radiological waste.
- Supply barrels, bags, containers, etc. for collection of the radiological waste, if required.
- Transportation of the radiological waste to collection points or decontamination areas.
- Obeying applicable NEK procedures.

2.10.4 Warehousing

The Contractor shall provide all services as described in Section 2.1 to perform warehousing of temporary material and permanent material that has been drawn from the Purchaser's stores:

- Supply of equipment (forklifts, bins, racks, pallets, etc.)
- Implementation of a material control program

The Contractor will be able to use Purchasers warehouse facilities.

2.10.5 Fire Protection

The Contractor shall provide all services as described in Section 2.1 to perform the following:

- Supply of fire protection equipment (extinguishers, etc.) for use outside the protected area
- Supply of trained fire watch personnel

2.10.6 Training

The Contractor shall assure training for NEK personnel for usage and maintenance of applicable new major equipment. Appropriate training shall include operation and maintenance. It has to include appropriate theoretical and practical (hands on) lessons per each modification/hardware for at least 8 attendees. It could be organized at Purchaser or Contractor facility.

The Contractor shall provide all services as described in Section 2.1 to perform craft skills training as required by the construction work procedures. The Contractor will be responsible for the performance of all training activities. The Contractor shall provide training on all craft and supervision involved with the implementation of a specific procedure prior to the initiation of the work contained in that procedure including all requires specific training required at NEK like GET (General Employee Training), RZ (Radiological Protection), Work Leaders training etc.

2.10.7 Site Maintenance

The Contractor shall provide all services as described in Section 2.1 to perform the following as required to perform other portions of the scope of supply:

- Cleaning (office and grounds) in the Contractor's general work areas and areas used by the Contractor
- Removal of parts, equipment, etc. from the roadways and walkways in the Contractor's general work areas
- Upkeep and repair of the roadways used primarily by the Contractor

2.10.8 Document Control

The Contractor shall provide all services as described in Section 2.1 to perform document control functions to support the scope of supply. This will be required for both documents that are originated by the Contractor and for the documents that are supplied to the Contractor by the Purchaser.

2.10.9 Machine Shop

The Contractor shall provide all the services as described in Section 2.1 to perform any machining services that are required to support the scope of supply.

2.10.10 Parking Shuttle

The Contractor shall provide all the services as described in Section 2.1 to supply and operate any type of parking shuttle that the Contractor deems necessary.

2.10.11 Medical

The Contractor will be responsible for the supply and/or operation of the following for the needs of Contractor personnel only:

- First aid and medical supplies

2.10.12 Sanitary Facilities

The Contractor will be responsible for the supply and maintenance of all temporary sanitary facilities installed by the Contractor to support the Safety Upgrade Project.

The Contractor will be responsible for the design, construction, and maintenance of all sanitary facilities constructed to support the Safety Upgrade project which tie directly into the existing plant permanent sewer system.

2.10.13 Health and Safety

The safety scope includes the provision of all personnel, materials, equipment, tools, facilities, and supplies necessary to implement the health and safety program required to accomplish the Safety Upgrade project. All work associated with the Safety Upgrade Project shall be performed in accordance with and in full compliance with all applicable regulations and laws and the Purchaser's safety rules. All work shall be performed in a systematic manner under the documented safety program which provides the necessary direction to comply with the rules and regulations and provides for the health and safety of the personnel and protection of the plant.

The Contractor shall manage and be responsible for the performance of the safety services scope of supply for all the work performed within the Project.

The Purchaser shall be provided with unrestricted access to the Contractor's facilities and safety records for the purpose of auditing the Contractor's safety program.

All persons employed by the Contractor, agents, subcontractors, or other persons for which the Contractor has responsibility, shall perform work under the direction of the Contractor's health and safety program. All persons shall be instructed in and be familiar with safety rules and regulations applicable to the work being performed.

The Contractor shall have sole responsibility for ensuring that such persons are so informed and that safe work practices are followed.

The Contractor shall designate a qualified Safety Representative. The Safety Representative shall attend all project safety meetings and participate fully in all activities outlined in

Contractor's safety program. The Contractor's Safety Representative shall have stop-work authority for unsafe acts or conditions, shall be considered key person, and shall be on site when work is performed. The Contractor's health and safety staff shall be adequately trained to respond to any emergency or medical situation resulting from the project work.

The Contractor shall maintain reports of all accidents and injuries and shall furnish Purchaser a weekly safety report. This report shall include:

- Accident tabulations and causes, first-aid and lost time cases, any fires that occurred and any health or environmental hazards observed during the week.
- Injury rates and trend report
- A review and summary of the safety activities, problem areas and contemplated actions, audits, and safety improvements being made.

The Contractor shall report immediately any accidents occurring at the site or in travel to or from the site. Any accident resulting in the lost time, injury, fatality, damage to property or equipment, the Contractor's construction manager shall investigate a serious "near miss", or the recognition of a potential hazard to health and environment.

The Contractor, once mobilized, shall hold regularly scheduled meetings to instruct its personnel on safety practices and the requirements of the safety program. The Contractor shall furnish safety equipment and enforce the use of this equipment by its personnel.

After the Contract award, the Contractor shall submit the industrial health and safety program to the Purchaser for approval. The Program shall specify which industrial health and safety standards were used in the design of overall project activities. The approval of Contractor's Program by the Purchaser does not relieve the Contractor of any Contractor health and safety responsibilities.

The Contractor's health and safety program shall, as a minimum, provide procedures to address the following:

- Safety organization duties and responsibilities
- Emergency preparedness for:
 - Fire
 - Serious accidents or fatality
 - Property damage accidents
 - Bomb threats
 - Evacuation
 - High wind precautions
- Training:
 - Orientation of employees
 - Safe practices communications
 - Safety meetings for craftsmen
 - Safety meetings for supervisors
- Control measures:
 - Supervisory control
 - Notification of hazards
 - Sanctions for safety violators
- Hazard communication:
 - Hazardous substance list
 - Material safety data sheets
 - Labels
 - Information for employees
- First aid and medical services:
 - First aid
 - Transportation
 - Emergency telephone numbers
 - Medical services (doctor, nurse, trained emergency medical personnel)
- Accident investigation, reporting, and record keeping:
 - Investigation
 - Reporting and record keeping

- Safety inspections
- Trend reporting and analysis
- Specific safety requirements/procedures for:
 - Housekeeping requirements
 - Tag-out/lockout clearance program per Purchaser procedures
 - Electrical hazards/safety
 - Small tools and shop equipment requirements
 - Welding and cutting requirements
 - Ladders and scaffold safety requirements
 - Personnel protective equipment:
 - Eye protection
 - Head protection
 - Hearing protection
 - Respiratory protection
 - Safety belts and lifelines
 - Crane and rigging safety
 - Confined space entry
 - Vehicles and traffic
 - Water hazard requirements
 - Heat stress program
 - Excavation and trenching requirements
 - Safety barricades
 - Fire prevention requirements
 - Hazardous atmosphere
 - Fire protection requirements

Contractor should take all responsibilities also for its subcontractor to include them into health and safety program.

Other Services and Hardware supply include provision of all miscellaneous services not defined elsewhere in this Specification that are necessary to accomplish the NEK Safety Upgrade Project.

Short description of the Scope of work to be performed by Contractor according to individual modification is described in next section. Further details are available in Appendix 22.

3 SAFETY CLASSIFICATION OF CONTRACTED WORK

The contracted work is classified as Safety Related.

4 DESIGN INPUT

4.1 The Common General Design Inputs

The common general Design Inputs are described in the document DCM-DI-001 "NEK Safety Upgrade Project Design Inputs and Interfaces" Rev.8 (see Appendix 22.1). For all modification packages specific separate design inputs shall be developed according to the following:

- Preliminary Specific Design Inputs as part of CDP 1024-BS-L, Attachment 12.
- The development of the final design inputs is within the scope of Contractors work. The initial design inputs are included as part of CDP 1024-BS-L. All original design documents available at NEK along with the information provided in this specification shall be put at Contractors disposal for review and use with respect to the proprietary policy.
- The design input documents shall be prepared in accordance with the valid revision of NEK procedure ESP-2.604. As a prerequisite for DMPs development a Design Input document shall be reviewed and approved by Contractor and by Purchaser.
- Each design input shall be checked and verified by Contractor vs. original design basis. The standards referenced in section 6 of this specification shall provide the basis for the design and construction.
- The design of the new systems shall ensure maximum reliability and performance for operation and the shortest and most effective maintenance with engagement minimum maintenance crew. It is also need to have provisions for testing and in-service inspection.
- The Contractor shall use as design input existing NEK specifications for valves (G-508 A), piping (G-528) and piping supports (H-500), where applicable and shall develop a new specifications for new systems and new equipment.

Both the normal operation and safe shutdown of a plant depend on the design adequacy and the structural integrity of the ASME Class 1 and Class 2 piping systems. To demonstrate design adequacy and structural integrity of the existing ASME Class 1 and Class 2 piping systems from interconnection points to final fixed points on existing systems, piping stress analyses shall be performed for loading under normal conditions, anticipated operating conditions, seismic disturbances, postulated pipe break conditions and design extension requirements.

In case of loss of AC power for more than 24 hours during extreme environmental conditions, BB2 DEC systems with corresponding instrumentation and control equipment shall be capable to perform its designated function.

4.2 Commercial Grade Dedication

The use of commercial grade items is an option, but it is not preferred by NEK. The Contractor shall give notice in writing to NEK prior to use or dedication of commercial grade items.

Commercial grade dedication (CGD) shall be in accordance with the nuclear industry standard (EPRI NP-6406 and NP-5652) and documented as acceptable to the NRC requirements. The Vendor shall give notice in writing to the NEK if dedicated commercial grade items are to be used.

Commercial grade dedication practice shall be described in the QA program manual.

CGD plans shall be submitted to the NEK for review, completion and approval prior to the issue of the purchase order and prior to the start of the CGD.

Dedication test record (for critical characteristics from the CGD plan approved by the NEK) shall include acceptance criteria. Dedication test records shall be supplied with items or shall be supplied as part of the final documentation package.

4.3 Shelf Life

The Contractor shall not ship any item that has less than 90% remaining shelf life, or is older than one (1) year at time of shipment. The Contractor shall provide shelf life data for recommended or/and delivered spare parts by one of the following methods:

- a. Expiration date
- b. Cure date or manufacturing date and material composition

If the above requirements are not met, the item will be shipped back to the Contractor at the Contractor's expense.

The Contractor shall provide in-storage maintenance instructions for all parts which are subject to in storage maintenance (ISM) so that NEK can maintain spare parts to achieve the recommended shelf life. The shelf life of all components shall be at least ten years with the implementation of periodic ISMs. If the above requirements are not met the material shall be shipped back to the Contractor at its expense.

4.4 Modifications included

Contractor is responsible to perform all design work, purchasing, complete installation activities, installation supervision work and close-out activities based on the approved CDP 1024-BS-L: Phase 3 Safety Upgrade Project Including Alternate Safety Injection System (ASI) Alternate Auxiliary Feedwater System (AAF) Bunkered Building 2 (BB2).

4.5 Definitions and Abbreviations

4.5.1 Abbreviations

AAF	Alternate Auxiliary Feedwater System
ABWT	Alternate Borated Water Tank
AC	Alternating Current
ACYT	Alternate Condensate Storage Tank
AF	Auxiliary Feedwater System
ANSI	American National Standards Institute
ASI	Alternate Safety Injection System
ASL	Approved Suppliers List
ASME	American Society of Mechanical Engineers
BOM	Bill of Material
BB1	Existing DG-3 Bunkered Building
BB2	New Bunkered Building for DEC systems
BDBA	Beyond Design Bases Accident
BS	Bunkered Systems
CB	Control Building
CDP	Conceptual Design Package
CFR	Code of Federal Regulations
DBA	Design Basis Accident
DC	DC Power Supply and Distribution System
DCM	Document Control Module
DG	Diesel Generator
DEC	Design Extended Conditions
DECA	Systems for prevention of Severe Fuel Damage
DECB	Systems for mitigation and monitoring of consequences of Severe Fuel Damage
DEC TP	DEC Transfer Panel
DECTS	Design Extended Conditions Technical Specification
DMP	Design Modification Package

DP	Documentation Package
ECB	Electrical Control Board
ECR	Emergency Control Room
EE	AC Power Distribution System
EMCB	Emergency Control Board
EDC	Engineering Design Criteria
EDG	Emergency Diesel Generator
EPS	Emergency Power Supply
EMQ	Electromagnetic and Radiofrequency Equipment Qualification
EMQDP	EMQ Documentation Package
EQ	Electrical and I&C Equipment Environmental Qualification
EQDP	EQ Documentation Package
ES	Mechanical, Electrical and I&C Equipment Survivability Evaluations
ESD	Engineering Service Division
ESDP	ES Documentation Package
ESF	Engineered Safety Feature
FAT	Factory Acceptance Test
FDCR	Field Design Change Request
FPD	Flat Panel Display
FRS	Floor Response Spectra
GD	Approval for work (by ZGO)
GET	General Employee Training
HVAC	Heating Ventilation and Air Conditioning
I&C	Instrumentation and Control
IEEE	Institute of Electrical and Electronic Engineers
IP	Installation Package
ING PM	Project Manager within Engineering Department
IZ	Conceptual Design (by ZGO)
LCO	Limiting Conditions for Operation
MCR	Main Control Room
MD	Medium Voltage Diesel Backed Up Switchgear
MECL	Master Equipment Component List
MEQ	Mechanical Equipment Environmental Qualification
MEQDP	MEQ Documentation Package
MD3	6,3 kV Safety Bus #3
MOV	Motor Operated Valve
MW	Mega Watts
NEK	Nuklearna Elektrarna Krško
NDE	Nondestructive Examination
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NSR	Non Safety Related
NSSS	Nuclear Steam Supply System
NUPIC	Nuclear Procurement Issues Committee
NUREG	NRC (Nuclear Regulatory Commission) technical report designation
OBE	Operating Basis Earthquake
PAOT	Post Accident Operating Time
PGD	Project for getting approval for construction (by ZGO)
PID	As built documentation (by ZGO)
PIS	Process Information System
PLC	Programmable Logic Controller
PORV	Power Operated Relief Valve
PQE	Plant Qualification Evaluation
PQP	Project Quality Plan
PZI	Project for construction (by ZGO)
QR	Quality Release
RB	Reactor Building

RCS	Reactor Coolant system
RG	Regulatory Guide
RTS	Return to service
RZ	Radiological Protection
SAT	Site Acceptance Test
SE	Safety Evaluation
SES	Safety Evaluation Screening
SI	Safety Injection system
SNSA	Slovenian Nuclear Safety Authority
SR	Safety Related
SQDP	SQ Documentation Package
SSC	Structures, Systems and Components
SSE	Safe Shutdown Earthquake
SU	Safety Upgrade
SUP	Start Up Procedure
TID	Total Integrated Dose
TOP	Turn Over Package
TS	Technical Specifications
QA	Quality Assurance
QC	Quality Control
QSD	Quality System Division
SQ	Seismic and Dynamic Equipment Qualification
URSJV	Uprava Republike Slovenije za jedrsko varnost (Slovenian Nuclear Safety Administration)
USAR	Updated Safety Analysis Report
USNRC	United States Nuclear Regulatory Commission
WOI	Waiver of Inspection
ZGO	Zakon o graditvi objektov (Slovenian Construction Code)

4.5.2 Definitions

BB2 Project – shall mean all activities requested with this specification including Engineering, Design, Coordination and Construction of BB2 building, related infrastructure and all related modifications. BB2 Project is short term to describe activities within this project.

Basic Design - shall mean documentation preparation for each individual modification in accordance with NEK procedure ESP-2.604.

Basic Design Review Meeting – shall mean participation of both parties (Contractor and Purchaser) in a meeting to review and challenge the Basic Design before the beginning of the detailed design.

Detailed Design - shall mean documentation preparation in accordance with NEK ESP 2.602 and all other relevant procedures of the ESP 2.602 under item 2.0

Design Documents - Specifications and drawings derived from regulatory requirements and/or design, quality assurance, and process requirements for use in the procurement, fabrication, installation, examination and testing; and analyses and reports that substantiate design characteristics or evaluate item performance.

Design Basis - That information that identifies the specific functions to be performed by a structure, system or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be (1) restraints derived from generally accepted state-of-the art practices for achieving functional goals or (2) requirements derived from the analysis (based on calculation and/or experiments) of the effects

of the postulated accident for which a structure, system, or component must meet its functional goals. They may also result from the regulatory requirements or applicable codes and standards.

Engineering shall mean the profession of applying scientific principles to the design, construction, maintenance, and of operation of buildings, equipment and systems

Procurement shall mean the provision of all personnel, techniques, and tools/equipment necessary or appropriate to perform the procurement services required to accomplish the project

Installation shall mean all the activities and measures to successfully install the projects in accordance with the requirements of the NEK procedure ESP 2.619.

Start-up shall mean testing to validate system functionality and performance while operating new equipment.

Turnover shall mean activities and documentation signifying that the work required by the plant modification packages has been (installed and tested) in accordance with requirements of the design modification package.

Construction shall mean all the activities to build the BB2 building.

Commissioning - The process by means of which systems and components of facilities and activities, having been constructed, are made operational and verified to be in accordance with the design and to have met the required performance criteria.

Purchaser or NEK or NPP Krško shall mean Krško Nuclear Power Plant.

Project shall mean NEK Safety Upgrade Project

Specification shall mean SP- ES5115 Technical Specification.

5 APPLICABLE NEK- CONTRACTOR DESIGN CONTROL PROGRAM

ED-1,	NEK Design Modification Control Program
ED-2,	NEK Document Control Program
ED-12	Environmental Qualification Program
ED-15,	NEK Configuration Control Program
ADP-1.1.016,	NEK Document Control Program
ADP-1.2.003,	Plant Design Modification and Control Process
ESP-2.607,	Design Verification
QD-1,	Quality Assurance Plan
QS-610:	Quality Specification QS 610 - Generic Quality Assurance Program Requirements

6 APPLICABLE CODES, STANDARDS AND DESIGN CRITERIA FOR THE WORK

The conceptual designs account for the NPP Krško current licensing bases, and provide for compliance with all the applicable codes and standards including the following, as applicable. The design criteria, regulations, codes and standards listed below are applicable to the Safety Upgrade Program and are to be considered in the detailed design. They will apply to either the design of the new systems, supporting systems or components and their structures.

To the extent specified herein, the version and full identity of all codes, standards, and other documents applicable to this Specification are shown in this section. A later version of some of the dated documents may become mandatory under regulations that have jurisdiction. If this

develops, the newer version of each document shall be identified by means of a revision to the Specification. If there is a conflict between this Specification and a referenced document, the Contractor shall refer the matter in writing to the Purchaser to inform him of the conflict and to provide a proposal to resolve the conflict for Purchaser's approval.

The code and standard dates are provided as a reference. The Contractor, unless otherwise stated by the Purchaser, shall use the appropriate codes and standards listed in this section in effect at the time Purchase Order is issued by Purchaser.

6.1 Slovenian codes

- JV5 "Pravilnik o dejavnih sevalnih in jedrskih varnosti"
- JV9 "Pravilnik o zagotavljanju varnosti po začetku obratovanja sevalnih ali jedrskih objektov"
- Odločba 3570-11/2011/7 "Odločba o izvedbi modernizacije varnostnih rešitev za preprečevanje težkih nesreč in blažitev njihovih posledic"
- ZGO Zakon o graditvi objektov (Slovenian Construction Code)
- Odredba o seznamu standardov, ob uporabi katerih se domneva skladnost z zahtevami Pravilnika o mehanski odpornosti in stabilnosti objektov, (Uradni list RS št. 8/11)
- Pravilnik o projektni dokumentaciji, Ur.l. RS 55/08
- Zakon o varstvu pred ionizirajočimi sevanji in jedrski varnosti, Ur.l.RS, 67/2002, Ur.l. RS, 110/2002-ZGO-1, 24/2003, 50/2003-UPB1,46/2004, 102/2004-UPB2, 70/2008-ZVO-1B, 60/2011
- Pravilnik o fizičnem varovanju jedrskih snovi, jedrskih objektov in sevalnih objektov, Ur.l. RS 31/2005
- Pravilnik o zagotavljanju varnosti po začetku obratovanja sevalnih ali jedrskih objektov Ur.l. RS, 85/2009, 9/2010 popr., 87/2011
- Zakon o vodah, Ur.l. RS, 67/2002, 110/2002-ZGO-1, 2/2004-ZZdrI-A, 41/2004-ZVO-1, 57/2008, 57/2012
- Uredba o zagotavljanju varnosti in zdravja pri delu na začasnih in premičnih gradbiščih, (Uradni list RS št. 83/2005)
- Zakon o varnosti in zdravju pri delu (ZVZD-1), (Uradni list RS št. 43/2011)

6.2 General US codes

- 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants"
- 10 CFR 50.63 "Loss of all Alternating Current Power"
- 10 CFR 50.48 "Fire Protection"
- 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety,"
- 10 CFR 50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"
- 10 CFR 21, "Reporting Of Defects And Noncompliance";
- IAEA Safety Standard Series No. NS-R-1, Safety of Nuclear Power Plants

6.3 USNRC Regulatory Guides

- RG 1.1, "Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal System Pumps (Safety Guide 1);
- RG 1.100, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants "
- RG 1.137, "Fuel Oil Systems for Standby Diesel Generators";
- RG 1.157, "Best-estimate calculations of emergency core cooling system performance";
- RG 1.180, "Guidelines for evaluating electromagnetic and radio-frequency interference in SR instrumentation and control systems"

- RG 1.217, Revision 0 – “Guidance for the Assessment of Beyond-Design-Basis Aircraft Impact”; U.S.NRC; 2011;
- RG 1.27, Revision 1 – “Ultimate Heat Sink for Nuclear Power Plants”;
- RG 1.29, Revision 1, “Seismic Design Classification”, , August 1973
- RG 1.32, “Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants”;
- RG 1.52, Revision. 3, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants”;
- RG 1.6, “Independence between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems”;
- Regulatory Guide 1.60, “Design Response Spectra for Seismic Design of Nuclear Power Plants”;
- RG 1.61, Revision 1, “Damping values for seismic design of nuclear power plants”
- RG 1.75, Revision 3 “Criteria for Independence of Electrical Safety Systems”; U.S.NRC; 2005;
- RG 1.76 Revision 1, “Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants”.
- RG 1.82, “Water sources for long-term recirculation cooling following a loss-of-coolant accident”;
- RG 1.89, Revision 1, “Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants,” Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC, June 1984.
- RG 1.9, Revision 3, “Selection, Design, Qualification and Testing of Emergency Diesel Generator Units Used as Class 1E Electric Power Systems at Nuclear Power Plants, , July 1973;
- RG 1.97, Revision 3, “Criteria for accident monitoring instrumentation for nuclear power plants”
- Regulatory Guide 1.122, “Development of Floor Response Spectra for Seismic Design of Floor Supported Equipment and Component”,
- Regulatory Guide 1.142, “Safety Related Concrete Structures for NPP (other than Reactor Vessel and Containment)”;
- RG 1.189, Fire Protection for Nuclear Power Plants
- Regulatory Guide 1.199, “Anchoring Components and Structural Supports in Concrete”;
- RG 5.71 Cyber Security Programs for Nuclear Facilities

6.4 Codes and Standards

- ACI 301 Specifications for Structural Concrete of Buildings
- ACI 318-08 Building Code Requirements for Structural Concrete
- ACI 349-06 Code Requirements for Nuclear Safety-Related Concrete Structures
- ACI 207.1R-05 Guide to Mass Concrete
- ACI 207.2R-07 Report on Thermal and Volume Change Effects on Cracking of Mass Concrete
- ACI 231R-10 Report on Early Age Cracking
- ACI 305R-10 Guide to Hot Weather Concreting
- ACI 306R-16 Guide to Cold Weather Concreting
- ACI 351.3R-04 Foundations for Dynamic Equipment
- ACI Journal TP 105-M07 Heat Loss compensation in Semi-adiab Curing Test
- ACI Journal TP 103-M40 Evaluation of Temperature Prediction Methods for Concrete Members
- ACI 311.5R-97 ACI Manual of Concrete Inspection
- ANSI/AISC N690-2006: American national standard specification for the design, fabrication, and erection of steel safety-related structures for nuclear facilities;
- ASCE-4-16, Seismic Analysis of Safety-Related Nuclear Structures and Commentary
- ASTM C1074 - 11 Standard Practice for Estimating Concrete Strength by the Maturity Method

- ASME BPVC Section III, Nuclear Components, Class 2&3, 1971 Edition through Winter 1972 Addenda for the interfaces to the existing systems;
- ASME Code Section II, III, V, VIII, IX that has been adopted and referenced in 10 CFR 50.55a
- ASME Code Section XI, 2007 Edition with the 2008 Addenda for fourth interval in-service inspection examination
- ANSI N18.2 - "Nuclear Safety Criteria for Water Reactor Plants"; ANS; 1973;
- ANSI/ANS- 58.6, "Criteria for Remote Shutdown for Light Water Reactors"; R2001 (1996)
- ANSI/ANS-5.1(N18.6) "Decay Heat Power in Light Water Reactors"; ANS; 1994 (1973)
- ANSI/ANS-58.14, Safety and Pressure Integrity Classification Criteria for Light Water Reactors
- ANSI/ASME N509-1989, 'Nuclear Power Plant Air Cleaning Units and Components';
- ASME AG-1-1997, "Code on Nuclear Air and Gas Treatment";
- ASME AG-1a-2000 Addenda to ASME AG-1-1997, December 2000
- ASME N510-1989, "Testing of Nuclear Air Treatment Systems";
- ASME NQA-1 "Quality Assurance Requirements for Nuclear Facilities Application" 2008 edition with 2009 addenda
- ANSI/ASNT standard CP-189 Standard for Qualification and Certification of Nondestructive Testing Personnel
- SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing
- IEEE 323-1974, "Qualifying Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers" and newer versions of standard IEEE 323
- IEEE 336-2005, "Recommended Practice for Installation, Inspection, and Testing for Class 1E Power, Instrumentation, and Control Equipment at Nuclear Facilities";
- IEEE 338-2006, "Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems";
- IEEE 344-1987 "Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"
- IEEE 379-1972, "Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems";
- IEEE 383 (1974 and newer versions), "Standard for Type Tests of Class 1E Electric Cable, Field Splices, and Connections for Nuclear Power Generating Stations," Institute of Electrical and Electronic Engineers"
- IEEE 382 (1980 and newer versions), "IEEE Standard for Qualification of Actuators for Power Operated Valve Assemblies with Safety-Related Functions for Nuclear Power Plants";
- IEEE 384-1984, "Standard Criteria for Independence of Class 1E Equipment and Circuits";
- IEEE 387-1984 IEEE Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations;
- IEEE 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations";
- IEEE 603-1991, "Criteria for Protection Systems for Nuclear Power Generating Stations";
- IEEE 627-2010 (Revision of IEEE 627-1980), "IEEE Standard for Qualification of Equipment Used in Nuclear Facilities", for the for new systems/components(DEC)
- IEEE 741-1986, IEEE Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations
- IEEE 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations";
- IEEE 308-1980, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations";
- IEEE's as specified in the USAR Section 3 for the existing systems/components

6.5 Other Supplemental Criteria and Information

- NEI 07-13, rev.8P – "Methodology for Performing Aircraft Impact Assessments for New Plant Designs"; NEI; 2011.

- NFPA 803-1989 “Standard for Fire Protection for Nuclear Facility Applications”
- NUREG-0700, Rev.2, “Human-System Interface Design Review Guidelines”.
- NUREG-1465, Rev.0, “Accident Source Terms for Light-Water Nuclear Power Plants”;
- SECY 11-093 with enclosure “Recommendations for Enhancing Reactor Safety in the 21st Century”.
- SECY 11-093 with enclosure “Recommendations for Enhancing Reactor Safety in the 21st Century”.
- NUREG-0588 Revision 1, “Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment”.
- ASME QME-1-2007, “Qualification of Active Mechanical Equipment used in Nuclear Power Plants”.
- NUREG-0800, SRP 3.11, “UNITED STATES NUCLEAR REGULATORY COMMISSION, Standard Review Plan (SRP), Environmental Qualification of Mechanical and Electrical Equipment”, Rev.3.

6.6 Other NEK Supplemental Criteria and Information

- Zakon o gradbenih proizvodih, Ur.l. RS, 52/2000
- Zakon o tehničnih zahtevah za proizvode in o ugotavljanju skladnosti, Ur.l. RS, 17/2011
- Odredba o seznamu standardov, katerih uporaba ustvari domnevo o skladnosti gradbenih proizvodov z zahtevami Zakona o gradbenih proizvodih, Ur.l. RS, 103/2011
- Pravilnik o mehanski odpornosti in stabilnosti objektov, Ur.l. RS 101/2005
- Odredba o seznamu standardov, ob uporabi katerih se domneva skladnost z zahtevami Pravilnika o mehanski odpornosti in stabilnosti objektov, Ur.l. RS, 8/2011
- Fire Protection
- Zakon o varstvu pred požarom, Ur.l. RS 3/07, 9/11
- Pravilnik o požarni varnosti v stavbah, Ur.l. RS 31/04, 10/05, 83/05, 14/07
- Pravilnik o študiji požarne varnosti, Ur.l. RS 28/05, 66/06, 132/06
- Pravilnik o protieksplzijski zaščiti, Ur.l. RS 102/00, 91/02, 16/08, 1/11, 17/11, 103/11
- Tehnična smernica TSG-1-001:2010; Požarna varnost v stavbah
- SIST DIN 14090: Površine za gasilce na zemljišču

6.7 NEK Programs, Procedures and Licensing documents

SP-S702,	Seismic Analysis, Testing and Documentation, Rev.10
ADP-1.0.131,	Organizacija izvedbe modifikacije
ADP-1.1.033,	Varnost in zdravje pri delu v Nuklearni elektrarni Krško
ESP-2.113	EAM MECL equipment numbering system
ESP-2.301,	Technical Specification Changes and Licence Amendments
ESP-2.302	Administration of Changes to the Updated Safety Analysis Report (USAR)
ESP-2.303,	Evaluation of Changes in Nek
ESP-2.307,	Administration of Changes to the Design Extended Conditions Technical Specifications (DECTS)
ESP-2.602,	Plant Design Modifications
ESP-2.604,	Design Considerations, Bases and Input
ESP-2.605,	Design Analyses and Calculations
ESP-2.611,	Design Modification Turnover and Closeout
ESP-2.613,	CAD Drawing Control of Scanning, Conversion or Revision Process
ESP-2.617,	Material and Equipment Specification
ESP-2.618,	System Design Description
ESP-2.619,	Preparation of Installation Packages
ESP-2.624,	Design Impact Evaluation
ESP-2.651,	EQ Program in Design Modification Process
ESP-2.650,	Environmental Qualification Program Instructions

ESP-2.609	Field design Change Request
ESP-2.951	Process Computer Signal Configuration Database Control
SP-A501	Painting of Equipment in Containment and Auxiliary Buildings
SP-A504	Coating Material for Equipment in Containment and Auxiliary Buildings
SP-G375A	Piping Line Specifications Non Safety Class Piping Krško Nuclear Power Plant
SP-G508A	Nuclear Safety Class Valves;
SP-G528A	Fabrication and Installation of Nuclear Safety Class Piping;
SP-H500	Pipe Supports
SP-J200,	Reinforced Concrete Including Formwork
SP-J201,	Placement of Reinforcing Steel
SP-J204,	Reinforcing Steel Splices
SP-J300	Fabrication and Delivery Of Reinforcing Steel
SP-J301	Fabrication and Delivery Of Structural Steel
SP-J302	Embedments and Anchor Bolts
SP-J303	Miscellaneous Steel
SP-J305,	Grout
SP-J500,	Reinforcing Steel Fabrication and Delivery
SP-J502,	Embedment and Anchor Bolts
SP-J505,	Grout
ADP-1.0.051	Klasifikacija dokumentov in informacij po stopnji zaupnosti in ravnanje s podatki in dokumenti, ki vsebujejo poslovno skrivnost

7 AFFECTED SYSTEMS

AB, AF, AS, CH, DC, DG, EE, FD, FP, LS, PC, PW, RB, RC, RH, SI, TZ, VA, WT

8 IDENTIFICATION OF AFFECTED EQUIPMENT

Interfaces with 1024-BS-L BB2 building support systems

The interface with the existing components and systems within the project BB2 building with support systems (Mod. 1024-BS-L) is mainly in the connection to the existing FP system, FD which will be connected to the existing plant meteorological exhausts. The modification will also invoke underground water well and all support systems to make BB2 building operable. Demineralized water connection point for initial filling of both tanks will be provided with connection point to the existing WT system in CCB 94.

There are also interfaces with other modifications which will be installed in to the BB2 building. For details see CDP 1024-BS-L.

Interfaces with 1010-AF-L Alternative Auxiliary Feedwater

The interface with the existing components and systems within the project AAF (Mod. 1010-AF-L) is mainly at the point where new piping will be connected to the existing AF, in RB room 03A and 03B. Containment penetrations will be installed using spare penetration locations S-1122-223.5 and S-1122-226.3.

Interfaces with 1005-SI-L Alternate Safety Injection

Interfaces with the existing components and systems with the project ASI (Mod. 1005-SI-L) are mainly piping on SI located in Reactor Building (el. 100, 115).

As required, standard piping containment penetrations will be installed. Spare penetration S-1043-0280 in Intermediate Building will be used.

Interfaces with 1030-EE-L Safety Upgrade of Emergency Alternate Power Supply

Interface with the existing components and systems with the project 1030-EE-L Safety Upgrade of Emergency Alternate Power Supply is the connection of 6,3 kV loads to the MD3 bus, the 400 V connection to the EE104SWGLD32 bus and 125 VDC connection to the DG3 DC panel.

9 REVIEW AND VERIFICATION OF THE WORK

The Contractor is required to perform a detailed "line-by-line" checking operation, review and/or verification of the changed portion of all documents in the Plant Design Modification package per ESP-2.607.

The Contractor shall provide a copy of all reference documents (pages) used in calculations as an appendix to the calculation or design input documents so that the NEK review of the Contractors review process can be expediently performed.

10 SCHEDULE REQUIREMENTS

Critical Schedule Completion Milestones:

Contract awarded	T0
PMM and PQP delivery	T0+1M (month)
Documentation for Construction Pit	T0+6M
Construction Pit	T0+11M
Documentation per ZGO	T0+11M
Development of BB2 Floor Response Spectra	T0+11M
Building construction (start-finish)	T0+11M to T0+33M
Equipment specifications	T0+11M
DMPs delivery	T0+18M
Major equipment delivery	T0+33M
IP delivery	T0+24M
Equipment installation	T0+26 to T0+46
Outage installation activities	October 2019, April 2021
SAT	October 2019, April 2021
SUP	TF
TS and USAR Change (approved by SNSA)	T0+24M
Essential Drawings (ESP-2.602)	TF
Operability Declaration	TF
TOP	TF+4M
Project close out	TF+5M

T0 – effective date of Contract (beginning of contract execution)

TF – April 2021 – outage – SAT/SUP completed

M – Months

11 STATUS REPORTING REQUIREMENTS

- Reports of Design Activities Progression
- The Contractor shall provide to NEK a monthly written status report for design work being completed, started, open problems, planned activities in next month and delayed.
- Reports of Completion of Particular Installation Activities
 - BB2 Building Construction
 - Underground well system Construction
 - Status of particular purchasing of major equipment
 - Risk management report (risk and contra measures)
 - Status of Open Action Items
 - Construction and Installation works
 - FAT
 - Status of PDR's (applicable after first FAT)
 - Major and Associated Equipment Installation
 - Pre-Outage Installation Activities
 - Outage Installation Activities
 - SAT
 - Commissioning

11.1 NON-CONFORMING

Any deviations or design changes which are not fully in accordance with the technical or quality assurance requirements of the procurement documents and which the Contractor desires to accept, must be accepted by the Purchaser. Any such deviation request must be made in writing by means of a Deviation/Change Request Form submitted to the Purchaser for acceptance prior to continuing work.

Non-conformance with specification requirements and applicable codes and standards invoked by this specification will not be accepted until approved by NEK. When such a condition exists, the Supplier shall initiate a non-conformance report (NCR) using the Contractor's standard non-conformance document, which identifies the non-conformance and the Contractor's proposed disposition.

The Contractor shall:

- a. Segregate the non-conformance item to prevent any further processing which may result in a change of the non-conformance as identified
- b. Make the NCR available to the responsible NEK Representative for review to ensure the non-conformance is completely identified and accurately stated
- c. Transmit the NCR with non-conformance disposition to NEK in an expeditious manner. The Supplier shall provide technical justification for the recommended dispositions.

The requirements of the specification are binding; no departures are acceptable without the prior consent of NEK.

The NCR shall provide the method by which the Supplier shall obtain a documented response and approval from NEK when non-conformances are identified. The use of NCRs will pertain to the work at the Contractor and/or Sub-Contractor's shops.

Once the item is identified with an NCR, the NCR shall remain assigned to that item permanently and NEK shall be advised of the originating NCR.

11.2 10CFR21 Reporting

Safety related items and services are subject to the provisions of Title 10 of the U.S. Code of Federal Regulations Part 21: Reporting of Defects and Noncompliance.

For Safety Related Items and/or services ordered from the USA, Contractor and Subcontractor reporting pursuant to 10CFR21 shall be made to the US NRC and NEK Procurement Support (ING.POD) Superintendent. For Safety Related Items and/or services supplied from outside the USA, Contractor and Subcontractor shall be subject to the reporting pursuant to 10CFR21 to the NEK ING.POD Superintendent only.

12 WORK OR INFORMATION TO BE PROVIDED BY NEK

NEK shall:

- Designate a NEK Safety Upgrade Coordinator who will serve as the principal interface with the Contractor and provide the overall project coordination.
- Designate a Project Manager or Project Responsible Engineer who will serve as the principal interface with the Contractor on the individual modification.
- Site Safety Supervision and Access Training organization.
- Purchase Required Safety Related Power, Control and Instrument Cables based on the BOM provided by the Contractor.
- Purchase Required Conduits, Conduit Couplings and Fittings based on the BOM provided by the Contractor.

NEK or his suppliers will have supervision in accordance with ZGO.

The Purchaser will provide all interface information for other modification which are not within the scope of this modification and have influence on to this project.

The Purchaser will provide access for onsite inspection to all the areas where new systems, major equipment and accessories will be located.

Upon request, the Purchaser will provide all available as-built documentation.

Whenever Purchaser approval is required in this specification for submittals, procedures, methodologies, approaches or options, such approval shall be provided in writing or if provided orally shall be confirmed in writing.

The Purchaser will perform all preliminary and final design documentation review and approval.

Approvals & Inspections - the Purchaser's Project Controls scope includes the provision of personnel, supplies, facilities, software, and equipment necessary to perform all cost and

schedule functions for the overall project. The Purchaser will maintain overall responsibility for outage management of all NEK activities which include the Contractor's work activities. The Purchaser has performed all necessary geological soil investigations at the location of the new building. The geological investigation report will be provided to the Contractor after the Contract award.

NEK will nominate coordinator (Koordinator I) for Safety at work in accordance with "Uredba o zagotavljanju varnosti in zdravja pri delu na začasnih in premičnih gradbiščih", (Uradni list RS št. 83/2005) for preparation phase.

13 CHANGES OF WORK SCOPE

The scope of work and services is fixed and firm.

14 DELIVERABLES TO BE PROVIDED BY THE CONTRACTOR

14.1 BID Phase

Note: During Bidding process the term Contractor shall be considered as Bidder.

The bidding documentation shall consist of the following chapters:

1. Project Schedule
2. Contractors Technical Approach to the project
3. At least two competitive bids for the items from the Attachment 22.7: AAF pump, ASI pump, Well pump, ABWT Tank, ACY Tank and HVAC System.
4. Technical proposal with sufficient explanation of technical solutions for each modification (DMP) and document explaining the integration of all system into the new systems shall be provided.
5. Compliance with technical specification matrix
6. Related drawings
7. List of used standards
8. Contractor's QA Manual in accordance with the item 20 of this specification
9. PMM and preliminary PQP

Note: Bidder can mark bidding documentation as proprietary; it can be marked everything except price per item, number of items to be delivered and total price.

Bidder shall state its compliance to this specification as a whole or in part and specify any and all other proposed approach to fulfill specific requirements.

Detail instruction about preparation of the Bid is described in document "Instructions to Bidders"

14.2 Project Execution Phase

All document deliverables shall be submitted in two versions as a minimum: for NEK review and FINAL version to be approved by NEK. All documents for review shall be delivered to NEK in three hard copies (paper) and one soft copy (pdf files structured with bookmarks and active cross reference links). All final documents shall be delivered in six hard copies and six soft copies (CD with files in format as applicable: structured pdf, MS Word, Excel, Access, AutoCAD).

The documents shall be formatted in files and printed as hardcopies in A4, A3, or A2 sizes only. The exceptions could be related only to the revisions or mark-ups of the existing NEK drawings that could be formatted in different (larger) formats.

In addition to the DMP project documentation that shall be delivered as a structured set of pdf files, Contractor shall deliver the following documents (potentially to be revised in future), in

their original file format that can be revised by NEK when and if needed (two copies of files on transportable media – CD are sufficient):

- FAT and SAT procedures MS Word(.docx)
- Textual parts of Procurement Specification, DMP and IP in MS Word
- Drawings in AUTOCAD (ACAD dwg format file)
- Spread sheets in Excel
- Data bases in Access, SQL or Oracle
- Training materials (lessons and exercises) in MS Word
- Training presentations in MS PowerPoint (pptx files)

All the submitted documents shall bear at least the following identification:

- Contractor's Name
- Date of issue
- Document number
- Revision number
- NEK's Order Number
- NEK's Specification Number

Final drawings shall be prepared in a form required by NEK procedure ESP-2.613 and shall be ready to be entered to NEK Document Control Module.

The design documentation has to be prepared according to the two different code requirements:

BB2 building civil construction Documentation according to the Slovenian Construction Code (ZGO)

- Project for getting approval for construction (PGD) (projekt za pridobitev gradbenega dovoljenja)
- Project for construction (PZI) (projekt za izvedbo)
- As built documentation (PID) (projekt izvedenih del)
- Documentation for getting license approval (dokumentacija za tehnični pregled)

Licensing documentation according to the Slovenian Construction Code requirements (ZGO) for:

- documentation for environmental approval (pridobitev okoljevarstvenega soglasja)
- approval for work (pridobitev dovoljenja za gradnjo)
- water approval (approval for water wells, additional discharge to river Sava)
- technical inspection by the Slovenian state commission (tehnični pregled)
- approval for the use of the new building (uporabno dovoljenje)

All on site and licensing documentation according to the Slovenian Construction Code /ZGO) shall be in Slovenian language.

Documentation according to NEK ESD procedures

- a. Detailed Procurement Specifications as described in 2.6 above
 - Procurement Specifications
 - BOMs for the remaining material per each modification and discipline
- b. Design Modification Packages (DMPs) for mechanical/piping, electrical and I&C work shall be prepared in accordance with the requirements of ESP 2.602, including all other applicable ESD procedures (acc. to Sect. 6.7). Contractor shall prepare DMP according to NEK procedure ESP-2.602, Plant Design Modifications for NEK review and approval. DMP shall be reviewed and approved by NEK prior to the installation. Before the submittal to NEK for review, the preliminary DMPs shall be subject to an independent review cycle organized and implemented by Contractor. After resolution of all comments as well as corrections related to the results of independent review cycle are implemented, the preliminary DMPs shall be submitted to NEK for review. The need for expeditious changes to the "Approved for implementation" DMPs shall be covered by the FDCR (Field Design Change Request) document prepared in accordance with NEK procedure

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- ESP-2.609. DMPs shall be developed for each project/modification as described in item 2.1 of this specification.
- c. **Calculations / Analysis Reports**
Design calculations shall consider operation during normal conditions, OBE, SSE, DEC and plant operational transients. Contractor shall define applicable acceptance criteria for each analysis. Calculations shall be prepared in accordance to NEK procedure ESP-2.605.
 - d. **TS and USAR changes (10CFR50.59)**
Contractor shall prepare necessary technical documentation according to NEK procedures ESP-2.301, Technical Specification Changes and Licensing Amendments, ESP-2.302, Administration of Changes to the Updated Safety Analysis Report (USAR) and ESP-2.303, Evaluation of changes in NEK to apply for SNSA license.
 - e. **Installation & Manufacturing Data**
The documentation pertaining to installation and manufacturing shall comprise the following as a minimum:
 - Index
 - The last revision of the installation and inspection plan showing the identification number of all records
 - Records of all the manufacturing and inspection operations chronologically scheduled in the installation and inspection plan
 - Bill of materials
 - Certificates of Compliance (CofC)
 - Non Conformance Reports (NCRs) All certificates required by materials Specifications
 - All certificates required by filler materials Specifications
 - Welding reports
 - Welding procedure qualification records
 - Heat treatment certificates
 - Deviation reports
 - Repair reports
 - Welders qualification records
 - As-built parts lists
 - Radiographs (originals)
 - All NDE records, etc.
 - Final cleaning Specification
 - Packing Specifications
 - Transportation Specifications
 - Other categories of records
 - f. **Factory Acceptance Test (FAT) procedure**
Contractor shall provide a Factory Acceptance procedure to exercise the full scope of equipment functional and performance testing.
 - g. **Site Acceptance Test (SAT) procedure**
Contractor shall prepare Site Acceptance procedures to exercise the full scope of functional and performance testing, including power testing, which may not have been possible during FAT.
 - h. **Installation Phase**
 - Installation Packages in accordance with NEK ESP 2.619
 - End of Operation Reports
 - i. **Final Documentation**
Essential drawings shall be furnished by Contractor to NEK as soon as possible but not later than when the systems are ready for Operability declaration.
 - j. **As Built drawings**
They include all affected and new drawings reflecting as built configuration. Essential drawings shall be delivered before the declaration of operability.
 - k. **Turn Over Package (TOP)**

Maximum 6 months after the installation completion, the Contractor shall prepare TOP according to NEK procedure ESP-2.611 Document Turnover and Closeout for NEK review and approval.

14.3 Additional Requirements

14.3.1 General Requirements

All documents (including drawings, graphs, ...) submitted shall be in the form of hard copies and electronic media. Hard copies shall be in the form of three good quality full-size reproducible and three good, sharp, black and white, direct-contact prints of the Contractor's original drawing. Electronic media shall be in a format fully compatible with the following software:

- Word Processing: Microsoft Word
- Spreadsheet: EXCEL©
- Computer-aided Drafting: AutoCAD©
- Planning & Scheduling: PRIMAVERA©

Additional details shall be defined between Contractor and Purchaser (like paper format A4, "dictionary" for Primavera software, etc.) after Contract award.

The Contractor shall furnish a complete set of the drawings.

- A black line reproducible and hard copy of each drawing shall be submitted with the transmittal stating the application and drawing status. A unique drawing number shall be defined by NPP Krško.
- The outline drawings shall provide sufficient outline dimensions to permit arranging space in the plant to accommodate the installation and maintenance of the newly installed equipment. As a minimum, the outline drawings shall provide overall dimensions, nozzle sizes, nozzle orientation, pipe weld end preparations, tolerances, foundation mounting details, including size and orientation of integral support structure, the location of piping and instrumentation connections and all other interfaces that will require connecting in the field. These physical outlines must clearly indicate any differences in size and space requirements as compared to the as-installed equipment. For maintenance purposes, the access for repair and inspection openings and manway cover handling shall be indicated.
- Assembly and detailed drawings including manufacturing programs shall be submitted prior to start of manufacturing or procurement of related items. These drawings shall show all operations to be carried out.
- Detail drawings shall contain information as to welding procedures, materials and process Specifications, materials ordering and procurement Specifications.

The Contractor also shall furnish all testing procedures related to modified systems. All Contractor documents shall bear at least the following identification:

- Date of issue
- Document number
- Revision number
- Supplier name and location
- Supplier's employee responsible for the preparation of the document
- Mandatory construction code
- Other organizations participating in the manufacturing
- Supplier's order number.

Two sets of the Final Documentation shall be submitted to Purchaser in a collected delivery four months after Operational Delivery and irrespective of the fact that individual documents of the Final Documentation were submitted to The Purchaser in an earlier stage. The Final Documentation is required to contain at least, the following:

- The Documentation of the Technical Supervision and Testing. One of the sets of these documents shall be original carrying the original signatures.
- The "As-Built" drawings

- The Updated NEK Technical Specification
- The Updated Safety Analysis Report
- The Technical Manuals
- Equipment Quality Report
- Dedication Packages
- Qualification Reports
- Approved Installation Procedures

To the extent any document required to be included in the Final Documentation has not been subject to review and approval by Purchaser, the Contractor shall arrange for such review and approval prior to its insertion in the Final Documentation set.

14.4 Tools for mechanical design area

Mechanical design and analysis shall be performed with Bentley® design software. Should Contractor use other software, it shall have capability to export data into Bentley® formats used by NEK. Used software shall be capable to produce isometric drawings, bill of material and perform piping and pipe support calculation. Mechanical design shall be done by using state of the art technology for the software tools resulting in interactive correlation between different series of drawings and documents. Find below the standard tools used by NEK for existing modification process:

Scope of work	Software tools	Version
Classical drafting	AutoCad	one of the latest two
Building Modeling	AutoCad or 3D software which is compatible with AutoCad	one of the latest two
Piping Modeling	Bentley AutoPlant V8i	one of the latest two
Fluid analysis	Bentley PlantFlow Plus	one of the latest two
Piping Stress Analysis	Bentley AutoPipe Nuclear	one of the latest two
Pipe Nozzles Analysis	Bentley AutoPipe Nozzle	one of the latest two
Modeling of Pipe Supports	Bentley STAAD.Pro V8i Nuclear or AutoCad or Inventor Professional	one of the latest two
Modeling of equipment	AutoCad	one of the latest two
Cable Raceways	Bentley AutoPlant V8i or AutoCad	one of the latest two
Ventilation raceways	3D software which is compatible with AutoCad	one of the latest two

All software used shall comply with the requirements of ASME NQA-1 2008, Addenda 2009.

14.5 Structural analysis and design software

Structural analysis and design requires a software package, which passes the nuclear industry software validation requirements. The software package includes 2D and 3D design software and the software for concrete and steel building finite element modeling, analysis and design in accordance with international structural codes. Purchaser's preferred tool for 2D or 3D design modeling and for structural analysis and design are AutoCAD [AutoDesk, Inc], STAAD.Pro V8i [Bentley Systems, Inc], SASSI, LS-DYNA and SHAKE, or equivalent computer software are acceptable tools for the seismic analysis. Verification and validation of the software shall be performed in accordance with ASME NQA-1 Part 1, Requirement 3, 800 Software Design Control; Part II, Subpart 2.7 Quality Assurance Requirements for Computer Software for Nuclear Facility Applications.

Any other software may be used provided that the proposed software nuclear industry software validation requirements To comply with the Purchaser's requirements, the proposed structural analysis and design software must have at least the following characteristics:

- **Linear models.** The linear models should include line elements for modeling frame structures; shell elements (which capture both the shear and bending deformations) used to model walls, floors, tanks, vessels and other walled areas; and solid element used to model three-dimensional elements.
- **Non-linear models.** The non-linear models should include the link elements for modeling gaps, hooks, dampers, friction isolator.
- **Soil structure interaction.** Linear, direct, soil structure interaction (SSI) methodologies
- **Section designer.** The software must offer a tool for generating one- or bi-axial interaction diagrams for concrete sections and calculation of moment-curvature relationship.
- **Loading.** The software must be capable of analyzing the structures exposed to code-based static and dynamic loading. Dynamic loading should offer at least the generation of wind, seismic, moving and wave load models.
- **Analysis.** The software must offer the possibility of linear static analysis and linear (time history and modal response spectrum)
- **Design.** Structural design must include at least concrete and steel design tools according with applicable American and European structural design codes.
- **Interoperability.** The software must be capable of interoperability with the software packages for data base management (e.g. MS Excel) and the CAD models (in *.dwg or *.dxf format).

Output. Output must include the following information: visualization of deformed geometry, internal forces (moment, shear and axial) diagrams, video animations of modal shapes and time history response and possibility to calculate the resultant internal forces across any cut of the structure. The software should have a tool for generating analysis report.

14.6 Tools for Electrical and I&C design area

The electrical system design calculations for Nuclear Utility Plants require a tool, which complies with the United States Code of Federal Regulation and includes complete software and library Verification & Validation in compliance with Title 10 Part 50, App B and Part 21. Purchaser's preferred tool is ETAP, which offers the following: arc flash evaluation, load flow analyses, short circuit studies, transient stability studies, protection coordination, cable ampacity calculations, DC analyses, Battery Sizing, Battery Discharge and Control Calculations. If the Contractor doesn't use the preferred software for electrical system design, the proposed software must at least meet the above requirements.

Contractor shall use raceway and cable systems design tool, which shall be capable to provide efficient complete layout, routing, and material estimating functions in a single, integrated system for raceways, cable trays, conduits, and the cables that run through them. It shall at least have the following functions:

- Detailed 3D design for accurate visualization and quantity take-offs,
- Automatic cable routing,
- Automatic report generation: bill of materials, cable schedules, cable pull cards,
- Automatic 2D drawing extraction from 3D model,
- Parametric raceway engine,
- Cable fills and weight calculations.

Purchaser's preferred choices are Bentley AutoPLANT Raceways V8i or/and Raceway and Cable Management V8i. If the Contractor doesn't use the preferred software for raceway and cable systems design, the proposed software must at least meet the above requirements.

Purchaser uses PC-CKS software database for conduits, cables and cable trays design. Contractor's chosen software for raceways and cable systems shall enable easy transfer from the new database into the existing PC-CKS database.

Contractor shall, in its project manual, in detail describe which software tools will be used for the design and for reproduction of the drawings and how it will maintain NEK equipment numbering system including cable and wire numbering, use of NEK drawings symbols, drawings format (headers) and series (206, 207, 208, 302, 911, 912, etc.). If the Contractor is using its own software tools, its outputs (calculations, drawings ...) shall be compatible with NEK software and in accordance with NEK requirements for drawings.

Software shall be able to maintain configuration control regarding use of wire-marks, terminal blocks and contacts from relays, switches and/or other devices. From the same database, drawings with wiring diagrams, one line diagrams, panels and equipment layouts shall be produced (NEK series 206, 207, 208, 209, 210, 809) together with the bill of material. Drawings shall be in AutoCAD format. Bill of material can be in MS Word, Excel, or compatible with those formats.

15 RECORDS

The Contractor shall turn all reproducible drawings and other documents such as any changes to plant procedures, equipment technical specifications, USAR updates, and reviewers checked drawings and documents over to the ING PM.

All documents have to have unique identification number with revision and need to be sorted into group and subgroup. Details have to be explained in to the PMM.

15.1 Records System

A records system shall be established and maintained by the Contractor to provide documentary evidence of the quality of items and activities affecting quality. The quality assurance (QA) records shall include results of reviews, inspections, tests, audits, monitoring of work performance, and material analyses. Records shall, as a minimum, identify the inspector or data recorder, date inspection was performed, type of observation, procedures used, results, acceptability, and action taken with any deficiencies noted. Collection, storage and maintenance of records shall be in accordance with the requirements of ASME NQA-1.

Additional records or supporting data shall also be maintained. All quality verification records, procedures, and qualifications shall identify the item or activity involved.

These records shall be retrievable and available for examination. One copy of all documents (including computer software and any referenced documents) required by this Specification, applicable regulations, codes and standards, or generated as a result of the Contractor's QA program shall be transferred to the Purchaser.

Responsible persons for generating, completing, or reviewing records shall ensure the following requirements are met:

- A. Assure Records are technically correct in accordance with applicable procedures.
- B. Assure Records are complete including all attachments. Records shall be reviewed to assure all required data, i.e., signatures, dates, etc., have been completed or marked "Not Applicable" (N/A) as required.
- C. Assure corrections to data have been made properly. Corrections to data shall include the date and the identification of the person authorized to make the correction. Examples of corrections are line through, write overs, white-out, correction tape and any other correction method. This is required anytime when record data (numbers, or the meaning, intent, or integrity of a record) is affected by a correction. This is not required for other information that is not considered data.

- D. Assure that records are legible - can be clearly read and suitable for microfilming. The original of all records should be transmitted to the Purchaser as the record. If a record is not legible one of the following methods shall be met:
- a. The illegible area of the record shall be enhanced by tracing or writing the information clearly on the record or by submitting additional information for clarification of the illegible area. The Contractor person authorized to perform this function shall initial and date the area enhanced or clarified.
 - b. If the record cannot be enhanced, the records shall be marked "Best Copy Available", and the marked record shall be initialed and dated by the responsible organization's supervisor or designee.

15.2 Code Reports

All installation works have to be documented in Final Report in accordance with ESP-2.619. Part of the Final Report shall also be statement that all installation works have been performed in accordance with Code requirements.

15.3 Design Reports

The Contractor shall prepare a complete design report in compliance with the ASME Boiler & Pressure Vessel Code, Section III: Appendix C - Article NCA-3550. The Contractor shall certify that the equipment furnished conforms to the specification requirements.

The report shall be certified by a Registered Professional Engineer qualified in accordance with ANSI/ASME N626.3 and shall discuss all loads (impact, static, seismic, and cyclic) and confirm that the equipment function will not be impaired under these loads.

A completed report shall be submitted to the Purchaser for review per ASME Section III requirements.

The Contractor shall furnish three (3) copies of a complete stress report for NPP Krško application. All technical reports, methodologies, calculations, or analyses provided to support the design, fabrication; installation and operation of the piping for Safety Upgrade Program shall also be submitted and become the property of the Purchaser at the time of delivery of the items.

Each portion of piping in Safety Upgrade Program shall be capable of withstanding the loads resulting from all steady-state and transient operating conditions, seismic disturbances, postulated pipe break conditions and design extension requirements and shall be verified by using acceptable methods which indicate that the stresses satisfy the requirements of ASME III. The results shall be included in the ASME III required Design Report.

Conformance with ASME III requirements shall be demonstrated in the Design Report. The Contractor shall identify in the Design Report other relevant incidents, if any, in addition to the previously listed categories, and shall analyze them in accordance with ASME III.

15.4 Installation Records

After installation and completion of Safety Upgrade project and related modifications all documents developed in installation phase become records and shall be provided by the Contractor to the Purchaser. The Contractor shall provide all procedures, drawings, checklists, test results, measurements, etc.

The Contractor shall designate all procedures in accordance with PMM. For example:

- C (construction) Procedures
- F (fabrication) Procedures
- T (transportation) Procedures
- Q (quality control) Procedures
- P (painting) Procedures
- I (insulation) Procedures
- M (material handling) Procedures

- FH (flushing & hydro testing) Procedures
- O (organization) Procedures
- W (welding) Procedures

15.5 Photographs and Video records

Photographic Record

The CONTRACTOR shall provide NEK with a set of chronological photographs or video records illustrating the major construction development throughout the project. Each picture is to give time and date with a brief written explanation of the activity occurring. The document should start with an aerial layout of the site prior to project start and finish with an aerial shot of the site at conclusion of the project.

16 ORGANIZATIONAL CONTACT

The Contractor shall coordinate all technical, commercial and schedule matters with the assigned NEK ESD PM.

Technical: Istok Junkar, Project Manager

Commercial: Mrs. Vesna Deak

17 CONTRACTOR TECHNICAL APPROACH TO THE WORK

As a part of the NEK "Request for Proposal/ Quotation", the Contractor shall prepare a brief description which outlines how the work will be performed, where it will be performed, and indicates how the Contractor understands his scope of work. The quotation should also indicate if similar project applications have been performed by the Contractor.

After the contract is awarded the Purchaser expects (3) copies of the PMM, which shall involve at least the following.

- List of Contractors design, fabrication and inspection facilities
- Work scope
- Presentation how work will be performed
- Project Plan
- Organizational Chart
- Key personnel
- Purchaser Support
- Subcontractors
- Correspondence
- Project Deficiency Reporting (PDR).
- System Performance Warranty Action Request (SPWAR)

Contractor's PQP (See Item 20.5) (2copies)

The Bidder' proposal shall include his reasons to every and all section either as a general statement or specific comments or either.

The Bidder is not hindered to submit any additional documents to ensure completeness of the offer.

The Contractor responsibilities (scope of work description and scope of supply) are specified in Chapter 2 of this Specification. Additionally, this Specification also provides requirements which Contractor must follow in the work mainly specified in Chapter 4.

The Contractor shall be completely responsible for the complete scope of supply (defined in section 2) except for the activities which are specified as 'NEK Responsibilities' (section 12) defined /agreed between Contractor and NEK.

The Contractor shall be responsible for the following resources:

- All craft labor required to physically perform the work. This labor force shall possess skills to perform the work on Safety Upgrade Project at NEK.
- Craft labor supervision. Labor supervision shall possess sufficient skills and experience to competently provide day-to-day direction to the craft labor in the performance of the work.
- Field Engineering. Contractor's field personnel shall be capable, qualified, and able to perform the duties required to the satisfaction of the Purchaser and shall be vested with authority to make decisions binding on the Contractor.

The Contractor shall supply, maintain and properly store all tools, material and equipment to be used in the performance of the work such to avoid damage or deterioration. The Contractor shall perform all work in quality manner in compliance with the diagrams, drawings, plans, specifications, procedures, and codes applicable to the scope of supply.

The Contractor shall be responsible for reporting and evaluating the "as-found" condition of equipment and commodities prior to repair start.

The Contractor shall present references of good practice on work on energy facilities in particular at work on operating nuclear power plants.

The Contractor shall be responsible for material handling.

The Contractor shall be responsible for all testing and inspections required prior to restore affected system to operation.

The Contractor shall be responsible for protecting any permanent plant systems and commodities that may be encountered in the course of performing the related scope of work. Any systems or equipment that incurs damages shall be replaced by the Contractor at no additional costs to the NEK.

18 ACCESS TO CONTRACTOR FACILITY AND DOCUMENTS

The Contractor will provide access to the Contractor-s and authorized sub-contractors-s facilities the NEK Representative who are engaged in the work for the purpose of reviewing the quality and the amount of the work being performed.

19 SUBCONTRACTED WORK

Note: Based on law of ZVISJV and based on "Pravilnik o dejavniki sevalne in jedrske varnosti (JV 5)" Article 67, (nadzor podizvajalcev in dobaviteljev) Purchaser is responsible for establishing surveillance on Contractor and its subcontractors to ensure high quality and nuclear safety for the public.

http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/si/Zakonodaja/SlovenskiPredpi si/NPB/Pravilnik_JV5_za_objavo.pdf

<http://www.uradni-list.si/1/objava.jsp?sop=2015-01-2872>

All sub-contractors shall be listed in the Proposal. If the selected supplier after Contract signature wants to change or select new sub-contractor, this is subject to NEK approval.

The Contractor shall impose to its Subcontractors the requirements of this Specification. The Contractor shall ensure that all Subcontractors meet the requirements of this Specification.

Since the Contractor retains full responsibility for all aspects of Subcontractors performance (including quality and schedule), the Contractor shall ensure that adequate and periodic audit and surveillance of the Subcontractor is maintained. The Contractor shall identify to all Subcontractors all applicable Quality Assurance and Quality Control requirements imposed by the NEK's specifications on the Contractor and shall ensure compliance thereto. All subcontractors shall be on the Contractor's Approved Supplier list. NEK's right of access to the Contractor's Subcontractors' facilities for the purpose of inspection or audit shall be imposed by Contractor's documents.

During an engineering phase of the project, the Contractor has to engage qualified companies with a proven experience record of development of Design Modification Packages in accordance with NEK procedures.

Such qualified companies (subcontractors) shall assure support engineering phase and installation phase response time less than eight (8) hours to assure timely preparation and processing potential FDCR (Field Design Change Request) per NEK ESP-2.609 procedure. The Contractor shall not subcontract any portion of the Work without the written approval of the NEK Responsible Engineer.

20 QUALITY ASSURANCE REQUIREMENTS

20.1 General

General Requirements:

- The Contractor shall have QA Program which complies with 10CFR50 App. B and conforms to NEK QA requirements. . NEK QA requirements are specified in Quality Specification QS610 rev.1 - Generic Quality Assurance Program Requirements, which is attached to the Request for Quotation. The Contractor shall implement and maintain this program while carrying out the requirements of this specification. All proposed changes to the program shall be submitted and approved by the Purchaser prior to the implementation.
- The Contractor has the responsibility for QA activities for all work pursuant to this Specification. All technical and quality requirements shall be met.
- QA requirements specified in this specification apply to the Contractor subcontractors. All work performed by Sub-Contractor(s) shall be subjected to the technical and quality requirements of this Specification as well. The Contractor shall be responsible for all subcontracted activities.

20.2 Quality Manual

One (1) controlled copy of the Contractor's QA Program Manual shall be submitted to NEK with the Proposal.

20.3 Contractor's Responsibilities for Sub-contractors

The Contractor has following responsibilities regarding its Sub-Contractors:

- The Contractor shall ensure that all potential sub-contractors meet the applicable requirements of the Specification.
- The Specification requirements for procedure submittals shall apply to Sub-Contractors for operations or services not performed by the Contractor. The Contractor shall first review sub-contractor's procedures to ensure compliance with the Specification requirements, submit these procedures, and obtain the Purchaser's acceptance in writing prior to performance of sub-contractor's work. The Contractor's procedure may be used at the Sub-contractor's facilities if necessary.
- The Contractor shall ensure that the sub-contractor is aware of all testing that the sub-contractor will be required to perform, and shall identify activities that require the presence of the NEK Representative. The Contractor shall ensure that the NEK Representative has the right of access to sub-contractor's facilities and documents needed to perform inspections or witness tests.
- The Contractor shall retain full responsibility of the sub-contractor work, supervise quality and document such facts in the Final Documentation Package.

20.4 Manufacturing and Inspection Plan

The Contractor shall provide manufacturing and inspection plans, final or subsequently updated, for acceptance prior to start of manufacturing. There may be more Manufacturing and Inspection Plans when it is practical to keep control over sub systems or work on different locations.

The Contractor shall send a detailed Manufacturing and Inspection Plan(s) which shall indicate a sequence of design activities, material acquisition, fabrication, installation, operation and testing activities, with identified R (record), W (witness) and H (hold) points, approved by NEK.

NEK will identify Record, Witness and Hold point steps prior to the approval of the Manufacturing and Inspection Plan. The Manufacturing and Inspection Plan shall be approved before proceeding with any affected activity.

The Manufacturing and Inspection Plan(s) shall cover at least all relevant inspection requirements and shall outline the manufacturing and production sequence and specific preplanned Contractor's inspections that are required to be performed. The Contractor shall update The Manufacturing and Inspection Plan and submit copies thereof to NEK after changes have been approved by NEK.

For each step in the Manufacturing and Inspection Plan, the following shall be specified:

1. component (i.e. material/part/assembly/complete set),
2. type of test, activity and method (e.g. destructive/non-destructive; visual, liquid dye-penetrant, magnetic particle, X-ray, ultrasonic, probes; analysis for chemical composition, etc.);
3. standards according to which new material, construction and other parts shall be purchased, or standards/procedure according to which a test, measurement, or inspection shall be performed;
4. procedure with acceptance criteria according to the applicable standard.

If there is a Witness or Hold point, and the acceptance criteria or testing procedure is established according to the manufacturer's standard, such a standard and reference testing procedure must be made available to NEK for inspection at least three (3) days before test execution. All provided documents must be in English. The standard shall be included in the list of all applicable standards with the Bid as specified in Item 3.0 of this Specification.

20.5 Project Quality Plan (PQP)

The Contractor shall submit PQP to NEK for review and approval. PQP shall generally describe Contractor's QA approach, provide specific information concerning the interfaces between various Contractor departments/facilities and describes application of the Contractor's QA program to the activities included in the scope of work (including Contractor/procurement control, treatment of Nonconformance's, reporting of deficiencies, corrective actions implementation).

20.6 Material Control and Identification

The Contractor shall establish and maintain a system for the identification and control of all materials, parts, components and partially fabricated assemblies. These measures shall ensure that identification of the item is maintained by part number, serial number or other appropriate means, on the item and on records traceable to the item throughout fabrication, shipment and use of the item. These identification and control measures shall be designed to 1) prevent the use of incorrect, defective material, parts, components and 2) provide traceability of all parts and components. New components and spares shall be identified in accordance with ESP-2.617 (Appendix 22.5).

In the event of defective material, parts and components, records must include the ultimate disposition of the component to ensure incorrect or defective material is properly excluded from use.

All code material reconciliations shall be supplied as a part of the Quality Data Records (QDR) package, included in the section pertaining to Certified Material Test Reports (CMTRs).

Identification labels shall be provided for all components to uniquely identify each item.

Nameplates and identification plates shall be of laminated construction with white letters on a black background.

20.7 Inspections

The number of NEK inspection and audit visits related to this project are not expected to be limited to specific number. Also, NEK is not expected to cover additional costs due to inspection and audit performance.

20.7.1 Notification Points

The Purchaser shall have the right to establish notification points for which the Contractor shall give prior notification to the Purchaser. In addition, the Purchaser may establish temporary notification points if necessary to ensure resolution of temporary quality problems. Notification for Witness or Hold points require the receipt of notification at least ten (10) working days in advance of the scheduled time of performance. Alternatively, if there is a resident NEK Representative, the schedules may be submitted in advance to the NEK Representative identifying the activities which have been designated as notification points in the Manufacturing and Inspection Plan. The Purchaser may require that activities performed without proper notification be repeated for NEK Representative observation at the Contractor's expense. The NEK Representative will witness the event or will authorize the Contractor to proceed without Purchaser's witnessing of the event.

20.7.2 Hold Points

Mandatory hold points are considered to be those tests, inspections, or operations which require witnessing by the NEK Representative and beyond which operations shall not proceed without written consent of the Purchaser.

The Contractor's failure to stop at a hold point will be a cause for rejection of those items for which notification was not provided or which were not held. Hold points require receipt of notification at least ten (10) working days in advance of the scheduled time of performance.

20.7.3 Stop Work Action

When the Purchaser's Inspector is concerned about some marginal condition found by the tests and inspections specified herein, the Purchaser's Inspector shall have the right to call for an appropriate supplementary nondestructive test. The cost of the test, and the effect if any on the schedule, shall be ascertained in advance. If the test shows the component is in compliance with this specification, the cost of the test will be borne by the Purchaser. If the test shows the component is not in compliance with this specification, the Contractor shall bear the cost of the test, and shall rectify the situation to the satisfaction of the Purchaser's Inspector with no additional cost to the Purchaser.

The Purchaser will verbally notify, and confirm in writing, to the Contractor any situation where, in the judgment of the Purchaser, the Contractor or Contractor's subcontractor are performing work contrary to the conditions and terms of the procurement documents, or where continued operations could cause damage to preclude further inspection of or render remedial action ineffective for any product or service.

If, after this notification by the Purchaser, the Contractor does not commence appropriate corrective action, the Purchaser, by acting through channels previously established, will initiate work stop action on the specified product or services and so notify the Contractor in writing.

Upon receipt of notification to Stop Work from the Purchaser, the Contractor and the Contractor's subcontractor shall cease operations, including shipments, on any specified product or service to the extent stipulated in the Stop Work notification. Resumption of operations shall

not be undertaken until the Contractor has obtained a written authorization from the Purchaser. The written authorization to resume further operations will be granted only after receipt and acceptance of the Contractor's written commitment to correct those conditions itemized in the notification to Stop Work.

Contractor's Responsibility

It is not intended that the NEK Representative will relieve the Contractor in any way whatsoever of its obligation to maintain an adequate test, inspection, and documentation program, or of any obligation under this specification.

20.7.4 Release for Shipment

Prior to each shipment, the Contractor shall submit to the Purchaser's Inspector the documentation packages as required by the Specification consisting of the records applicable to the shipment, which records shall be loose-leaf bound and appropriately identified for reference and use.

20.8 Documentation

20.8.1 Certificate of Compliance

A "Certificate of Compliance" shall be submitted by the Contractor certifying that the equipment and materials are in conformance with the requirements of this specification and other specific specifications.

The Contractor will not only be required to certify the compliance of his own actions, but those of subcontractor he may use.

The Contractor and the possible Contractor's sub-contractors shall maintain adequate documentation as listed in section 14.2 hereto support the facts certified in the "Certificate of Compliance" for turnover to the Purchaser.

20.8.2 Records Systems

A record system shall be established and maintained by the Contractor to provide a documentary evidence of the quality of items and activities affecting quality. 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 item or activity involved.

Contractor's Documentation

QA & QC documents are a deliverable item. The Contractor's Quality Control Representative shall approve them, and then present them to the Purchaser for review and approval. Documentation to be transmitted with a shipment shall be adequately packaged, protected, and secured to ensure it will arrive undamaged with the shipment.

Each page of each document submitted shall be clearly identified by the Purchaser's name, purchase order numbers, equipment description and specification identification, and the Contractor's name and address. Page numbers (e.g. 1 of 5, 2 of 5, etc.) are required or tables of contents detailing attached pages. Each individual document shall be legible and shall have reproducible microform capability. No information shall be recorded closer than 20mm to the binding edge or closer than 6mm to any other edge of the paper. Also, the approval status shall be clearly identified on each document.

The Contractor shall be responsible for inspecting the item(s) and checking the applicable records, prior to shipment, to verify compliance with all specification requirements. Acceptance of the completed sets of records by the Purchaser does not relieve the Contractor of responsibility for compliance with Specification requirements.

All records required by this specification, applicable regulations, or codes and standards, or generated as a result of the Contractor's QA program shall become part of NPP Krško QA Records. The Purchaser shall be notified in advance if, at any future date, Contractor should

plan to destroy any records. At the discretion of the Purchaser, all quality assurance records and documentation related to this specification shall be transferred to the Purchaser. Certified copies of test reports shall be furnished to the Purchaser's Project Engineer each properly identified and including a description of the test covered and of the materials or equipment tested. Reports shall be submitted on all tests specified.

21 NEK PROPRIETARY DATA

NEK has a proprietary interest in all of the drawings, designs, specifications, calculations, documents, information or know-how which may be furnished pursuant to the Contract execution and 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 confidentiality provision. All developed documentation related to Technical Security shall be treated as Safeguard information.

Within the draft of the PMM the method (procedure) to handle the documentation with the Safeguard information shall be prescribed. Documents with such information shall become the confidential mark and their distribution and revision shall be done not to violate the Confidentiality policy and to limit their distribution only to the personnel qualified and responsible for their usage. Prior to the delivering of the existing drawings required for the preparation of the Design Modification packages the NEK will mark such type of drawings. On the other hand for the new drawings with such confidential content that shall be done by the Contractor based on the Criteria from the PMM. See also reference ADP-1.0.051. The confidentiality policy is applicable for the documents related to the Remote Shutdown, Transfer to the control capabilities from one to other location etc.

22 APPENDICES

- 22.1 NEK Safety Upgrade project Design Inputs and Interfaces, Rev.8
- 22.2 CDP 1024-BS-L
- 22.3 Overall Project Schedule
- 22.4 Guideline for ES Impact Evaluation
- 22.5 Requirements from ESP-2.617 for MECL Update for new components and spares
- 22.6 Calculation of Floor Response Spectra for BB2 and water well
- 22.7 List of Supply of Major Equipment
- 22.8 List of Supply of miscellaneous hardware
- 22.9 Draft Project Management Manual
- 22.10 DEC System Controls and Indications – SUP Phase 3

Appendix 22.1

NEK Safety Upgrade Project Design Inputs and Interfaces

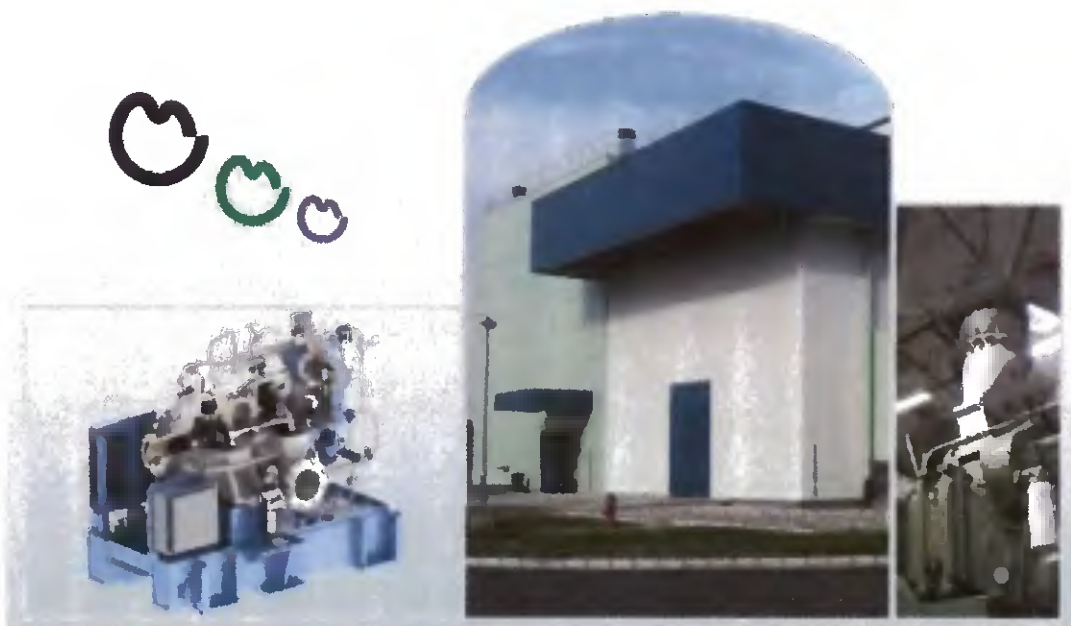
NEK

NEK Safety Upgrade Project Design Inputs and Interfaces



Revision 8

March 2016



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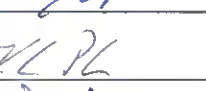
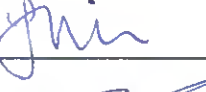



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Contents

1.	Introduction.....	3
2.	Scope and Purpose	4
	Acronyms.....	5
3.	Common design Requirements	8
	3.1 Safety Classification of New DEC Systems	10
	3.2 Seismic load.....	11
	3.3 Flooding.....	13
	3.4 Extreme weather conditions.....	14
	3.5 Releases of radioactive materials	14
	3.6 Ultimate Heat Sink and Capacity/volume of additional water tank/coolant.....	17
	3.7 Separation of systems and single failure criteria.....	17
	3.8 Additional design requirements for buildings in correlation with aircraft accident.....	18
	3.9 Supervision and control management enhancements in the alternate shutdown station Emergency Control Room.....	18
	3.10 Plant Station Power supply	19
	3.11 DEC Instrumentation.....	19
	3.12 Fire Protection design inputs	20
	3.13 Equipment Qualification and Equipment Survivability	20
	3.14 Plant Safety Upgrade Project applicable codes, standards and regulatory requirements.....	23
4.	References.....	25
	ATTACHMENT 1	27

1. Introduction

Nuclear Power Plant Krško (NEK) decided to take steps for Upgrade of safety measures to prevent severe accidents, and to improve the means to successfully mitigate their consequences. NEK prepared Safety Upgrade Program for the modernization [4-1]. The content of the program for NEK Safety Upgrade (Safety Upgrade Program – SUP) is consistent with the nuclear industry response to the Fukushima accident. This includes plant upgrades/design changes to address Design Extension Conditions (DEC) [4-19] and partially Beyond Design Bases Accident (BDBA). The general overview of DEC with relations on design, operations and procedural use is presented on Figure 1.

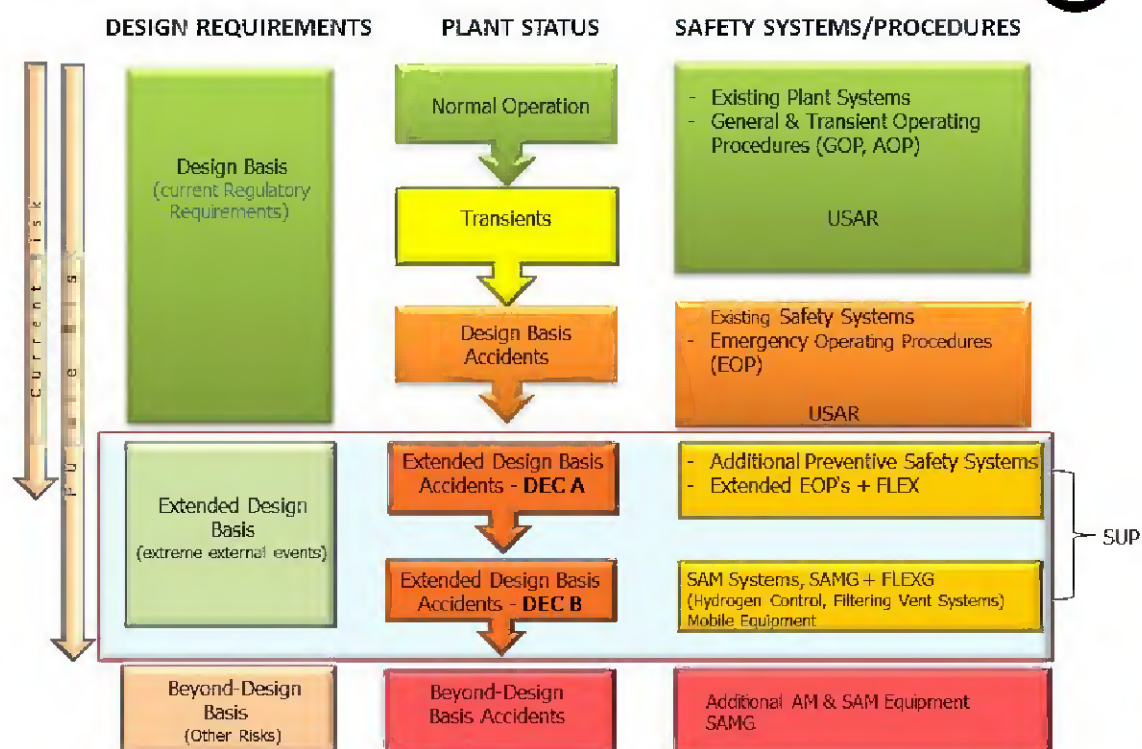
Implementations of proposed design changes shall be performed as defined in program and approved by the Slovenian Nuclear Safety Administration (SNSA) decree [4-1 and 4-46]. Major part of modifications (Phase 1 and Phase 2) which will assure significant contribution to NEK safety will be completed till the end of year 2018.

Safety Upgrade Program (SUP) consists of the following main projects and modifications, which are grouped into 3 phases:

1. Phase 1 (2012-2014) – This phase is completed and consists of modifications related to Containment integrity – pressure & hydrogen control:
 - a. 1008-VA-L Passive Containment Filtering Vent System – PCFVS
 - b. 1002-GH-L Passive Autocatalytic Recombiners – PAR
 Both modifications were implemented during Outage 2013.
2. Phase 2 (2014-2018) – includes the following modifications:
 - a. 1025-RC-L PRZR PORV Bypass Valves
 - b. 1028-SF-L SFP Alternate Cooling
 - c. 1029-RH-L RCS and CNT Alternate Cooling
 - d. BB1 Project with the following subset of modifications:
 - i. 1007-XI-L Emergency Control Room
 - ii. 1027-NA-L ECR/TSC Support Systems
 - iii. 1137-EE-L Upgrade of BB1 Electrical Power Supply
 - iv. 1140-RC-L Replacement of the ICCMS control cabinets
 - v. 1053-PC-L Upgrade of NEK Communications Systems
 - vi. 1058-VA-L ECR/TSC HVAC Habitability systems
 - vii. NEK KFSS Upgrade and Construction of the Simulator Emergency Control Room
 - viii. 1069-TZ-L Technical security for the ECR and TSC
 - e. 1026-NA-L Flooding Protection of NSSS complex
 - f. 1056-NA-L Reconstruction of the Operating Support Center (OSC)
3. Phase 3 is planned to be implemented till the end of the 2021. Modifications shall ensure the rest of Safety Upgrade Program functionalities (alternate sources of water for heat sink and water injection pumps):
 - a. 1024-BS-L Bunkered Building 2 with Auxiliary Systems
 - b. 1005-SI-L Safety Upgrade of SI system
 - c. 1010-AF-L Safety Upgrade of AF system
 - d. 1030-EE-L Safety Upgrade of Emergency Alternate Power Supply

Part of phase 3 safety upgrade project is also a construction and use of spent fuel dry storage facility (SFDS) with design lifetime of 100 years with DEC seismic, flooding and other design and construction requirements.

SUP Concept



*PSA – Probabilistic Safety Assessment – CDF Reduction for a factor 4

Figure 1: Accident plant design – operations – procedural overview

2. Scope and Purpose

This document describes Plant Safety Upgrade Project modifications purposes, design requirements and basic common design inputs at NPP Krško, as results of approved NEK Safety Upgrade Program.

The purpose of this document is to establish common understanding of design inputs, requirements and assumptions for all Safety Upgrade Project modifications.

The common design requirements and bases are described in section 3.

Acronyms

AAF	Alternative Auxiliary Feedwater
ABWT	Alternative Borated Water Tank
ASI	Alternative Safety Injection
ACYT	Alternative Condensate Storage Tank
ANSI	American National Standards Institute
AOP	Abnormal Operating Procedure
ARHX	Alternative Residual Heat Removal Heat Exchanger
ARP	Alarm Response Procedure
ASME	American Society of Mechanical Engineers
BB1	Bunkered Building 1
BB2	Bunkered Building 2
BDBA	Beyond Design Bases Accident
BDB	Beyond Design Bases
BS	Bunkered System
CC	Component Cooling
CFR	Code of Federal Regulations
CL	Cold Leg
CNT	Containment
DB	Design Bases
DBA	Design Basis Accident
DB LOCA	Design Bases Loss of Coolant Accident
DEC	Design Extension Conditions
DEC A	Systems for prevention of severe fuel damage in the core or in the spent fuel pit
DEC B	Systems for mitigation and monitoring of consequences of severe fuel damage
DG3	Diesel Generator #3
EMCB	Emergency Control Board
ECCS	Emergency Core Cooling Systems
ECR	Emergency Control Room
EDG	Emergency Diesel Generator
EDMG	Extensive Damage Mitigation Guidelines
ELAP	Extended Loss of all AC Power
EOP	Emergency Operating Procedure
EQ	Electrical and I&C Equipment Environmental Qualification
ESW	Essential Service Water
EUR	European Utility Requirements
FRS	Floor Response Spectra
GDC	General Design Criteria

HELB	High Energy Line Break
HVAC	Heating Ventilating Air Conditioning
IAEA	International Atomic Energy Agency
ICCMS	Inadequate Core Cooling Monitoring System
IPE	Individual Plant Examination
I&C	Instrumentation and Control
KFSS	Krško Full Scope Simulator
LB	Large Break
LOCA	Loss of Coolant Accident
LOOP	Loss of Offsite Power
LWR	Light Water Reactor
MAAP	Modular Accident Analyses Program
MC	Main Complex Structures (Reactor Building, Auxiliary Building, Intermediate Building, Control Building, Fuel Handling Building, Drum Storage Area)
MCR	Main Control Room
MD1	6,3 kV Safety Bus #1
MD2	6,3 kV Safety Bus #2
MD3	6,3 kV Safety Bus #3
MEQ	Mechanical Equipment Environmental Qualification
MD	Motor Driven
MOV	Motor Operated Valve
NEK	Nuclear Power Plant Krško
NPP	Nuclear Power Plant
NSR	Non Safety Related
NSSS	Nuclear Steam Supply System
NUREG	Regulatory Guides from US Nuclear Regulatory Commission (USNRC)
OBE	Operating Base Earthquake
OSC	Operations Support Center
PAR	Passive Autocatalytic Recombiner
PCFV	Passive Containment Filtered Vent System
PGA	Peak Ground Acceleration
PORV	Power Operated Relief Valve
PRZR	Pressurizer
QA	Quality Assurance
RCS	Reactor Coolant System
RG	Regulatory Guide
RSP	Remote Shutdown Panels
SAME	Severe Accident Management Equipment

SAMG	Severe Accident Management Guideline
SBO	Station Blackout
SFDS	Spent Fuel Dry Storage
SFP	Spent Fuel Pit
SI	Safety Injection
SNSA	Slovenian Nuclear Safety Administration
SOP	System Operating Procedure
SR	Safety Related
SSC	Structures, Systems and Components
SSE	Safe Shutdown Earthquake
SUP	Safety Upgrade Program
SW	Essential Service Water
TD	Turbine Driven
TSC	Technical Support Center
UHS	Ultimate Heat Sink
USAR	Updated Safety Analysis Report
USNRC	United States Nuclear Regulatory Commission
WENRA	Western European Nuclear Regulators Association
WENX	Westinghouse Supporting Document

3. Common design Requirements

The additional structures, systems and components (SSC) defined and selected as NEK plant safety upgrade modifications, will be designed and constructed in accordance with the following requirements, specific for NEK design and site location.

A set of Design Extension Conditions (DEC) is derived on the basis of engineering judgment, deterministic assessments and probabilistic assessments based on reference [4-19] IAEA SSR-2/1 document, NEK IPE evaluation [4-20] and NPP KRŠKO Analyses of Potential Safety Improvements [4-11]. There are some combinations of events that are more severe than design basis accidents and are considered as design extension requirements. These combinations addressed in the area of prevention of severe accidents are:

- **DEC-A1: LOCA Scenario (without ECCS):**
Seismic event (PGA up to 0.6g) consequently causes a combination of LOCA and Station Blackout (SBO¹). It is assumed that DEC A equipment² is available and ECCS equipment is not available, except RHR system piping, which is available for long term recirculation.
The focus of this scenario is to inject water to the primary system to compensate inventory losses and to cooldown RCS using ASI pump with suction from ABWT. To obtain maximal water requirements, RCS injection with ASI pump is started at the transient initiation. The main RCS inventory loss assumed in the analysis is seismically induced up to 12 inch LB LOCA of SI accumulator discharge line to CL. Such a scenario, where ASI is the only means for cooling down the RCS, allows the determination of the maximum quantity of borated water, which must be available in ABWT under DEC conditions. Long term decay heat removal after injection phase will be done through the ARHX.
- **DEC-A2: Loss of Secondary Heat Sink (without both MD and TD pumps and water sources - CY tanks) Scenario:**
Combination of seismic event (PGA up to 0.6g) and external flooding, assuming that DEC A equipment is available and DB equipment is not available, except RHR system piping available for long term recirculation, NSSS complex is not flooded. This scenario assumes that external flooding does not allow use of external support for 7 days due to floods, however in the analysis it is conservatively assumed that AF system as secondary heat sink is not available for 30 days. Also Station Blackout (SBO) is conservatively assumed due to a seismic event. To obtain maximal water requirements, RCS is assumed to be intact therefore no RCS line breaks and resulting LOCA are assumed. SI accumulators, as passive equipment not requiring electrical power, are operable during the entire event.
The plant cooldown is performed through the secondary side using AAF pump with suction from ACYT for 30 days, which is refilled with well water. Such a scenario, where AAF is the only means for cooling down the RCS, allows the determination of the maximum quantity of water which must be available in ACYT for 30 days operation under DEC conditions. After 30 days, it is assumed that long term decay heat removal could be done through ARHX.
- **DEC-A3: Loss of UHS Scenario (without SW and CC systems):**
A seismic event (PGA up to 0.6g), consequently causing loss of Ultimate Heat Sink (UHS³) for 30 days and SBO assuming that DEC A equipment is available and DB equipment is not available, except RHR system piping available for long term recirculation. The focus of this scenario is to cooldown plant without UHS. The plant cooldown is performed through the secondary side using AAF pump with suction from ACYT. ASI pump with suction from ABWT is used to compensate primary system inventory shrinkage. Long term decay heat removal after cooldown through secondary side will be done through the ARHX.
- **DEC-A4: Aircraft Accident Scenario:**
Scenario assumes large commercial aircraft accident with consequently large fire. DEC A equipment is assumed to be available and DB equipment is not available, except RHR system piping available for long term recirculation. Conservatively concurrent LOCA is assumed (up to 12 inch). The focus of this

¹ SBO – Station Blackout means loss of design bases (DB) power supply on MD1 and MD2 safety power supply buses (MD3 is available).

² DEC A equipment - ASI pump, ABWT, AAF pump, ACYT, well, ARHR pump, ARHX, PRZR Bypass MOVs, power supply from MD3

³UHS - Loss of Ultimate Heat Sink means loss of design bases (DB) systems ESW and CC (Sava River is available for suction with mobile equipment)

scenario is to inject water to the primary system to compensate inventory losses through the potential LOCA and to cooldown RCS either with ASI pump with suction from ABWT or/and with the secondary side using AAF pump with suction from ACYT. Long term decay heat removal has to be insured for 30 days using ARHR.

- **DEC-AS: Unavailability of both RHR pumps Scenario:**

Scenario assumes unavailability of both RHR pumps and availability of DB UHS systems (SW and CC systems) and DEC A equipment. The focus of this scenario is to use ARHR pump for RCS cooldown, and RCS cold leg or RCS hot leg recirculation with one train RHR train. ARHR pump is not considered as normal ECCS equipment and will be started manually.

In case, that all DB equipment is not available, long term decay heat removal will be performed through ARHR HX using ARHR pump.

- **DEC B: Mitigation of Consequences of Core Damage:**

In case that all actions for prevention of core damage are not successful (for whatever the reason) core damage occurs. The focus of this scenario is mitigation of core damage and long term cooldown using DEC B equipment⁴.

SG PORVs are considered as DB equipment which will be used in DEC A and DEC B scenarios if needed. All other combinations of events /accidents are considered as Beyond Design Bases and will be addressed by mobile equipment.

The assumed time duration of the above mentioned conditions are the following:

- Loss of off-site power (LOOP) for 7 days,
- Station blackout (SBO) for 72 hours, valid for DB equipment emergency power supply with assumed DEC equipment available and DB equipment is not available,
- Loss of ultimate heat sink (UHS) for 30 days,
- Loss of the UHS combined with SBO for 72 hours, assuming that DEC equipment is available,
- Flooding water will retain for 7 days.

For the purpose to achieve severe accident conditions, it is assumed that the DEC equipment will not be available for first 24 hours due to the ELAP and that core will be melted and corium relocated into containment. This is the basic assumption for Design Extension Conditions Systems for Containment Filtering Vent System and Passive Autocatalytic Recombiners. This assumption also led to the DEC equipment requirements that batteries for DEC systems and ECR shall have capacity for 24 hours (to cover ELAP).

All basic requirements and assumptions are listed in the following subsections. However the specific Design Bases and Inputs for each modification will have to be prepared in accordance with the NEK ESP-2.604 [4-34] Design Consideration, Bases and Inputs for each SUP Modification in the initial Phase of design.

Based on plant specific fragility analyses [4-36], we assume that integrity of existing systems (e.g. RC piping, RH piping, etc.) will be available and functional at higher seismic accelerations (0,6g). Due to that no seismic re-design or requalification of the existing systems is foreseen. In case that new equipment is designed/ located in the area where non-seismically designed existing equipment could represent potential »seismic two-over-one« hazard for DEC equipment, design protective features for DEC shall be taken into account.

For the interconnections from new DEC systems to the existing systems, the design shall consider new developed floor response spectra for the main complex, as defined in [4-22].

Since new DEC systems piping will not operate during normal plant operations, (operating time is less than 2% as stated in USAR Chapter 3.6.1), High Energy Line Breaks (HELB) on those lines do not need to be considered, except for the interconnection point and to the first valve (valid for Phase 3 of SUP).

The SUP concept must be in accordance with the proposed revised WENRA Safety Reference Levels document [4-47].

⁴ DEC B equipment - ASI pump, ABWT, AAF pump, ACYT, water well, ARHR pump, ARHX, PCFV, PARs, power supply from MD3.

Implementation of the SUP project will require significant revision of the different operation sets of procedures; however the following principle will be followed:

- The usage of new systems and components will be integrated into the existing NEK EOP, AOP, SOP and SAMG procedure in the manner to be used as an alternative if the ECCS system components will not be operable (of any reason).
- Existing procedures (AOP, ARP, EOP etc.) cover the plant response to any possible plant abnormal and accidental event in any possible plant operation and shutdown mode, however they will be upgraded (for example AOP PRI-6 LOCA during shutdown) to include also the usage of the new DEC equipment to prevent core damage.
- Before instructed to start the new DEC equipment the revised procedures shall provide the instructions to preserve required preconditions (e.g. start of the EDG #3 to energize the MD3).
- The existing set of procedures shall be revised or expanded to cover the shutdown and cooldown of the plant from the MCR and ECR (by the usage of existing ECCS and new safety equipment). The usage of all mobile SAME equipment will be prescribed as an additional option to prevent and mitigate the plant accident.
- Existing plant AOP INS-3 MCR evacuation and FRP-3.9.101 Fire in the MCR room will be merged to cover the situation when the MCR will have to be evacuated. This procedure will therefore cover variety of the initial events which will require the evacuation of the MCR (MCR Fire, Inaccessibility of the MCR due to the smoke, etc.) and will give all instructions for the manual actions which will have to be done to transfer the control capabilities to the auxiliary location e.g. ECR.
- New Extensive Damage Mitigation Guidelines (EDMG) will be developed and used in case of major loss of plant control systems and in case of large fire or natural hazard which prevent use of normal plant control systems.

In the case of the MCR evacuation (regardless of the reason) the procedures will cover normal and abnormal (in conjunction with some external event) plant shutdown and cooldown until the Plant Cold Shutdown. New set of the Alarm Response Procedures will be developed for the ECR to support the operation of the plant from the ECR.

3.1 Safety Classification of New DEC Systems

New installed DEC systems will be designed in accordance with design requirement as explained in this document to assure the operability under all postulated circumstances and conditions.

The classification of the part of systems interconnecting the existing system will be in accordance with the original Classification Criteria as described in the USAR Section 3 in accordance with the ANSI/ANS-51.1-1983, Nuclear Safety Criteria for Design of Stationary Pressurized Water Reactor Plants [3.14-19] and ANSI-N18.2 - NUCLEAR SAFETY CRITERIA WATER REACTOR PLANTS [3.14-34].

New alternative SSC will not be considered as a part of original Engineering Safety Features (with the exception of direct interfaces e.g. valves, pipeline, etc.) but will be designed with the same design requirements and criteria (ANSI/ANS-58.14 - [3.14-29]). All new SSC will be marked in accordance with Plant System codes and designated with similar system function abbreviation. These SSC will be treated as a safety related per ANSI-N18.2, unless otherwise specifically justified. The design of the new SSC shall be adequate to meet the conditions, circumstances and requirements specified in this document.

A mechanical pressure retaining components should be design in accordance with applicable ASME code requirements.

Quality Assurance for the design, procurement, fabrication, installation, maintenance and testing for each new SSC shall be commensurate with the Safety Classification of each SSC, as required by the NEK QA Program.

3.2 Seismic load

Existing equipment (OBE=0.15g PGA, SSE=0.3g PGA)

When replacing components, in-housed in other Major equipment (which is originally qualified for the OBE (0.15g PGA) and SSE (0.3g PGA)), these components shall be qualified to the original FRS's (e.g. replacement of the relay, replacement of the (part) of cabling, replacement of the instrumentation related to this major component, replacement of the control switch etc.). Such qualification of components is consistent with the Qualification of the Major Equipment.

Qualification of existing equipment shall be done in accordance with SP-S702 Section 5.2.1 (Definition of Seismic Input for Qualification of Safety-Related Equipment) and FRS curves described Appendix A of SP-S702 (OBE=0.15g PGA, SSE=0.30g PGA).

Appendix A of SP-S702 shall be applied in the case of:

- Procurement and qualification of spare parts or replacements of components, which were originally qualified for OBE and SSE. This includes alternate components, which may not be physically identical to the original, but require an equivalency evaluation to ensure that it will perform the design function of the component it is replacing.
- Modifications, where new components are installed to the existing buildings or embedment plates. Existing buildings and embedment plates remain qualified for OBE and SSE. It has been determined that no re-qualification for higher seismic levels is required in this case.
- Re-qualification of existing pipeline/tubing segments and mechanical components located between the tie-in point, where new systems are attached to the existing pipelines, to the nearest anchorage on each side. Such pipeline segments or mechanical components remain qualified for OBE and SSE. It has been determined that no requalification for higher seismic levels is required in this case.
- Seismic design of new DEC A or DEC B or modified SSCs in the Main Island Structures, Essential Service Water Intake Structure and Ground Surface for OBE loading.

Note:

- i) *The last bullet means that the OBE loading remains unchanged for NEW EQUIPMENT IN THE EXISTING BUILDINGS. Therefore, the OBE spectro included in Appendix A also apply for DEC equipment in the existing buildings.*
- ii) *The OBE loading for new buildings and in-housed new equipment is increased from 0.15g PGA to 0.30g PGA.*

DEC equipment in the existing buildings and DEC equipment on the yard (OBE=0.15g PGA, DEC Earthquake=0.6g PGA)

The newly upgraded safety equipment in the existing Safety-Related Buildings and new DEC equipment in the yard will be designed for an increased seismic loading of 0.6g PGA at free field (the existing design basis for Krsko NPP is 0.3g PGA (e.g. SSE)). This increased seismic load (0.6 g) will be used as a means to increase the margin of safety related to the availability and operability of these systems designed for extreme natural events (DEC equipment) and for the preventing and mitigation of the Beyond Design Bases Accident (BDBA). Increased seismic loading will also be applied to new Safety-Related piping/tubing and new piping/tubing supports associated with the new equipment.

For design and purchasing of the SSC for the new systems in Bunkered Building 1 (BB1), Main complex (MC) structures and Essential Service Water Intake Structure (ESWIS) of NPP Krsko, and new equipment in the yard new floor response spectra (FRS) have been developed for 0.6g PGA at free field. The new floor response spectra for yard and BB1, MC and ESWIS for 0.6 g for DEC equipment are included in the NEK Specification SP-S702, Appendix C. [4-22].

The seismic design/qualification of new DEC SSC in the yard and those, installed inside the MC, ESWIS or BB1, shall be performed in accordance with guidelines of SP-S702, Section 5.2.3 and FRS curves described in Appendix C [4-22]. As noted above, the new DEC equipment and interconnections from new DEC systems to the existing systems equipment shall be designed for an increased seismic loading of 0.6g PGA at free field. The

DEC FRS (Appendix C of SP-S702) apply in the case of seismic design of new DEC equipment and interconnections.

Qualification requirements shall be also applied to the modified equipment. Modified equipment is any mechanical equipment modified by the installation of new DEC equipment, including any modified component from the tie-in point up to the nearest anchorage on each side. Modified equipment shall be qualified for OBE (0.15g PGA) and SSE (0.30g PGA) loading. Review of existing equipment qualification against design criteria for OBE and SSE seismic loads shall be performed prior the modification. No seismic re-design or re-qualification of existing equipment is foreseen for existing equipment.

Appendix C FRS (described in SP-S702) shall be used where qualification for DEC seismic levels is required. Appendix C is applicable to the DEC yard equipment and equipment in Main Island structures, Essential Service Water Intake Structure and Bunkered Building 1 for the following work:

- Analysis, design, and qualification of new DEC SSCs in the existing buildings, including connections from new DEC SSCs to the tie-in point on the existing SSCs.
- Design of protective features for new DEC SSCs in the cases in which new DEC SSCs are designed in an area at which the non-seismically designed SSCs can represent potential "seismic two over one" hazards.
- Procurement and qualification of spare parts or replacement parts of the components which had previously been qualified in accordance with Appendix C.
- Assessments of existing equipment (i.e. buildings, embedment plates, piping systems, panels, cabinets, cable trays and conduits, which are important for mechanical integrity and functionality of new DEC safety-related components that are qualified in accordance with Appendix C.

OBE loading remains unchanged for new equipment in the existing buildings and on the yard. Therefore, the OBE spectra included in Appendix A also apply for DEC yard equipment and that in-housed in the existing buildings.

For new equipment in the existing buildings or in the yard, which is not designed for DEC requirements (e.g. replacement of the Turbine Driven AF pump etc.), the qualification shall be done in accordance with the SP-S702 Section 5.2.2 and FRS curves described in Appendix B of SP-S702.

Detailed modelling requirements and explanations:

1. An influence of existing equipment on seismic response of new equipment (and vice versa) must be taken care of in the designing process. New equipment must be designed such that any possible negative effects on existing equipment are minimized (or eliminated). Where necessary, the new mechanical DEC equipment, modified equipment and existing equipment must be combined into a single mathematical 3D model for seismic analysis.
2. In rare cases, in which the new safety related equipment is designed (and constructed) in the area where the non-seismically designed existing equipment can represent potential "seismic two over-one" hazards for DEC equipment, the design shall include protective features for DEC equipment. It is not expected to perform such verification/analyses for safety related, seismically designed and qualified existing SSC.
3. Assessment of potential effects of new equipment on existing equipment: The modified equipment shall be reanalyzed for OBE and SSE loading after modification and re-qualified against deterministic criteria. Modified equipment shall be then analyzed for DEC loading in order to estimate DEC/SSE stress ratios.

New DEC Buildings, in-housed DEC equipment (increased OBE=0.30g, DEC Earthquake=0.78g)

The effect of the uncertainties related to the NPP Krsko seismic hazard calculation should be considered in the seismic design of new SSCs dedicated to preventing and mitigation of accidents due to extreme natural events (DEC buildings and equipment) and the Beyond Design Bases Accidents (BDBA) (for example: Operational Support Centre (OPC), Bunkered Building 2 (BB2)). For this purpose, it is required that the earthquake ground motion used for the seismic design of new DEC buildings is defined with the design response spectrum for peak ground acceleration of $0.6 \times 1.3 = 0.78$ g.

The earthquake loading for BB2 are seismic loads imposed by ground accelerations due to increased NEK DEC and increased OBE earthquake peak ground acceleration (PGA) values of 0.78 g and 0.30 g, respectively. Earthquake loading for BB2 is represented by an envelope of:

- (1) Elastic response spectra defined in SIST EN 1998-1:2005 [4-51], and
- (2) The USNRC Regulatory Guide 1.60 design ground response spectra and as defined in NEK USAR Section 3.7.1.1, Figures 3.7-1f to 1h (which are based on a PGA of 0.3 g).

So calculated enveloped response spectra for BB2 shall be normalized to 0.3g for OBE loading and 0.78g used for DEC.

OBE loading for new DEC buildings, in-housed DEC equipment and yard DEC SSCs is increased from 0.15g PGA to 0.30g PGA. The safety factor 1.3 is not applied to increase the OBE loading (0.3g PGA) for new DEC buildings, in-housed DEC equipment and yard DEC SSCs.

The systems and components inside new DEC buildings also shall be designed for a DEC seismic loading. The increased seismic load shall be used as a means to increase the margin of safety related to the availability and operability of the systems designed for the prevention and mitigation of the DEC:

- i) The floor response spectra for new buildings are calculated for 0.3g, 0.6g and 0.78g
- ii) It is required that for the qualification of safety-related major equipment in-housed in new buildings the floor response spectra for peak ground acceleration of 0.78 g are used. The safety-related major equipment includes: reservoirs, tanks, pumps, 6.3 kV and 400 V electrical equipment and ventilation systems. Floor response spectra for peak ground acceleration of 0.78 g are also used for supporting structures like piping supports and embedment plates inside new buildings.
- iii) For the piping design, the factor of 1.3 does not apply. Design peak ground accelerations for piping systems is 0.3g PGA and 0.60 g PGA for OBE and DEC, respectively. Seismic loads shall be determined from OBE and DEC in-structure response spectra and building differential displacements.
- iv) The nozzle demands for pumps and tanks shall be calculated utilizing 0.78 g PGA floor response spectra.

Note that the use of the factor 1.3 under the above paragraphs (ii) and (iv) does not exclude using of code-specified seismic demand and safety factors. Therefore, in addition to the factor 1.3, the use of code-specified seismic demand and safety factors used for the qualification of systems and building components, also apply.

3.3 Flooding

Existing plant structures provide external flood protection of NEK to the level of the left river bank of the Sava River (157.1 m above sea level.). New equipment will be protected with higher elevation (or by alternative design methods like sealing etc.). New design shall assure flood protection even in case of Sava river bank failure. The required margin level is 40 cm (upper edge of the existing river bank plus 40 cm yields protection to 157.53 m a.s.l.). All DEC SSC shall meet this level requirement to assure that they can perform their function under the postulated flood conditions. With completion of modification 1026-NA-L, NSSS buildings are protected to water level 157.53 m a.s.l.

Designs shall consider buoyance force in case of flooding and high ground water level.

The level of flooding protection was determined in accordance with the References [4-11] and [4-12].

Design of new structures/buildings shall address potential internal flooding sources. Design shall assure that in the case that the water source failure (tank) safety functions of the systems and components installed in this building will not be jeopardized.

3.4 Extreme weather conditions

The new SSC will be designed for minimum/maximum outdoor temperatures of -35,1°C/46°C (dry bulb), 36°C (wet bulb) Reference [4-25]. Design of all the SSC shall assure that the internal building temperature will not be below 5°C (13°C for the room where the batteries will be installed) and not above 40°C. All required temperature values needed for the design of the SSC are presented in Attachment 1 with respect of frequency and calculated duration of this condition.

The new SSCs shall be designed for extreme winds of maximum velocity of 240 km/h, which could possibly be expected in the area with very low probability and for tornados and tornado missiles in accordance with Regulatory Guide RG-1.76 Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants - reference [4-39].

The new SSC shall be designed for extreme snow loads. Snow loads on the roof shall be increased to 3,2 kPA which corresponds to calculated 10.000 year return period of ~ 125 cm snow height as described in Attachment 1.

The exposure of the NEK area to atmospheric discharge was considered in accordance with the WENRA Safety Reference Levels rev.1 September 2014. Lightning analysis was performed to demonstrate lightning amplitude in kA and specific density of lightning strokes (ref. 4-57). The design input for 10.000 years return period lightning protection is current amplitude 400kA and average stroke specific density of 1.4/km²/year.

3.5 Releases of radioactive materials

The DEC SSC that will be installed for controlling/limiting radioactive fission products release shall be designed to ensure controlled accident radioactive discharges, containing less than 0.1% of volatile and particulate fission products of the reactor core. This parameter is important for design and development of the containment vent and filtering system to be installed.

The source term of radioactive materials that come out of the reactor core shall be considered as defined by NUREG-1465 [4-6] and WENX-08-19 report [4-7].

In 1962 The U.S. Atomic Energy Commission published TID-14844, "Calculation of Distance Factors for Power and Test Reactors" which specified a release of fission products from the core to the reactor containment in the event of a postulated accident involving a "substantial meltdown of the core." During the last decades substantial additional information on fission product releases has been developed based on significant severe accident research, and NUREG 1465 document utilizes this research by providing more realistic estimates of the "source term" release into containment, in terms of timing, nuclide types, quantities, and chemical form, given a severe core-melt accident.

The source term calculation performed during NEK IPE level 2 calculations with MAAP program tools was performed within WENX/95/24 [4-8]. The limiting release fraction calculated for release category 6 "Early Containment Failure" gives the results as described below. This source term values are essential for the design and development of emergency control room and emergency preparedness facilities where human actions need to be performed during accident evolution. The additional assessment will have to be done for the accessibility of other location for the manipulating of the DEC equipment similar as it was done for the existing location in WENX 94/27 NPP Post- Accident Shielding Review [4-9].

NEK Design Basis:

The radiological consequences as a result of DB LOCA are analyzed for offsite environment and for control room (USAR 15.6.5.4). The fission product inventories are based on the method from TID 14844 [4-13]. The instantaneous release of 100% noble gasses and 50% iodine to the containment atmosphere is assumed. Additional release of 50% iodine to the sump is assumed and available for release from ESF systems.

The same methodology from TID 14844 was used also for post-accident shielding review (WENX 94/27) ref. [4-15] and for calculation of doses for electrical equipment environmental qualification. The assumed releases are: 100% noble gasses, 50% or 25% of iodine (depending of the scenario) and 1% of all other fission products.

For the above analyses no containment failure was assumed. The design leakage from containment and annulus, and design air intake and filter efficiencies for control room are taken into account.

Severe accidents:

The fission product releases, as a result of severe accident, shall be based on the methods from NUREG-1465 [4-6]. The more realistic releases are given in terms of timing, nuclide types, quantities and chemical form. The same method is incorporated into MAAP computer code. The assumed releases are:

Fission Product	Release fractions			
	Gap release (0 hours)	Early In-vessel (1.3 hours)	Ex-vessel (2 hours)	Late In-vessel (10 hours)
Noble gasses	0.05	0.95	0	0
I	0.05	0.35	0.29	0.07
Cs	0.05	0.25	0.39	0.06
Te	0	0.15	0.29	0.025
Sr	0	0.03	0.12	0
Ba	0	0.04	0.10	0
Ru	0	0.008	0.004	0
Ce	0	0.01	0.02	0
La	0	0.002	0.015	0

The analysis method for the release to the environment takes into account the removal or reduction of fission products via ESF system (spray, filters) and by natural processes such as aerosol deposition.

NEK limiting scenario for the environmental release, from IPE Level 2, is Release Category 6, Early Containment release (Loss of MFW, AFW, HPI and LPI). This transient is reanalyzed with the additional assumption that containment spray is not available. There are differences in results compared to the original results which can be attributed to the hot leg creep rupture prior to vessel rupture and wet cavity modification.

Release fractions:

Fission Product	Release (%)			
	1 day	2 days	7 days	30 days
Noble gasses	100	100	100	100
CsI	36.5	36.6	36.6	37.5
TeO ₂	8.1	0.9	0.91	9.1
SrO	0.16	0.16	0.16	0.16
MoO ₂	1.5	1.5	1.5	1.5
CsOH	27.7	28.4	28.6	30.2
BaO	0.63	0.63	0.63	0.64
Lanthanides	0.03	0.03	0.03	0.03
CeO ₂	0.34	0.34	0.34	0.34
Sb	14	17.4	27.6	27.7
Te ₂	0.07	0.07	0.16	0.16
Uranium and transuranics	0.0016	0.0018	0.0019	0.002

The values are based on MAAP analyses, not take into the consideration uncertainties.

Concentration of fission products released to environment

The estimation of fission products concentration, following release after severe accident, was determined using MAAP4 computer code for NEK limiting scenario for environmental release, from IPE Level 2 (Release Category 6, Early Containment release, Loss of MFW, AFW, HPI and LPI). The analysis method, based on recommendations of NUREG-1465 [4-6], takes into account the removal or reduction of fission products via ESF system (spray, filters) and by natural processes such as aerosol deposition.

Performed analysis gave the release of 36,5% for health significant fission products (I and Cs) from containment in 2 hours. The released masses are: 13,7 kg for I and 148,75 kg for Cs. The timing of the release is taken according to NUREG-1465 and during these periods the release rate is assumed to be constant:

Fission Product	Release fractions		
	Gap release (0 hours)	Early In-vessel (1.3 hours)	Ex-vessel (2 hours)
I	0.05	0.35	0.25
Cs	0.05	0.25	0.35

The value for atmospheric dispersion factors is taken from USAR Table 15.0.12-1 (95 percentile value X/Q at 500 m distance), $X/Q=1.1E-3 \text{ s/m}^3$.

According to the above assumptions the resulting fission product concentrations at 2 h following containment failure are:

Fission product	Concentration
I	1.42 mg/m ³
Elemental I	71.24 µg/m ³
Particulates (Cs + I)	18.81 mg/m ³

Design of habitability structures/systems (structure that assure shielding, ventilation, air filtration,...) for ECR/TPC and OPC shall assure that individual that will be staged in one of those locations for 12 hours/day, 6 days per week, will not receive cumulative dose more than 50 mSv in time frame of one year after the accident. With the total exposure while daily accessing this facilities individual shall not receive dose higher than 100 mSv/year from the buildings/SSC which are designed to contain radioactive material after the accident.

Based on performed modification 1008-VA-L in outage 2013, where containment filtering ventilation system has been installed, new release fractions of different particulates and isotopes were calculated in technical report ESD-TR-25/13 [4-49]. The purpose of this report is to estimate the release following the SBO accident scenario that was used for design of PARs and PCFVS, taking into account actual number of PARs and actual retention capabilities of PCFVS.

3.6 Ultimate Heat Sink and Capacity/volume of additional water tank/coolant

Ultimate heat sink (UHS) is assured with the Sava River water in normal and DEC conditions. Sava River Dam provides the UHS safety function. This function is ensured during and following the design-basis earthquake (SSE) and, in addition, a loss of upstream Sava River flow, as applicable site-related event. The UHS is assured with:

- the dam foundation (Spillway Crest) in combination with minimum water flow in case of Design Based Earthquake (SSE)
The NEK River dam foundation (Spillway Crest) is designed to assure the intended design function of UHS through the assurance of the adequate Sava river level for the ESW pumps suction (147,85 m.a.s.l.), in the case of DB event (SSE, PGA=0.3g). As a part of the River Dam upgrade, seismic analysis demonstrated that the NEK River dam foundation (Spillway Crest) is able to sustain its function during earthquake with the intensity twice the design-basis earthquake 2xSSE (PGA=0.6g). As the top of plant river dam foundation (Spillway Crest) is at 147.50 m.a.s.l. level, at least of 32 m³/s of additional Sava river flow of is necessary to maintain the required Sava river water suction level at 147.85 m.a.s.l.
In case of loss of ESW system (DEC assumption), Sava River water supply is assumed to be available for use with mobile pumps (cooling supply for ARHR heat exchanger).
- pool capacity formed by the gates lowered to the bottom position in case of loss of upstream river flow.
The loss of upstream river Sava flow will not disturb ESW cooling water flow of 1.06 m³/sec (16,800 gpm). River dam threshold is designed to continue with its function by forming a pool of capacity 450.000 m³ (1.19x10⁸ gallons) from which ESW is supplied by water, assuming gates fully lowered to the bottom position.

Capacity of new water sources for Phase 3 SUP shall be adequate for minimum 30 days supply of residual heat removal [4-1]. For the prevention of severe accident (DEC-A) the following water inventories are required:

- Alternative Boron Injection Tank (ABWT) with useful net volume of 1000 m³
- Alternative Condensate Storage Tank (ACYT) with useful volume of 500 m³
- Water well with capability/flow rate of 8l/s for refilling.

Available tank volumes will be maximized based on considerable available free space in BB2 building.

3.7 Separation of systems and single failure criteria

The newly installed SSC (valid for Phase 3) and equipment shall be separated and independent from the existing safety systems and equipment, and located at safety distance from the NSSS Island (>100 yards or 91,44m).

In general, a single failure requirement is not required for the new DEC systems because these systems are a backup or alternate method for preventing and mitigation of the consequences of the Severe Accident.

In addition to the Alternative SSC, flexible equipment has been purchased and has been incorporated into the common Severe Accident prevention and mitigation Plant strategy (EOP's, SAMG's etc.). This will increase the number of available options and features to cope with the severe event, but shall in no way jeopardize the availability of the ECCS systems.

3.8 Additional design requirements for buildings in correlation with aircraft accident

Any civil adaptation to existing safety building BB1 or new buildings in Phase 3 of SUP will be designed and reinforced to be capable to sustain events related to external large commercial aircraft impact on the plant (dynamic forcing function equivalent to B.5.b NRC requirement or European Utility Requirements for LWR NPP (EUR) and large fires) and shall assure functionality of equipment located inside these buildings during and after DEC.

3.9 Supervision and control management enhancements in the alternate shutdown station Emergency Control Room

New emergency control room (ECR) will be designed to provide alternate shutdown capability and to host the instrumentation and control for plant cooling for 30 days after the accident. The environmental conditions inside this building shall allow operators to act under severe accidental conditions for at least a 30 days period. New ECR will be designed as a new location for the existing Remote Shutdown Panels (RSP) and for new DEC equipment control and operation. The intention of the new Emergency Control Boards (EMCB) as a replacement for the existing RSP's will be to enable plant shutdown and cooldown in the case of the evacuation of the MCR. The transfer panels located on the nuclear island will assure sufficient separation of the shutdown panel controls in the ECR from the control in the MCR. In the case of the unavailability of the ECR (BB1) the normal shutdown systems will be available (both trains) for Plant Shutdown and Cooldown from MCR. On the other hand in the case of the unavailability of the MCR, the DEC controls in the MCR (e.g. Additional PRZR PORV valves) will be isolated providing independent operation of the DEC Systems from the ECR.

DEC A systems will have capability to be controlled from MCR (REMOTE) or from ECR. New DEC components will be electrically connected to the MD3 bus which will be capable of being powered from a different power source. This capability allows use of alternative power sources in case that normal power source from DG3 is not available.

Emergency Control Board (EMCB) Panel in BB1 and additional Main Control room (MCR) DEC Panel will be classified SR. Indications on Emergency Control Board (EMCB) Panel will be classified SR and indications on MCR DEC Panel will be classified NSR.

The ECR control and instrumentation power must be available from battery source separate from the existing plant batteries, and have the capacity to supply the required loads for 24 hours (ELAP). This battery source must be capable of being recharged with other power sources from the plant (MD1 or MD2 if available) or by using a mobile power source, in the case that no DB or DEC plant power source(s) are available.

The ECR will be designed to adequately meet the requirements of 10 CFR Part 50, Appendix A, General Design Criterion 19, to permit access and occupancy of the control room under the postulated accident conditions including shielding requirements.

Additional requirements for the ECR are provided in applicable ANSI/ANS-58.6 [3.14-20].

3.10 Plant Station Power supply

Based on defined scenarios described in section 3.0, LOOP and loss of UHS are taken into account by assuring the following:

- a) The power supply for the DEC systems (i.e. for Phase 2 modifications: 1025-RC-L, 1028-SF-L and 1029-RH-L) is independent and not exposed to the same risk as the normal safety shutdown systems (DG3 operation is independent of the operation of other systems, the Equipment location is protected against the flooding and there is greater safety margin regarding the seismic event)
- b) In case of SBO, MD3 bus shall be powered from DG3 or additional stationary or mobile DG units. In the worst case the power shall be re-established in 24 hours after the event.

During normal plant operation the MD3 bus will be powered from the MD1 or MD2 bus to provide the operation of the DG3 Auxiliary Equipment (battery charger, DG3 stand-by pumps, DG3 heaters, HVAC Unit for electrical rooms) and ECR in general (instrumentation etc.).

Additional set of safety batteries, inverter and charger will be installed to supply the DEC system instrumentation for duration of 24 hours. After 24 hours it is assumed that power supply is established via DG3 or mobile DG units. In case of loss of AC power on the MD3, DEC instrument & controls will be powered from the safety related battery.

After the LOOP transient and start of DG1 and DG2 the power supply to MD3 shall be restored either from MD1 or MD2. In the case of SBO the DG3 shall be started to supply MD3 (MD1 or MD2) and all DEC systems. In the case that total load of DEC systems, required to operate, is below DG3 minimal required load (20% of its rated power [4-21]), DG3 shall be stopped and mobile DG shall be connected to the MD3 bus.

3.11 DEC Instrumentation

Independent set of instrument channels will be provided to support the operation of the DEC systems, including the most important channels required for the monitoring of the Severe Accident Parameters available in ECR. Independent Instrumentation Rack(-s) will be provided in the ECR assuring the possibility to operate the DEC systems and to monitor critical plant parameters like reactor core exit temperature, RCS pressure & Temperature etc.

The DEC panel will be designed in Accordance with the NUREG 0700 Control Room Design.

The design basis for NEK accident and post-accident instrumentation is based on Regulatory Guide 1.97 Revision 3 (RG 1.97). RG 1.97 does not define requirements for DEC instrumentation required for beyond design basis events, therefore it is not directly applicable for DEC instrumentation.

Safety upgrade program will partially apply requirements prescribed by RG 1.97. Additional instrumentation channels for control and monitoring of Design Bases Accidents (DBA) safety functions from ECR will be assigned to appropriate class per Regulatory Guide 1.97 Rev.3. New instrumentation channels intended to control and monitor Severe Accidents (channels classified as DEC A and DEC B – see section 3.13) from ECR or MCR will be also designed per appropriate class of RG 1.97 instrument channel qualification requirements.

3.12 Fire Protection design inputs

All fire protection design considerations for new SSC shall base on GDC Criterion 3 Fire Protection and NUREG 0800 section 9.5.1 assuring the sufficient separation of the areas where the DEC systems will be located.

Special attention shall be given during the design of the alternative (DEC) systems (possible new systems in Phase 3 and especially ECR) which could be used as Safe Shutdown capability per Appendix R Section III G for the plant Shutdown and Cooldown. Existing fire hazard shall be reviewed during the design phase to evaluate the possibility that new systems could be used as the replacement of the existing systems to satisfy the requirements for the plant Safe Shutdown and Cooldown in case of fire in the Zone under Consideration. This new systems and associated circuits shall be independent of cables, systems or component in the area, room or zone under consideration. This new systems will be powered from the independent on-site power supply (DG #3), and will be designed as a Safety Related thus could be used as a substitute to the originally installed Shutdown Systems. (e.g. in case of the AHS to achieve and maintain the Cold shutdown conditions also assuming usage of mobile equipment). The new systems which could be used for the Safe shutdown and Cooldown shall be therefore also declared as a Safe Shutdown Equipment in the existing FHA.

Emergency Control Room will be designed with the intention to represent the Alternate and dedicated shutdown capability in case of the Fire in the MCR and Cable Spreading Area (in this case the Zone under consideration). This is also consistent with the one of the main requirement from the ANSI/ANS-58.6-1996 [3.14-20].

3.13 Equipment Qualification and Equipment Survivability

Systems functions and related equipment defined under NEK plant safety upgrade project shall be evaluated for extended Design Basis Events (DBE) environment and/or Design Extensive Conditions (DEC) under which system/equipment function is required to be operable or equipment shall not fail in manner to prevent mitigation of accident or progress accident consequences.

Equipment Environmental Qualification (to Design Basis Accident):

Electrical and I&C Environmental Qualification (EQ): NEK is performing qualification program under 10CFR50.49 "Environmental Qualification of Electric Equipment Important to Safety" [3.14-31] requirements and NUREG 0588 Revision 1, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment" [3.14-32] requirements. NEK formal program is prescribed in document ED-12 [4-17] and its lower level procedures. New equipment and existing modified equipment shall be evaluated to comply with EQ program requirements. Also new systems interconnecting the existing systems shall be evaluated to assure that EQ program requirements are accomplished (system safety function shall be assured). EQ documentation files containing information necessary to determine qualification status of subject equipment shall be prepared per ED-12 requirements.

Mechanical Equipment Environmental Qualification (MEQ): NEK does not have formal MEQ program. New systems/equipment and modified existing systems/equipment shall be evaluated to assure that subject system/equipment will perform designated safety related function under Design Basis Accident (DBA). Also new systems interconnecting the existing systems shall be evaluated to assure that MEQ requirements are accomplished (system safety function shall be assured).

Mechanical equipment shall be qualified in accordance with international nuclear industry codes and standards (US NRC and IAEA) to assure that system/equipment will be capable of performing designated safety function in the DBA environmental conditions. MEQ shall be performed to comply with the requirements of 10CFR50, Appendix A, "General Design Criteria (GDC) 4" [3.14-1].

Following references may be used as MEQ guidelines:

- ASME QME-1-2007, "Qualification of Active Mechanical Equipment used in Nuclear Power Plants" [4-23]
- NUREG-0800, SRP 3.11, UNITED STATES NUCLEAR REGULATORY COMMISSION, Standard Review Plan (SRP), Environmental Qualification of Mechanical and Electrical Equipment, (Rev. 3), NRC, Washington, DC (2007) [4-24]

MEQ documentation files containing information necessary to determine qualification status of subject equipment shall be prepared.

Equipment Survivability Evaluations (to Design Extension Conditions)

New systems/equipment and modified existing systems/equipment shall be evaluated to assure that subject system/equipment will perform designated safety function under Design Extension Conditions (DEC). Also new systems interconnecting the existing systems shall be evaluated to assure that safety function is accomplished (system safety function shall be assured).

Document STR-NEK-12-04 "NEK SUP equipment under DEC survivability concept" [4-18] defines "Equipment Environmental Survivability" requirements (regulatory framework, scope of subject equipment, preliminary selection of severe accident scenarios, equipment survivability assessment process and methodologies). NEK will define severe accident environmental conditions for Equipment Survivability purpose in separate technical report. Technical specification SP-ES1232, Rev.1 [4-50] defines subject severe accident scenarios for determination of severe accident (DEC) environmental conditions.

There will be implemented WENRA [4-47] principles (for existing reactors – "Issue F") related to DEC systems/equipment categories and consequent environmental qualification levels.

Equipment category DEC A will serve for prevention of severe fuel damage in the core or in the spent fuel storage. Therefore this equipment will be qualified (survivability assessment evaluation) to the level of Design Basis Accident environment. Severe accident management accident mitigation actions with corresponding timing will assure that environmental conditions will not exceed DBA environment. Equipment Survivability shall be performed in accordance with Equipment Environmental Qualifications requirements (the same methodology and level of qualification).

Equipment Category DEC B will serve for mitigation and monitoring of consequences when severe accident progress to the Core Damage. There shall be considered following DEC system functions:

- Containment overpressure protection and controlled radioactive releases into the environment
- The threat due to the combustible gasses mitigation
- Containment long term heat removal
- Instrumentation needed for the management of Core Damage severe accident

Therefore this equipment operability shall be justified (survivability assessment evaluation) to the level of determined Core Damage severe accident manageable end state environment which is more severe than DBA environment. Whenever possible the method and level (qualification testing, required margins, etc.) of qualification prescribed for Equipment Environmental Qualifications shall be used.

New Safety Upgrade Project electrical, I&C and mechanical equipment and modified existing equipment shall be evaluated to comply above specified requirements. Documentation files containing information necessary to determine "survivability" status of subject equipment shall be prepared.

Seismic and Dynamic Equipment Qualification

The newly upgraded safety electrical, I&C and mechanical equipment shall be qualified to higher seismic loading as defined in section 3.2. Qualification requirements shall be also applied to associated existing systems/equipment with the new systems/equipment and interconnections.

Qualification shall be performed in accordance with prescribed methodologies in SP-S702 Technical Specification "Seismic Analysis, Testing and Documentation" [4-22] and Regulatory Guide 1.100, Rev.3 "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants" [3.14-30].

Documentation files containing information necessary to determine qualification status of subject equipment shall be prepared.

Electromagnetic and Radiofrequency Equipment Qualification

New Safety Related Instrumentation and Control (I&C) Systems and existing modified Safety Related I&C Systems shall be qualified in accordance with RG-1.180 Rev.1 "Guidelines For Evaluating Electromagnetic and Radio-frequency in Safety-Related Instrumentation and Control Systems" [3.14-28] regarding radiofrequency,

electromagnetic interfaces and power (voltage) surges where applicable. It is not intended to perform any equipment qualification analysis for systems to which new systems connect (with exception of determination of electromagnetic or radiofrequency emissions of existing equipment if it is estimated to generate significant levels) as an interface nor to provide any equipment qualification beyond the equipment added to meet equipment qualification requirements.

3.14 Plant Safety Upgrade Project applicable codes, standards and regulatory requirements

1. General 10CFR50, Appendix A General Design Criteria
2. 10CFR50.63 Loss of all Alternating Current Power;
3. RG-1.6, Independence between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems;
4. RG-1.9, Selection, Design, Qualification and Testing of Emergency Diesel Generator Units Used as Class 1E Electric Power Systems at Nuclear Power Plants, Revision 3, July 1973;
5. RG-1.29, Seismic Design Classification, Revision 1, August 1973
6. deleted
7. ANSI/ANS-5.1-2005: Decay Heat Power in Light Water Reactors;
8. Regulatory Guide 1.76 rev. 1 "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants";
9. RG-1.32, Criteria for Power Systems for Nuclear Power Plants;
10. RG-1.137, Fuel Oil Systems for Standby Diesel Generators;
11. Standard Review Plan NUREG 0800
12. ASME BPVC Section III, Nuclear Components, Class 3, 1971 Edition through Winter 1972 Addenda for the interfaces to the existing systems;
13. Latest ASME BPVC edition accepted by NRC could be used for new systems/components,
14. ASME AG-1-2009, Code on Nuclear Air and Gas Treatment;
15. ACI 301 Specifications for Structural Concrete of Buildings;
16. ACI 318-08 Building Code Requirements for Structural Concrete
17. ACI 349-06 Code Requirements for Nuclear Safety-Related Concrete Structures
18. ACI 349-97 Code Requirements for Nuclear Safety Related Concrete Structures;
19. ANSI/ANS-51.1-1983 Nuclear Safety Criteria for Design of Stationary Pressurized Water Reactor Plants (withdrawn).
20. ANSI/ANS-58.6-1996 Criteria for Remote Shutdown for Light Water Reactor
21. IEEE's as specified in the USAR Section 3 for the existing systems/components
22. IEEE 627 for the for new systems/components(DEC)
23. JV5 Pravilnik o dejavnih sevalne in jedrske varnosti
24. JV9 Pravilnik o zagotavljanju varnosti po začetku obratovanja sevalnih ali jedrskih objektov
25. Zakon o graditvi objektov (ZGO)
26. Pravilnik o mehanski odpornosti in stabilnosti objektov, (Uradni list RS, št. 101/05)
27. Odredba o seznamu standardov, ob uporabi katerih se domneva skladnost z zahtevami Pravilnika o mehanski odpornosti in stabilnosti objektov, (Uradni list RS št. 8/11)
28. RG 1.180 »GUIDELINES FOR EVALUATING ELECTROMAGNETIC AND RADIO-FREQUENCY INTERFERENCE IN SAFETY-RELATED INSTRUMENTATION AND CONTROL SYSTEMS, Rev. 1, October 2003
29. ANSI/ANS-58.14, Safety and Pressure Integrity Classification Criteria for Light Water Reactors
30. Regulatory Guide 1.100, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants "; Rev.3, September 2009
31. 10CFR50.49 "Environmental Qualification of Electric Equipment Important to Safety"
32. NUREG 0588 Revision 1, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment"
33. RG 1.52 rev.4 DESIGN, INSPECTION, AND TESTING CRITERIA FOR AIR FILTRATION AND ADSORPTION UNITS OF POST-ACCIDENT ENGINEERED- SAFETY-FEATURE ATMOSPHERE CLEANUP SYSTEMS IN LIGHT-WATER-COOLED NUCLEAR POWER PLANTS
34. ANSI-N18.2 - NUCLEAR SAFETY CRITERIA WATER REACTOR PLANTS
35. ASME N509-1989 "Nuclear Power Plant Air-Cleaning Units and Components"
36. ASME N510-1989 "Testing of Nuclear Air Treatment Systems"
37. ASME Code Section II
38. ASME Code Section IX
39. ASME B31.1-2007 "Power Piping"
40. NFPA 803-1998 "Standard for Fire Protection for Nuclear Power Plants"
41. NFPA 90A-2002 "Standard for Installation of Air Conditioning and Ventilation Systems"
42. NFPA 70-202 "National Electrical Code"

43. IEEE 323 "Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations"
44. IEEE 344 "Recommended Practice for Seismic Qualification of Class 1 Equipment Used in Nuclear Power Plants"
45. US NRC RG 1.57 "design Limits and Loading Combination for Metal Primary Containment System Components"
46. US NRC RG 1.60 "Design Response Spectra for Seismic Design of Nuclear Power Plants"
47. US NRC RG 1.61 "Damping Values for the Seismic Design of Nuclear Power Plants"
48. SIST IEC 62305 "Protection Against Lightning"
49. TSG-N-003-2013 "Tehnična smernica - Zaščita pred udarom strele"
50. Regulatory Guide 1.97 Rev. 3 "INSTRUMENTATION FOR LIGHT-WATER-COOLED NUCLEAR POWER PLANTS TO ASSESS PLANT AND ENVIRONS CONDITIONS DURING AND FOLLOWING AN ACCIDENT".

In general, the plant design and licensing basis standards are applicable for the design of the DEC systems as described in the section 3 and 4. New alternative SSC will not be considered as a part of original Engineering Safety Features (with the exception of direct interfaces e.g. valves, pipeline, etc.) but will be designed with the same design requirements and criteria (ANSI/ANS-58.14). All new SSC will be marked in accordance with Plant System codes and designated with similar system function abbreviation. The designation of new equipment will follow the rules as defined in procedure ESP-2.113 [4-30].

If specific design of the alternative systems will show that it is convenient (e.g. due to the availability of the supplier on the market) not to follow the specific USA NRC and other regulation it shall be proven (within specific design package) that the operation of this systems will meet with the design requirements from this document and basic assumption and that the systems are available under all postulated events (e.g. earthquake).

The originally used Engineering Design Guidelines shall be used unless more restrictive or demanding requirements will have to be taken in account due to the Plant Safety Upgrade project specific requirements (e.g. Conduit Support Criteria due to the higher seismic loads etc.).

4. References

1. DCM-RP-083, Program nadgradnje varnosti NEK
2. JV 5 Pravilnik o dejavnih sevalnih in jedrskih varnostih
3. ADP-1.0.133, Organiziranost, priprava, izvedba in vodenje programa nadgradnje varnosti (PNV) NEK
4. NRC's Report "Enhancing Reactor Safety in the 21st Century"; U.S.NRC;
5. SECY 12-0025, PROPOSED ORDERS AND REQUESTS FOR INFORMATION IN RESPONSE TO LESSONS LEARNED FROM JAPAN'S MARCH 11, 2011, GREAT TOHOKU EARTHQUAKE AND TSUNAMI; U.S.NRC
6. NUREG-1465 "Accident Source Term for Light-Water Nuclear Power Plants", US NRC, 1995
7. WENX-09-18 "Post-Accident Dose NPP Krško Area AB037, AB081, AB104, CB004 and IB039 Reassessment Using AST"
8. WENX/95/24 "IPE level 2 Report"
9. WENX 94/27 NPP Post- Accident Shielding Review
10. 10 CFR 50 Appendix B
11. "NPP KRŠKO Analyses of Potential Safety Improvements", NEK ESD-TR-09/11, Rev. 0
12. 5-KSH/d-127, PREPARATION OF NEW REVISION OF PMF STUDY AND CONCEPTUAL DESIGN PACKAGE FOR FLOOD PROTECTION OF NPP KRŠKO; ULj-FGG; February 2010
13. TID-14844 "Calculation of Distance Factors for Power and Test Reactor Sites", 1962
14. US NRC Regulatory Guide 1.4 "Assumption Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors", 1974
15. WENX 94/27 "Krško Nuclear Power Plant Post-Accident Shielding Review", 1994
16. deleted
17. ED-12 "Environmental Qualification Program" rev.2.
18. STR-NEK-12-04 "NEK SUP equipment under DEC survivability concept", Rev.1
19. IAEA Specific Safety Requirements, SSR-2/1, January 2012.
20. Krško Individual Plant Examination – Level 2, Westinghouse Energy Systems Europe, August 1995.
21. 2P-81 Electro Motive Division "Power Pointers", 1981
22. SP-S702 Technical Specification "Seismic Analysis, Testing and Documentation", Rev.10
23. ASME QME-1-2007, "Qualification of Active Mechanical Equipment used in Nuclear Power Plants"
24. NUREG-0800, SRP 3.11, UNITED STATES NUCLEAR REGULATORY COMMISSION, Standard Review Plan (SRP), Environmental Qualification of Mechanical and Electrical Equipment, (Rev. 3), NRC, Washington, DC (2007)
25. OBDELAVA METEOROLOŠKIH MERITEV ZA USAR, 1977 – 2011, KONČNO POROČILO, MEIS 2013.
26. NUREG 0700 Control Room Design.
27. NUREG 0711 rev.2; Human Factors Engineering Program Review Model
28. IEEE 7-4.3.2-1993 Standard Design Criteria for Digital Computers in Safety Systems of NP Generation Station
29. NEI 12-02 Industry Guidance for Compliance with NRC Order EA-12-051 "To modify Licenses with regards to reliable SFP Instrumentation".
30. ESP-2.113 "EAM MECL EQUIPMENT NUMBERING SYSTEM"
31. NEK Updated Safety analyses Report
32. NEK Technical Specifications
33. ESP-2.602 "PLANT DESIGN MODIFICATION"
34. ESP-2.604 "DESIGN CONSIDERATIONS, BASES AND INPUTS"
35. ESP-2.624 "DESIGN IMPACT EVALUATION"
36. SPSA-ABS-NEK-2004-001 Krško SPSA, Task 1, Seismic Fragilities and Specifications for Risk Model Updates, Revision 1, ABS Consulting August 2004
37. KRSKO-1-DC-SE-0002, "Main complex Floor Response Spectra for DEC – 0.6g", Worley Parsons 2013.
38. NEK ESD-TR-01/13 Scenario Analysis for DEC Inventory requirements
39. Regulatory Guide RG-1.76 Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants
40. Worley Parsons, Main complex FRS for DEC (0.6 g), KRSKO-1-DC-SE-0002
41. Design Modification Package 1002-GH-L, "Severe Accident Hydrogen Control System (PAR)", Rev.1
42. WENX-12-33, "Krško Severe Accident Hydrogen Control Project Sizing of Passive Autocatalytic Recombiners", Rev.1, February 2013
43. Design Modification Package 1008-VA-L, Passive Containment Filtered Vent (PCFV) System, Rev.1
44. WENX-12-05, Krško MAAP Analysis to Support Development of Partial Conceptual Design Package for Containment Severe Accident Hydrogen Control and Filtered Vent, Rev.1, February 2012

45. WENX-12-32, Dose Rate Analysis in Auxiliary Building, Rev.3
46. SNSA decree for extension of the implementation of the SUP program until 2018, number 3570-11/2011/26 dated on 11th of October 2013.
47. WENRA SAFETY REFERENCE LEVELS FOR EXISTING REACTORS, Update in relation to lessons learned from TEPCO Fukushima Dai-Ichi accident, 24th September 2014
48. NEK ESD-TR-09/11; NPP Krško Analyses of Potential Safety Improvements
49. NEK ESD-TR-25/13; Estimation of Fission Products Release to Environment for Station Blackout (SBO) Accident Following Passive Containment Filtered Vent (PCFV) System Installation, rev. 0, December 2013
50. SP-ES1232; Determination of Environmental Conditions for Equipment Survivability, Rev.1
51. SIST EN 1998-1:2005, Eurocode 8: Design of structures for earthquake resistance - Part 1: General rules, seismic actions and rules for buildings
52. NEK ESD TR 05-15 Water Inventory Requirements/Management for DEC-A and DEC-B Accidents Rev.0
53. NEK ESD TR 17-15 ASI pump pressure and flow requirements for DEC-A LOCA
54. NEK ESD TR 18-15 NEK ESD TR 18-15 - MAAP Analysis of Containment Cooling During DEC B Mitigation
55. ENCO Review of Safety Upgrades in EU Countries related to Post Fukushima Safety Improvements and Life Extension
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57. »ANALIZA NEVIHT IN ATMOSFERSKIH PRAZNITEV S PREDLOGOM POSODOBITVE USAR, Študija št.: 2320, EIMV, April 2016«.

ATTACHMENT 1

Temperature, snow height and wind speed values needed for the design of the SSC with respect of frequency and calculated duration of this condition

Location	Parameter	Value description	100-years return value	1 000-years return value	10 000-years return value*
NEK MT 2 m	Air temperature	Max. ½-hour avg.[°C]	40,5	43,3	46,0
NEK MT 2 m	Air temperature	Max. 1-hour avg.[°C]	40,3	43,1	45,8
NEK MT 2 m	Air temperature	Max. 4-hours avg.[°C]	39,8	42,4	45,1
NEK MT 2 m	Air temperature	Max. 8-hours avg.[°C]	38,3	40,8	43,4
NEK MT 2 m	Air temperature	Max. 12-hours avg.[°C]	36,2	38,6	40,9
NEK MT 2 m	Air temperature	Max. 24-hours avg.[°C]	30,1	31,8	33,5
NEK MT 2 m	Air temperature	Max. 3-days avg.[°C]	29,6	31,6	33,5
NEK MT 2 m	Air temperature	Max. 7-days avg.[°C]	28,2	30,0	31,8
NEK MT 2 m	Air temperature	Max. 14-days avg.[°C]	27,0	28,7	30,5
NEK MT 2 m	Air temperature	Min. ½-hour avg.[°C]	-25,5	-30,3	-35,1
NEK MT 2 m	Air temperature	Min. 1-hour avg.[°C]	-25,2	-29,9	-34,7
NEK MT 2 m	Air temperature	Min. 4-hours avg.[°C]	-24,7	-29,4	-34,1
NEK MT 2 m	Air temperature	Min. 8-hours avg.[°C]	-24,0	-28,8	-33,5
NEK MT 2 m	Air temperature	Min. 12-hours avg.[°C]	-23,3	-28,0	-32,7
NEK MT 2 m	Air temperature	Min. 24-hours avg.[°C]	-19,1	-23,1	-27,2
NEK MT 2 m	Air temperature	Min. 3-days avg.[°C]	-15,3	-18,5	-21,7
NEK MT 2 m	Air temperature	Min. 7-days avg.[°C]	-11,4	-13,8	-16,1
NEK MT 2 m	Air temperature	Min. 14-days avg.[°C]	-8,4	-10,4	-12,3
Brege	Snow height	Daily height [cm]	73,9	99,4	124,8
Brege	Snow height increment	Daily height incr.[cm]	41,5	54,2	67,0
NEK MT 10m	Wind speed	max. 1/2 h average (m/s)	14,0	16,4	18,9
NEK MT 10m	Wind speed	max. second average (m/s)	24,6	28,2	31,7

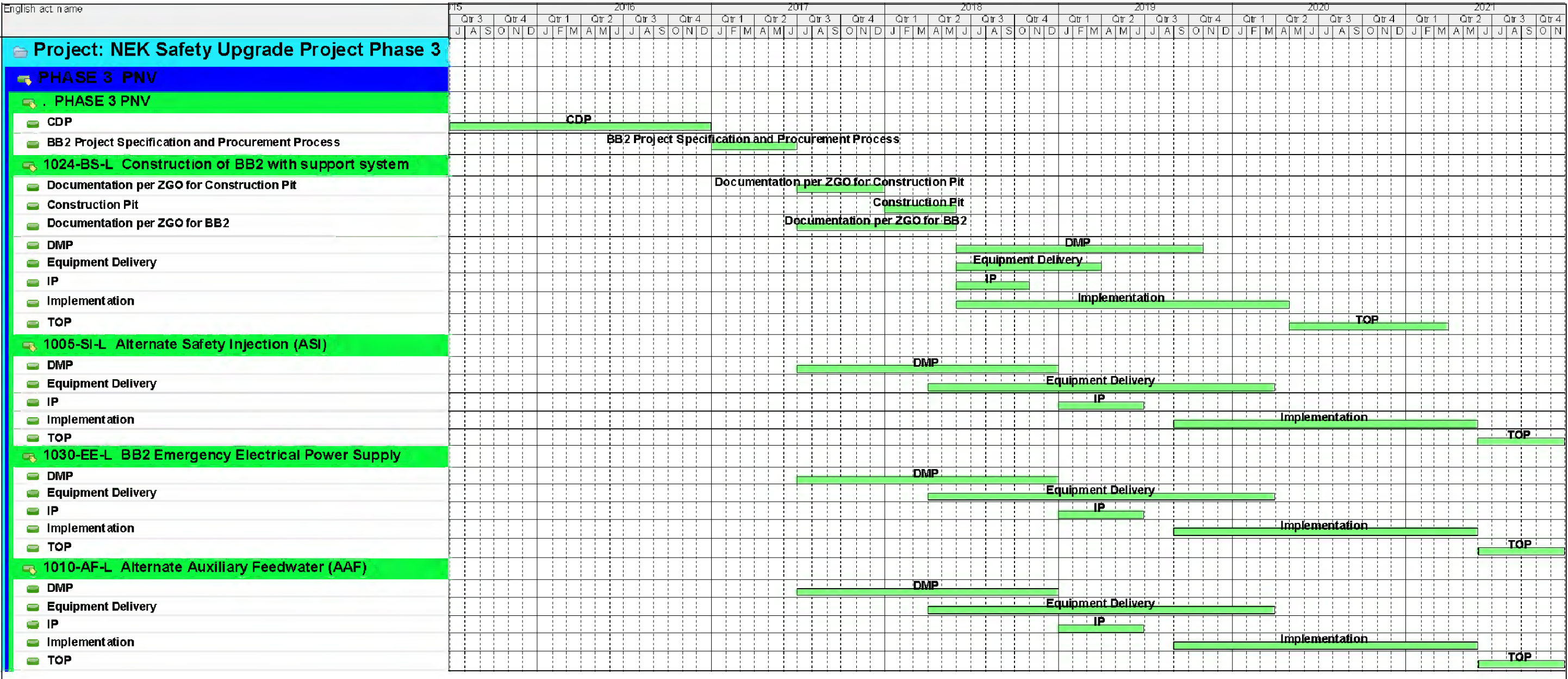
*This column shall be used for DEC SSC design!

Appendix 22.2

CDP 1024-BS-L

Pdf file of CDP is on CD/DVD. It can be obtained from Purchaser upon request.

Appendix 22.3
Overall Project Schedule



Appendix 22.4
Guideline for ES Impact Evaluation

PLANT MODIFICATION

Plant Mod. No. _____

Rev. No. _____

GUIDELINE FOR ES IMPACT EVALUATION

Page No. _____

1. Equipment No. - subject of ES classification evaluation (Note1):
2. Detailed Equipment Safety Function Description (Note 2):
3. Equipment is required to MITIGATE CONSEQUENCES OR MONITOR SPECIFIC SEVERE ACCIDENT (SA) **AND** IS LOCATED IN HARSH ENVIRONMENT CAUSED BY THAT SPECIFIC SEVERE ACCIDENT
(Is exposed to Severe Accident Harsh environment; including DBA environment)

<input type="checkbox"/> YES	<input type="checkbox"/> NO
------------------------------	-----------------------------
4. Equipment will perform its Safety Function during or after being exposed to Severe Accident Harsh environment (Note 3)

<input type="checkbox"/> YES	<input type="checkbox"/> NO
------------------------------	-----------------------------
5. **Final ES classification** (Note 4):

<input type="checkbox"/> DEC A	<input type="checkbox"/> NO
<input type="checkbox"/> DEC B	
6. Severe Accident Phase /Time Frame category (Note 5):

- DEC environment mitigation or monitoring in Time Frame 1	<input type="checkbox"/> YES	<input type="checkbox"/> NO
- DEC environment mitigation or monitoring in Time Frame 2	<input type="checkbox"/> YES	<input type="checkbox"/> NO
- DEC environment mitigation or monitoring in Time Frame 3	<input type="checkbox"/> YES	<input type="checkbox"/> NO
- DEC environment mitigation or monitoring in Time Frame 4	<input type="checkbox"/> YES	<input type="checkbox"/> NO
- Other: _____		
7. Required Post Accident Operating Time - PAOT (from beginning - accident initiation) – designate:

- Time from event initiation:	0 – 1hr	<input type="checkbox"/>
- Time from event initiation:	1hr – 24hr	<input type="checkbox"/>
- Time from event initiation:	1day – 1month	<input type="checkbox"/>
- Time from event initiation:	1month – 1year	<input type="checkbox"/>
- Other (more accurate / equipment specific)	_____	

NOTES:

1. ES Impact Evaluation form shall be completed for all new equipment (designated by unique MECL equipment number) located in Severe Accident Harsh – by exception of equipment which by nature does not require ES assessment (piping, supports, cable trays, metal tanks, etc.).
2. For example: Motor Operated Valve; normal operating position (opened) /Severe Accident function (close and stay closed); define which accident scenario is applicable for equipment survivability assessment; etc.
3. If answer is negative, than explanation must be given – function/time relaxation (Examples: Component will fulfill it's safety-related function prior to being exposed to a harsh environment OR this component will not be required to change the position or state after experiencing the harsh environment OR exposure to the harsh environment will not cause a change of state or mislead the operator)
4. IF both answers on questions 3 and 4 are "YES" than equipment is classified as ES equipment - designate DEC A or DEC B and equipment will be subject of further ES evaluation. In that case provide additional information required under questions 6 and 7. DEC A and DEC B definitions are defined in NEK DCM-DI-001, "NEK SAFETY UPGRADE PROJECT DESIGN INPUTS AND INTERFACES" document.
5. Time Frame categories description (for detailed description see continuation):
 - '1': Pre-Core Uncovery
 - '2': Core Heatup
 - '3': In-Vessel Accident Phase
 - '4': Ex-Vessel Accident Phase

PLANT MODIFICATION

Plant Mod. No. _____

Rev. No. _____

GUIDELINE FOR ES IMPACT EVALUATION

Page No. _____

Time Frame categories detailed description:

Time Frame 1 - Pre-Core Uncovery

Time Frame 1 is defined as the period of time in the accident sequence after the accident initiation and prior to core uncovery. The fuel rods are cooled by the water/steam mixture in the reactor vessel. The accident has not yet progressed beyond the design basis of the plant, and hydrogen generation and the release of fission products from the core is negligible. Emergency Operating Procedures are designed to maintain or recover the water inventory and heat removal in the reactor coolant system to prevent core uncovery and establish a safe, stable state. Recovery within Time Frame 1 prevents the accident from becoming a severe accident. During Time Frames 1, most of the equipment needed will receive a signal to start. However, failure of some functions is likely to be the reason the accident has proceeded to severe accident. Equipment survivability in Time Frame 1 is covered under the design basis equipment qualification program.

Time Frame 2 - Core Heatup

Time Frame 2 is defined as the period of time after core uncovery and prior to the onset of significant core damage as evidenced by the rapid zirconium-water reactions in the core. This is the transition period from design basis to severe accident environment. The overall core geometry is intact and the uncovered portion of the core is overheating due to the lack of decay heat removal. Hydrogen releases are limited to relatively minor cladding oxidation and some noble gas and volatile fission products may be released from the fuel clad gap due to rupture of fuel rod cladding at these higher temperatures. As the core-exit gas temperature increases, the EOPs transition to inadequate core cooling procedures. Upon entry into these procedures, the control room staff initiates actions to mitigate a accident. The operators attempt to reduce the core temperature by depressurizing the RCS, re-establish the water inventory in the reactor coolant system. Recovery in Time Frame 2 prevents the accident from becoming a core melt. The containment conditions are expected to be within the design basis conditions while the reactor vessel and RCS conditions will be slightly above the design basis. Equipment survivability in Time Frame 2 should be evaluated to demonstrate it is within the equipment qualification envelope.

Time Frame 3 - In-Vessel Severe Accident Phase

Time Frame 3 is the period of time in the severe accident after the accident progresses beyond the onset of rapid zirconium-water reactions and prior to the establishment of a controlled, stable state (end of in vessel core relocation), or prior to reactor vessel failure. The onset of rapid zirconium water reactions of the fuel rod cladding and hydrogen generation defines the beginning of Time Frame 3. The heat of the exothermic reaction accelerates the degradation, melting and relocation of the core. Fission products are released from the fuel-clad gap as the cladding bursts and from the fuel matrix as the fuel pellets melt. Over the period of Time Frame 3, the initial, intact geometry of the core is lost as it melts and relocates downward. Containment temperatures may exceed design basis accident limits depending on the status of containment cooling systems. Severe accident management strategies exercised during Time Frame 3 are designed to recover reactor coolant system inventory and heat removal, to maintain reactor vessel integrity and to maintain containment integrity. Recovery actions in Time Frame 3 may create containment environmental challenges by increasing the rate of hydrogen and steam generation.

Time Frame 4 - Ex-Vessel Severe Accident Phase

Time Frame 4 is defined as the period of time after the reactor vessel fails until the establishment of a controlled, stable state. The plant design and procedures are designed to provide the capability to inject into the reactor vessel and depressurize the RCS to try to recover the core in-vessel. However, failure of some functions is likely to be the reason the accident has proceeded to severe accident. Molten core debris is relocated from the reactor vessel onto the containment cavity floor which creates the potential for rapid steam generation, core-concrete interaction and non-condensable gas generation. Severe accident management strategies implemented in Time Frame 4 are designed to monitor the accident progression, attempt to re-establish a coolable core debris configuration on the containment floor. The primary objectives of these strategies are to maintain containment integrity and mitigate fission product releases to the environment.

Appendix 22.5

Requirements from ESP-2.617 for MECL Update for new components and spares

Equipment information for component

Part number						
Item description						
Manufacturer						
Manufacturer-title-address						
Mfr part number(MPN)						
MPN Description						
Manufacturer-title-address						
Safety Classification (Y/N)						
Seismic Category (1, N/A)						
ASME CODE PN (Y/N)						
IEEE PN (Y/N)						
ENV EQ PN (Y/N)						
Quantity						
Unit of measure(UOM)						
Serial control (Y/N)						
Serial number						
Lot/Heat/Real/Batch No						
Shelf Life Control						
Shelf Life Months						
Storage Level (A,B,C,D)						
ISM REQ (Y/N)						
Qualified Life-Months						
Service/Operation Life-months						
Chemicals-MSDS (Y/N)						
Hazardous Material (Y/N)						
Nuclear Material (Y/N)						
Radioactive Material (Y/N)						
Item Price						
Purchase order no						
Ref records Ref. document (OM; DWG; BOM)						

Note:

1. Contractor shall provide all required information for main component and subcomponents.

Equipment information

Part number	
Item description	
Manufacturer	
Manufacturer-title-address	
Ref. document (OM; DWG; BOM)	

Equipment's Spare parts

Mfr part number(MPN)						
MPN Description						
Manufacturer-title-address						
Safety Classification (Y/N)						
Seismic Category (1, N/A)						
ASME CODE PN (Y/N)						
IEEE PN (Y/N)						
ENV EQ PN (Y/N)						
Quantity						
Unit of measure(UOM)						
Serial control (Y/N)						
Serial number						
Lot/Heat/Real/Batch No						
Shelf life control						
Shelf Life Months						
Storage Level (A,B,C,D)						
ISM REQ (Y/N)						
Qualified Life-Months						
Service/Operation Life-months						
Chemicals-MSDS (Y/N)						
Hazardous Material (Y/N)						
Nuclear Material (Y/N)						
Radioactive Material (Y/N)						
Item Price						
Purchase order no						
Ref records						

Note:

1. Contractor shall provide all required information for Equipment's spare parts delivered within contracted scope of supply
2. Table shall be filled by Contractor with all requested information latest at delivery of Spare Parts

Appendix 22.6

Calculation of Floor Response Spectra for BB2 and seismic design parameters for yard infrastructure

Floor response spectra for BB2 and seismic design parameters for yard infrastructure

1.0 Background and description of the work

The BB2 will be constructed at the South-West side of the NEK yard and will accommodate the tanks of borated and demineralized water, AAF and ASI pumps, valves, piping, and the rest of the supporting equipment. Other important infrastructure for the BB2 project is underground AAF and ASI piping between the BB2 and the Nuclear Island and water well on the yard. The BB2, in-housed systems and equipment and the underground piping infrastructure are classified Seismic Category I systems, and will be designed to meet seismic performance requirements during and after an event of DEC Safe Shutdown Earthquake. The water well is not safety related, but is designed and according to seismic requirements applicable to Seismic category 1 due to its importance.

This appendix defines minimum requirements for the calculation of floor response spectra (FRS) for the BB2 and determination of seismic design parameters of yard infrastructure. FRS and seismic design parameters will represent an input to the design of seismic resistance of DEC systems and equipment.

For the DEC systems and equipment inside the Nuclear Island and on the free field ground surface, the Peak Ground Acceleration (PGA) intensity corresponding to DEC Safe Shutdown Earthquake is 0.6 g, which is equal to two-times the design Safe Shutdown Earthquake (SSE), the latter representing the design based earthquake for systems, structures, and components (SSC) of NEK. The intensity as $2 \times \text{SSE}$ (0.6 g) for DEC Safe Shutdown Earthquake was selected based on the NPP Krško analyses of potential improvements, and the fact that this value is higher than that as estimated for the return period 10 000 years [13]. OBE loading for new equipment in the Nuclear Island and on the free field ground surface remains at the level of existing equipment. Therefore, the peak ground acceleration for OBE for equipment inside the Nuclear Island and on the free field ground surface equals at 0.15g.

For new DEC underground piping and new water well, the Peak Ground Acceleration (PGA) intensity corresponding to DEC Safe Shutdown Earthquake is 0.6 g. OBE loading for new underground piping and new water well is 0.3g PGA.

For the BB2 and in-housed major DEC equipment the design PGA intensity equals at 0.78 g (0.6×1.3). The multiplication factor of 1.3 takes approximately into account the effect of the uncertainties related to the NPP Krško seismic hazard calculation. OBE loading for BB2 and in-housed DEC systems and components is 0.30g PGA.

The state-of-the-art standards and methodology shall be considered in order to meet the requirements of this specification. The background and the input data needed for the calculations are defined in the Conceptual Design Package (CDP) for the planned modification 1024-BS-L [12], USAR [14] and Nuclear Regulatory Commission (NRC) guides. The input data regarding the geo-mechanical properties will be provided by NEK after the geo-mechanical investigations will be finished, but before the subscription of the contract.

2.0 Scope of services

The scope of services of this specification includes the calculation of FRS for BB2 and determination of seismic design parameters for yard infrastructure. All work is divided into phases as follows:

- PHASE 1: Phase 1 defines the methodology to be used to develop FRS for BB2 and to perform the seismic analyses of the water well and the underground yard piping.
- PHASE 2: The Phase 2 includes the preliminary calculation of FRS for BB2 for PGA intensities of 0.3, 0.6 and 0.78 g and seismic design parameters of water well and underground yard piping for PGA intensities of 0.30 g and 0.6 g. Also included is a parametric study on the impact of accidental torsion on the calculated FRS and how the effects can be accommodated in the final FRS.
- PHASE 3: The Phase 3 includes final calculation of FRS and seismic design parameters of water wells and underground yard piping.
- PHASE 4: In the Phase 4, the USAR change package for section 20 and new revision of technical specification SP S702 [15] shall be prepared.

2.1 PHASE 1 - Methodology

The first Technical Report (TR1) has to describe the BB2 structural model, input data and computer codes used. Also included is the step-by-step description of the methodology for calculation of the FRS. FRS shall be calculated in accordance with NRC RG 1.122 [3], ASCE 4-98 [4] and NRC RG 1.61 [2]. Attention should be given to the soil-structure interaction (SSI) simulation. At high seismic intensities soil can respond in nonlinear range. The methodology for the site response analysis shall address the effects of large soil strains.

Acceptable approach for SSI is defined as follows:

- BB2 is embedded approximately 14.5 m below grade and consequently is considered a Deeply Embedded and/or Buried (DEB) structure with an embedment to total height ratio of 0.72 and an embedment to foundation radius ratio of 0.66. Since BB2's embedment to foundation radius ratio of 0.66 is more than double the 30 percent threshold defined in ASCE 4-98 at which the effects of embedment can be neglected, and based on the recommendations of NUREG/CR-6896 which is endorsed by the USNRC, the linear, direct, soil structure interaction (SSI) methodologies defined in ASCE 4-98, Section 3.3.3 shall be used in order to achieve acceptable SSI response analyses.

Acceptable approach for soil site response analysis is (but not limited to) as described below:

- In order to mitigate possible large soil strains, the site response analyses may be performed using multiple recorded time histories, provided that these time histories are recorded at the sites with similar seismotectonic features as that of the NPP Krško, but scaled to the PGA intensities considered. Real recorded time histories are to be used, since it is anticipated that they are more narrow-banded than the NRC RG 1.60 motions [1], and would have less tendency to overdrive the soil, and thus produce soil strains more realistically. In the analyses of soil site response, the recorded time histories shall be applied at the fictitious rock outcrop. The results of the soil response analysis are the equivalent shear velocity of soil, needed for the determination of the soil properties for the SSI analysis.
- The strains of the soil column strongly depend on the assumed reduction curve of soil shear modulus. In the PSHA [13], it was determined that the Seed and Idriss reduction curves [24] are not representative of the site and therefore, an average of results of a site response analysis using Seed and Idriss and one using EPRI reduction curves [25] probably represent more realistic results. Therefore, it is suggested that different reduction curves are considered. If more accurate site-specific data are not available, Seed and EPRI reduction curves may be used.
- The time history deconvolution should be based on artificial time histories generated based on broad-banded NRC RG 1.60 [1] response spectra.

- The strain dependent soil properties, which represent the input for the deconvolution, should be calculated using multiple recorded time histories and appropriate reduction curves.

The second Technical Report (TR2) has to describe the methodology for calculation of seismic design parameters of water well and underground yard piping. Described should be all calculation steps, input data and computer codes used. The methodology defined in ASCE 4-98 and SRP 3.7.3 [8] is acceptable. The evaluation approach shall consist of (a) evaluation of ground response to shaking, and (b) assessment of water wells and underground yard piping response to ground deformations. The following are the minimum requirements in determining the methodology:

a) Evaluation of the ground response:

- PGA intensities at the surface of 0.30 g and 0.6 g are considered.
- The influences of the local soil conditions on the spectral accelerations at different depths should be investigated. The document, NUREG/CR-6926 states that for the determination of seismic motion at different depths is typically evaluated by using the equivalent linear analysis based on the assumption that the shear wave spreading in vertical direction. This method may be used for the purpose of the scope of this phase.
- For the seismic design of the water wells and underground piping shear deformations of the soil are important. Therefore, the shear deformations of the soil shall be estimated.
- The calculations should be based on the local site soil data.
- Appropriate reduction curves have to be considered.
- The estimated ground response to shaking may be sensitive to the details of the soil profile. The sensitivity of estimated spectral accelerations and shear deformations on most governing input parameters have to be assessed.

b) Assessment of water well and underground piping response to the ground deformations:

- The deformations of piping/well casing due to the ground shaking shall be calculated. It is suggested that the following deformation modes shall be considered: (1) compression and extension, (2) longitudinal bending, (3) shear deformations and (4) "ovalling" the circular section.
- With exception to the segments close to the through-wall penetrations, the piping and well casings are expected to be relatively flexible in comparison to the surrounding grounds. It may be assumed that the piping will move with the ground during earthquake. The interaction between the piping and the surrounding ground may be ignored. The deformations of the piping may be assessed by using the free-field deformation approach.
- Seismic interaction between yard piping segments close to the through-wall penetrations and the buildings has to be considered.

2.2 PHASE 2 - Preliminary calculations

The third Technical Report (TR3) contains preliminary BB2 FRS for PGA intensities of 0.3 g, 0.6 g and 0.78 g. Median input soil properties (without considering uncertainties) shall be used. The results shall be presented for all elevations and for all rooms of the BB2, as well as for different equipment damping values including the frequency dependent FRS as required for piping design. Preliminary FRS need not be broadened or smoothed. In addition, in the TR3, a parametric study to establish the impact of accidental torsion on FRS and to determine the approach how the accidental torsion can be accommodated in the final FRS has to be presented.

More detailed requirements for calculation of the preliminary FRS are as follows:

- The calculation shall be performed in accordance with SRPs 3.7.1 [6], 3.7.2 [7] and ASCE 4-98 [4]. Linear, direct, soil structure interaction (SSI) methodologies defined in ASCE 4-98, Section 3.3.3 shall be used in the seismic analyses of BB2 to determine the preliminary FRS.

- A single set of three (two horizontal and one vertical) statistically independent time histories is the minimum requirement for the seismic analyses in accordance with SRP Section 3.7.2 and ASCE 4-98.
- Deconvolution shall be performed to account for the attenuation of seismic input to the bottom of the BB2 foundation.
- The vertical seismic input at the bottom of the foundation of the BB2 shall be defined as the product of an envelope of the two deconvolved corresponding response spectra and the vertical to horizontal spectral ratio values defined in ASCE 4-98, and ASCE/SEI 43-05 [5].
- Strain-dependent soil properties (including soil shear modulus and damping) generated by the site response analysis of the soil column shall be utilized for the SSI. Soil hysteretic damping shall comply with SRP 3.7.1 [6]. Strain-dependent soil properties shall be determined using real recorded time histories and different sets of reduction curves for soil shear modulus. The median results are taken as the final strain-dependent soil properties for the site.
- Structural damping values for the analysis of BB2 and equipment damping values, which the FRS will be calculated for, shall be in accordance with NRC RG 1.61 [2] and in conjunction of values defined in the USAR [14].
-
- The composite modal damping values have to be limited in accordance to SRP 3.7.2.
- Preliminary FRS calculation shall consider the median soil properties.
- SASSI, LS-DYNA, SHAKE, or equivalent computer software are acceptable tools for the seismic analysis. Verification and validation of the software shall be performed in accordance with ASME NQA-1 Part 1, Requirement 3, 800 Software Design Control; Part II, Subpart 2.7 Quality Assurance Requirements for Computer Software for Nuclear Facility Applications.

The fourth Technical Report (TR4) contains preliminary calculation of seismic design parameters of water well and underground yard piping for PGA intensities of 0.30 g and 0.6 g.

2.3 PHASE 3 – Final calculation of FRS and seismic design parameters of water wells and underground yard piping

The fifth technical report (TR5) has to include calculation of final BB2 FRS. Final FRS shall be performed for the 0.3 g for OBE, and for the 0.6 g and 0.78 g PGA intensities for DEC. Final FRS, which will be further used for the seismic design of SSC of BB2 for DEC, have to represent the envelopes of FRS for 0.6 g and 0.78 g PGA.

In the process of evaluation of final FRS, the following requirements need to be considered in addition to that used for the preliminary calculation:

- In the seismic analysis the uncertainties in the estimation of the soil shear modulus should be approximately considered as required by SRP 3.7.2 and ASCE 4-98.
- The calculated FRS shall be broadened in accordance with NRC RG 1.122 [3] and ASCE 4-98. The final FRS for each intensity considered shall represent the envelope of spectra broadened by $\pm 15\%$ (obtained from system analysis using median soil properties), and spectra which account for the uncertainties in the soil shear modulus (when those uncertainties produce frequency variations which are in excess of $\pm 15\%$ from median case FRS). The local peaks on the envelope spectra shall not be additionally broadened.

Other response parameters, such as displacements, are also required as a result of final calculations. The maximum absolute displacements and rotations (relative to the ground) shall be computed for the representative nodal points at different elevations of BB2. The following have to be considered:

- Maximum absolute displacements and rotations may be calculated for those points and elevations, which the floor response spectra were calculated for.
- Alternatively, displacements and rotations at individual elevations may be calculated for the corresponding floor mass nodal points and/or centers of stiffness.

- Also shall be calculated maximum absolute displacement at the locations of underground piping penetrations

The sixth technical report (TR6) has to include calculation of final seismic design parameters of water well and underground yard piping for PGA intensities of 0.30 g and 0.6 g.

2.4 PHASE 4 – Preparation of USAR change package and preparation of new revision of SP-S702

In phase 4, USAR, Section 20, change package and revision of SP-S702 have to be prepared by Contractor.

In USAR Section 20, the seismic design bases for DEC SSC should be described. The section 20 shall also contain a description of the methodology for FRS calculation and a list of references. In section 20, the final FRS of BB2 has to be presented.

The USAR and SP-S702 will include enveloped FRS for 2%, 3%, 4%, and 7% equipment damping, and frequency dependent piping system damping. The other three damping values (0.5%, 5%, 10%), which are not consistent with NRC RG 1.61 [2] shall be included in final technical report and calculations.

3.0 Design Inputs

- (1) Conceptual Design Package for the planned modification 1024-BS-L [12]
- (2) USAR, Section 3.7 [14]
- (3) DCM-DI-001 “NEK Safety Upgrade Project Design Inputs and Interfaces” Rev.8
- (4) Geološki-geomehanski elaborat za MOD 1024-BS-L “Bunkerska zgradba BB2”, Irigo, 2016.

4.0 Applicable design control program

Applicable NEK procedures and quality program requirements for performing engineering services:

ADP-1.2.116: Program nadzora dokumentov v NEK (ANG: Nek Document Control Program)
ADP-1.0.020: Uporaba korektivnega programa (ANG: The use of corrective action program)
ADP-1.2.127: Quality records management
ESP-2.302: Administration of changes to the updated safety analysis report (USAR)
ESP-2.301: Technical Specification Changes and Licensing Amendments
ESP-2.303: Evaluation of changes in NEK
ADP-1.2.010: Technical Report

5.0 Applicable codes, standards and design criteria for the work

The minimum of the applicable codes, standards and design criteria is specified below. Any additional reference identified by the subcontractor shall be added to the list.

U.S. NRC Regulatory Guides:

- [1] RG 1.60, Design Response Spectra for Seismic Design of Nuclear Power Plants, Revision 1, 1973.
- [2] RG 1.61 – Damping Values for Seismic Design of Nuclear Power Plants, Revision 0, 1973.
- [3] RG 1.122 – Development of Floor Design Response Spectra for Seismic Design of Floor Supported Equipment or Components, Revision 1, 1978.

Codes and Standards:

- [4] ASCE 4-98, Seismic Analysis of Safety-Related Nuclear Structures and Commentary
- [5] ASCE 43-05, Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities.
- [6] NUREG-0800, US NRC Standard Review Plan, SRP Section 3.7.1 - Seismic Design Parameters, Rev. 3, March 2007.
- [7] NUREG-0800, US NRC Standard Review Plan, SRP Section 3.7.2 - Seismic System Analysis, Rev. 3, March 2007.
- [8] NUREG-0800, US NRC Standard Review Plan, SRP Section 3.7.3 - Seismic Subsystem Analysis, Rev. 3, March 2007.
- [9] NUREG/CR 6926, Evaluation of the Seismic Design Criteria in ASCE/SEI Standard 43-05 for Application to Nuclear Power Plants, Brookhaven National Laboratory and U.S. NRC, March 2007.
- [10] NUREG/CR-6896, BNL-NUREG-75410-2006, "Assessment of Seismic Analysis Methodologies for Deeply Embedded Nuclear Power Plant Structures", Feb. 2006.
- [11] SIST EN 1998-1: 2005, Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings.

NEK documents:

- [11] NEK Safety Upgrade Project Design Inputs and Interfaces, Revision 8, 2016.
- [12] Conceptual Design Package: CDP 1024-BS-L Phase 3 Safety Upgrade Project Including Alternate Safety Injection System (ASI) Alternate Auxiliary Feedwater System (AAF) Bunkered Building 2 (BB2). NEK, 2016.
- [13] Revised PSHA for NPP Krško site: Report PSR-NEK-2.7.2, Revision 1, 2004.
- [14] NEK USAR
- [15] SP-S702-044687-000 Rev.10 – Seismic Analysis, Testing and Documentation.
- [16] PSR-NEK-2.7.2, Rev.1 – Revised PSHA for NPP Krško site
- [17] ADP 1.2.010 – Technical Report
- [18] SP-S702-044687-000 Rev.10 – Seismic Analysis, Testing and Documentation
- [19] NEK QS-610 Rev.1 – Generic Quality Assurance Program Specification

Quality Assurance:

- [20] 10 CFR Part 50, App. B – Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
- [21] 10 CFR Part 21 – fReporting of Defects and Noncompliance
- [22] ASME NQA-1-2008 – Quality Assurance Requirements for Nuclear Facility Applications
- [23] ASME NQA-1a-2009 – Addenda to ASME NQA-1-2008

Other references:

- [24] Seed, H.B. and Idriss, I.M. (1970). Soil Moduli and Damping Factors for Dynamic Response Analysis. Report No. EERC 70-10, University of California, Berkeley, December.
- [25] EPRI (1993), Guidelines for determining design basis ground motions, Electric Power Research Institute, EPRI TR-102293, v.1-5.

6.0 Review and verification of the work

The Contractor is required to perform a detailed review of all software, as well as documentation which is to be delivered.

The Contractor shall provide a copy of all verification and validation worksheets for software and documentation, which is to be delivered.

Verification and validation of the software shall be performed in accordance with ASME NQA-1 Part 1, Requirement 3, 800 Software Design Control; Part II, Subpart 2.7 Quality Assurance Requirements for Computer Software for Nuclear Facility Applications.

All preliminary reports or deliverables as well as final calculations should be submitted to NEK for review and approval by NEK and Independent Evaluation Reviewer. All preliminary deliverables and report should be prepared three weeks prior finalization date, which is required for NEK review and comments and Contractor to prepare final report or delivery.

7.0 Information to be provided by NEK

The Purchaser has performed all necessary geological soil investigations at the location of the new building. The geological investigation report will be provided to the Contractor after the Contract award.

8.0 Deliverables to be provided by the Contractor

The documentation in phases 1–4 shall consist of the following technical report (TR1 – TR6):

PHASE 1:

- (1) The first Technical Report (TR1) describes the BB2 structural model, input data and computer codes used. Also included is the step-by-step description of the methodology for calculation of the FRS.
- (2) The second Technical Report (TR2) describes the methodology for calculation of seismic design parameters of water well and underground yard piping.

PHASE 2:

- (3) The third Technical Report (TR3) contains preliminary FRS for PGA intensities of 0.3 g, 0.6 g and 0.78 g. Median input soil properties (without considering uncertainties) shall be used. The results shall be presented for all elevations and rooms of the BB2, as well as for different equipment damping values including the frequency dependent FRS as required for piping design. Preliminary FRS need not be broadened or smoothed. In addition, in the TR3, a parametric study to establish the impact of accidental torsion on FRS, and to determine the approach how the accidental torsion can be accommodated in the final FRS, has to be presented.
- (4) The fourth Technical Report (TR4) contains preliminary calculation of seismic design parameters of water wells and underground yard piping for PGA intensities of 0.30 g and 0.6 g

PHASE 3:

- (5) The fifth Technical Report (TR5) presents calculation of final BB2 FRS. Final FRS shall be performed for the 0.3 g for OBE, and 0.6 g and 0.78 g PGA intensities for DEC. Final FRS, which will be further used for the seismic design of SSC of BB2 for DEC, have to represent the envelopes of FRS for 0.6 g and 0.78 g PGA.
- (6) The sixth Technical report (TR6) contains calculation of final seismic design parameters of water well and underground yard piping for PGA intensities of 0.30 g and 0.6 g.

PHASE 4:

- (7) The USAR change package, Section 20, and new revision of technical specification SP S702 [15] shall be prepared.

Deliverable item:	No. of hard copies:	Electronic version:
Methodology and preliminary calculations	1	1
Final calculations	1	1
Revision of SP-S702	1	1
UCP for section 20	1	1

All inputs and outputs (drawings, calculations, spread sheets and other supporting notes, etc.) essential for results interpretation and use of the results in further projects at NEK, shall be delivered. Acceptable format is the standard table/figure format (e.g. MS Excel or equivalent).

All documentation shall be written in English according to ADP 1.2.010: Technical Report.

Appendix 22.7

List of Supply of Major Equipment

Modification: 1005-SI-L			
Equipment	QTY	Unit Price [€]	Sub-Total [€]
Alternate Safety Injection Pump	1		
ASI Boric Acid Batching Tank	1		
ASI Boric Acid Batching Tank Mixer	1		
Motor Operated Isolation Valve, Safety Class 2	1		
Alternate Borated Water Tank Nuclear Safety Class 3	1		
Piping Containment Penetration Module	1		
Recommended Spare Parts (list to be provided)	1		
		TOTAL	

Modification: 1010-AF-L			
Equipment	QTY	Unit Price [€]	Sub-Total [€]
Alternate AFW PUMP	1		
Motor Operated Isolation Valve, Safety Class 3	2		
Alternate Demineralized Water Tank Nuclear Safety Class 3	1		
Piping Containment Penetration Module	2		
Recommended Spare Parts (list to be provided)	1		
		TOTAL	

Modification: 1024-BS-L			
Equipment	QTY	Unit Price [€]	Sub-Total [€]
Well Pump	1		
Sump Pump	2		
Electric Heaters	6		
Lighting	1 set		
HVAC VA system	1 set		
Hoist cranes for installation and maintenance of ASI and AAF Pumps	2		
Doors	1 set		
Recommended Spare Parts (list to be provided by the Contractor)	1 set		
		TOTAL	

Modification: 1030-EE-L			
Equipment	QTY	Unit Price [€]	Sub-Total [€]
Motor Control Center 1E	1		
Lighting Distribution Panels	2		
125 VDC Panel	1		
Recommended Spare Parts (list to be provided)	1		

Appendix 22.8

List of Supply of Miscellaneous Hardware including installation costs

Modification: 1005-SI-L				
Equipment	Unit	Installation Cost per [€/Unit]	Estimated Quantity	Sub-Total [€]
Class 2 piping (Category 2501):				
4"	m			
6"	m			
Class 3 piping (Category 2501):				
3"	m			
4"	m			
6"	m			
Class 3 piping (Category 151):				
8"	m			
NNS Piping (Category 150)				
2"	m			
3"	m			
Pipe Supports				
Large support (>4" pipe)	piece			
Small support (≤4" pipe)	piece			
Welding Fittings				
Elbows:	piece			
90°				
45°				
Bends	piece			
Tie-in connections:	piece			
Reducers:	piece			
Other equipment:				
Level indicators	piece			
Level transmitters	piece			
Temperature indicators	piece			
Flow indicators	piece			
Flow transmitters	piece			
Pressure indicators	piece			
Pressure transmitters	piece			
Vent valve	piece			
Drain valve	piece			
Check valve	piece			
Manual Isolation valve	piece			
Piping Containment Penetration	piece			
Other Installation Costs	pc			
			TOTAL	

Modification: 1010-AF-L				
Equipment	Unit	Installation Cost per [€/Unit]	Estimated Quantity	Sub-Total [€]
Class 2 piping (Category 1501):				
3"	m			
Class 3 piping (Category 1501):				
4"	m			
1" (drains, vents)	m			

Class 3 piping (Category 151):				
6"	m			
Class 2 piping (Category 1501)				
3"	m			
1"(drains, vents)	m			
Pipe Supports				
Large support (>4" pipe)	piece			
Small support (≤4" pipe)	piece			
Welding Fittings				
Elbows: 90° 45°	piece			
Bends	piece			
Tie-in connections:	piece			
Reducers:	piece			
Other equipment:				
Level indicators	piece			
Level transmitters	piece			
Temperature indicators	piece			
Flow indicators	piece			
Flow transmitters	piece			
Pressure indicators	piece			
Pressure transmitters	piece			
Vent valve	piece			
Drain valve	piece			
Check valve	piece			
Manual Isolation valve	piece			
Piping Containment Penetration	piece			
Other Installation Costs	pc			
			TOTAL	

Modification: 1024-BS-L				
Equipment	Unit	Installation Cost per [€/Unit]	Estimated Quantity	Sub-Total [€]
Pipe 4" HDPE	m			
Pipe 4" (Category 150)	m			
Large support (>4" pipe)	pc			
Small support (≤4" pipe)	pc			
Fire Detection	pc			
Fire Suppression	pc			
Freeze Shield Piping Insulation	m			
Other Installation Costs	pc			
			TOTAL	

Modification: 1030-EE-L				
Equipment	Unit	Installation Cost per [€/Unit]	Estimated Quantity	Sub-Total [€]
Cable Trays	m			
Other Installation Costs	pc			
			TOTAL	

Appendix 22.9

Draft Project Management Manual

NUCLEAR POWER PLANT KRŠKO

Project Modification _____

Project Name

Contractor Logo



PROJECT MANAGEMENT MANUAL (PMM)

Rev 0

	Name	Org. Unit	Signature	Date
Approved by (NEK):	_____	_____	_____	_____
Approved by (Contractor)	_____	_____	_____	_____
Reviewed by:	_____	_____	_____	_____

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1. REVISION CONTROL LOG

[illegible]

2. CROSS-REFERENCES

- Project Quality Plan for Project _____

3. TABLE OF CONTENTS

1.	Revision Control Log	2
2.	Cross-references.....	2
3.	Table of contents.....	3
3.1.	Table of Enclosures	4
4.	Abbreviations, Purpose and applicability of the document	5
4.1.	Purpose and applicability	6
4.2.	Relation to other documents	6
5.	Project Description	6
5.1.	Project Scope	6
5.2.	Phases of project.....	7
6.	Project Organization.....	8
6.1.	Project Teams	8
6.1.1.	Site Team	8
6.2.	Project Steering Committee	8
6.2.1.	Purpose and goals.....	8
6.2.2.	PSC-meetings.....	8
6.3.	Project Meetings and conferences.....	9
6.4.	Sub-Contracting.....	9
6.5.	Correspondence and Document transmission	10
6.5.1.	Communication channels.....	10
6.5.2.	Project correspondence	11
6.5.3.	Authorized persons.....	12
6.5.4.	External Sharepoint page	12
6.6.	IT-Tools and Software	12
7.	Project Controlling	12
7.1.	Project Planning and Scheduling	12
7.1.1.	Types of schedules	12
7.1.2.	Updating and follow-up	13
7.1.3.	Project Schedule features.....	13
7.2.	Project reporting	13
7.3.	Action item handling and Issue tracking.....	14
7.4.	Controlling of project Specific Issues, deficiencies and non-conformances	14
7.4.1.	Problem/ Deficiency Report (PDR)	14
7.4.2.	System performance / warranty action request (SPWAR)	16
7.4.3.	Nonconforming product.....	17
8.	Project change management.....	17
8.1.	Control of design and development changes	17
9.	Quality Assurance	18
10.	Site Work.....	19
10.1.	Planning	19
10.2.	Logistics	19
11.	Document Deliverables and transmittal schedule	19

11.1.	Drawing and document numbering system	19
11.2.	Document status (<i>Contractor</i>)	20
11.3.	Document review by NEK	20
11.3.1.	Process	20
11.3.2.	NEK approval status	20
11.4.	Document transmittal schedule	21
12.	Provisional Acceptance Parameters	21
13.	Attachments	I

3.1. TABLE OF ENCLOSURES

Enclosure 1:	List of abbreviations and definitions	6
Enclosure 2:	Lessons Learned from stator modification	Error! Bookmark not defined.
Enclosure 3:	Project Team NEK	8
Enclosure 4:	Project Team <i>Contractor</i>	8
Enclosure 5:	Project Organizational-Chart Contractor	8
Enclosure 6:	Project Organization- Chart NEK	8
Enclosure 7:	Project Steering Committee	8
Enclosure 8:	Project-meetings and characteristics	9
Enclosure 9:	Correspondence requirements related to topic	10
Enclosure 10:	List of software for project management	12
Enclosure 11:	PDR priorities and handling	15
Enclosure 12:	SPWAR Priorities and modalities	17
Enclosure 13:	Division of responsibility on scope changes	18

4. ABBREVIATIONS, PURPOSE AND APPLICABILITY OF THE DOCUMENT

Abbreviation	Description
AC	Award of Contract
AIL	Action item list (list with major issues which need to be resolved)
Contract PM	Contract Project Manager
CHO	Change order
CPM	Commercial Project Manager
DCM	Document Control Management (by NEK)
DC	Document controller
DMP	Design modification package
DOR	Date of Release
IPS	Integrated Project Schedule
MPR	Monthly Project Report
MS	Microsoft (applicable in respective software products)
mths	months
NEK	Nuklearna Elektrarna Krsko
NPP	Nuclear power plant
OPS	Overall Project Schedule
PDR	Problem / Deficiency Report
PG	Power Generation
PM	Project Manager
PMM	Project Management Manual
PQP	Project Quality Plan
PQST	Project QST
PSC	Project Steering Committee
QA	Quality Assurance
QC	Quality Control
QIR	Quality incident report
QMM	Quality Management Manual
QST	Quality assurance specification turbogenerators
SPWAR	System Performance Warranty Action Report
tbd	To be decided
TPM	Technical Project Manager
TTL	Technical Team Lead
wks	weeks
Workflow	predefined sequence of activities within the project-organization
WP	Work-package

PS	Project Scheduler
----	-------------------

Enclosure 1: List of abbreviations and definitions

4.1. PURPOSE AND APPLICABILITY

The PMM serves as guidance for the project implementation from Award of contract until the end of warranty period. It does not limit nor change in any form contractual requirements.

The PMM is worked out in close cooperation between NEK and **Contractor** for ensuring a fertile, effective and efficient cooperation for achieving the projects goals for both parties benefit. The PMM is approved by **Contractor** and NEK Project Managers.

The PMM will be reviewed, which means changed and replenished, during the project course for following exemplary reasons:

- Some data is not yet available (e.g. certain handling procedures, FAT procedure). They will be referred to as soon as available.
- Changes in workflows or organization, especially the design of software which is used during the project for correspondence and filing (share-point-platform) often triggers new revisions because of customization.
- Contract/ scope changes (e.g. optional scope)

4.2. RELATION TO OTHER DOCUMENTS

The three most important guidelines for project implementation are the PMM, the PQP and the IPS.

All overall *Contractor* quality related issues are part of the offer as a QMM 602. The PQP (Project Quality Plan) is more project-specific and shows quality related activity during the entire project course with referenced procedures and standards. The PMM however shows document deliverables which are linked to the PQP. Referenced documents which are necessary for project controlling and implementation, e.g. Problem/ deficiency reports, are explained and attached. Processes which are more into the details of non-conforming products are described in the PQP. The PDR and SPWAR can be seen as the main interface between the **Contractor** internal quality processes and NEK processes.

5. PROJECT DESCRIPTION

To be fulfilled by the Contractor

5.1. PROJECT SCOPE

To be fulfilled by the Contractor

The Scope of the project is described in SP-XXXXX in detail.

5.2. PHASES OF PROJECT

Single phases of the project are:

1. Design and Engineering
2. Material procurement (if applicable)
3. Manufacturing (if applicable)
4. Transport (if applicable)
5. (Assembly at NEK-site) only applicable for Stator Project (if applicable)
6. Lifting (if applicable)
7. Erection, Commissioning & Testing (if applicable)
8. Trial run (if applicable)
9. Hand-over
referring to documentation and other details (e.g. spare parts)
10. Warranty period (separately for main contract and CHO)

The project phases are visible in the monthly provided integrated project schedule, taking the above mentioned phases into account.

Category	Aspect	Improvement	Previous situation
Organization	Meetings of Project Steering Committee		
	PSC Members		
	Quality management within the project		
	Communication		
	Personnel, intercultural understanding		
Project management	Project management personnel and location of PMs		
	Requirement management		
	Outage planning		
Quality management	Understanding of quality requirements on both sides		
	Supplier management (control of suppliers)		

6. PROJECT ORGANIZATION

6.1. PROJECT TEAMS

Enclosure 2: Project Team NEK

Enclosure 3: Project Team **Contractor**

Enclosure 4: Project Organizational-Chart **Contractor**

Enclosure 5: Project Organization- Chart NEK

6.1.1. SITE TEAM

During the implementation of the project, the Site Project Manager is the main point of contact for NEKs Project Manager and Site Manager. This revision of the PMM will be amended with details of the site team as well as the site organization as soon as the team is assigned.

6.2. PROJECT STEERING COMMITTEE (IF APPLICABLE)

6.2.1. PURPOSE AND GOALS

The Project Steering Committee (PSC) (if applicable) supervises the work of the Project Management. The Project Management reports in regular PSC-meetings on project progress and critical issues if existing. It is comprised of management personnel from NEK and the **Contractor** as shown in below Enclosure 6: Project Steering Committee.

Enclosure 6: Project Steering Committee

6.2.2. PSC-MEETINGS

Meeting-Period: every 3-6 months. Initial meeting to be called by NEK, officially communicated approximately 3 weeks prior to the meeting date (please see Enclosure 7: Project-meetings and characteristics).

Agenda: To be created by NEK and the **Contractor** Project Managers. The proposal has to be sent to all members well in advance (two weeks) of the date for commenting and approval.

Location: The meeting will be hosted alternating by NEK and the **Contractor** on locations of their choice taking travel conditions and requirements for meeting purposes for all members into account.

Minutes of meeting: Minutes will be prepared by hosting PM directly in the meeting for common approval and signature afterwards. They will be signed by NEK and the **Contractor** managers.

6.3. PROJECT MEETINGS AND CONFERENCES

Name	Tasks and purposes	Owner	Attendants	Frequency	Invitation due date by owner
PSC meetings (if applicable)	Management review of project				
PM meetings	Regular meetings with Contractor and NEK PMs, held as telephone conferences or personal meetings according to needs. Project Management for Project-controlling and status updating				
Site Readiness Review Meeting	Preparation of outage. Verification that all requirements for successful outage are fulfilled.				
Safety meeting (site)	Safety controlling at site				
Job Mobilization meeting	Preparation of Outage work				
Bi-monthly quality telcon	Vendor quality and production schedule follow up. Coordination of WPs, PDRs and quality proceedings				
Technical Meetings	Discuss and solve technical problems				

Enclosure 7: Project-meetings and characteristics

6.4. SUB-CONTRACTING

Sub-contractors will be managed by team-members who are responsible for respective scope. A list of current subcontractors with contact and scope information can be found as Attachment 1: List of subcontractors and potential subcontractors, on page I.

Subcontractors are chosen in accordance with respective, applicable quality requirements (please compare PQP). NEK receives copies of technical specifications for subcontractors without commercial information. The **Contractor** intellectual property rights have to be protected and respected.

As per main contract, The **Contractor** shall notify to NEK the names of the subcontractors proposed to perform a part of the Scope of Supply and shall not award any principal part of the Scope of Supply to any subcontractor without prior written approval of NEK. The refusal should be justified by NEK. Full overall responsibility always remains on The **Contractor's** side concerning participation of Slovenian and non-Slovenian companies as The **Contractor's** subcontractors. Approval for hardware subcontractors which are listed in this revision of the PMM are deemed as "approved by NEK".

6.5. CORRESPONDENCE AND DOCUMENT TRANSMISSION

6.5.1. COMMUNICATION CHANNELS

Item/ topic	Formal trans- mittal	Medium/ format	Direct Addressee	Copy to
All commercial contractual matters (e.g. Invoices)	yes	Optional: Postal Letter Email with scanned letter		
All requests related to contractual obligations (Change-requests, Change-orders etc.)	yes			
Technical information with direct contractual relevance	yes	optional		
Technical information without direct contractual relevance	normally no	Email		
Results of technical information exchanges (e.g. design input)	yes	Email		
Project specific issues, deficiencies, non-conformances of any type (NCR, PDR, SPWAR) please see chapter 7.4	yes	Email, to be confirmed by receiver		

Enclosure 8: Correspondence requirements related to topic

Technical information with direct contractual relevance refers to input-data of high significance e.g. design data as input for calculations which determine design of components. All exchanged design input data or information must display its respective source.

Technical information without direct contractual relevance is related to e.g. explanations for understanding, comments if easily and quickly to implement and without high significance. Quickly to implement provides, that misunderstandings will be discovered quickly without causing damage. Providing the possibility of exchanging technical information without the obligation of formal record has the purpose to facilitating information flow.

All mentioned people might be temporarily replaced. Respective names have to be communicated to the other party according to the correspondence requirements.

Internal project correspondence box

The **Contractor** Share-point portal for the project, which hosts project related documents and information, provides a library for filing all email communication. Outgoing mails from the **Contractor** are copied to the box (cc). Incoming mails to the **Contractor** are forwarded from the account of the PM by using a MS-Outlook forwarding rule. Internal alerts will be implemented. The library and respective procedures ensure a high level of information-availability and security of communication within the project team.

6.5.2. PROJECT CORRESPONDENCE

Contractor and NEK use a specific tracking system for the correspondence within this project (i.e. Numbering system). The following basic rules will be followed when assigning letters, email, or file numbers:

YY-BBB-CCC-XXX, where:

- a. **YY** stands for project subject
- b. BBB three letters abbreviation for the sender (i.e. NEK)
- c. CCC three letters abbreviation for the receiver, (i.e. for the **Contractor**)
- d. XXX current number of the letter or email.

Formal coding of correspondence is used if content could need to be referenced, because of contractual relevance. To be transmitted formally: Invoicing, Non-conformance reports, PDRs, SPWARs, change-requests, change-orders, minutes of meetings except for informally handled minutes of PM-telcons.

Document which have to be provided by the **Contractor** to NEK in hardcopy or (vice versa) e.g. Drawings, Reports, Calculations, Lists etc. will be sent by post accompanied with a formal letter number. The accompanying letter for a transmittal will include the following data: Addresses of sender and receiver, name of sender PM with signature, date, purpose of transmittal (for approval <FA>, for commenting <FC>, for information <FI>). For attached documents: Document no, Document Rev., Document Title, Document Issuer, Document format, Document Type, Transmittal no.

A template can be found as Attachment 7: Transmittal Sheet, page VII.

In the further course of the project the **Contractor** may be granted access to certain parts of NEK Share-point portal through which documents could be provided during the commenting and review processing.

6.5.3. AUTHORIZED PERSONS

Transmittals are normally sent by the Project managers. Other **Contractor** persons entitled are: Technical Project manager, Quality Manager, Documentation Control and others, who are entitled by the PM. Transmittals which contain final contractual deliverables from the **Contractor** to NEK as per contract, are sent by the Local PM or entitled persons from the **Contractor** who is the contract partner of NEK.

6.5.4. EXTERNAL SHAREPOINT PAGE

NEK established an external data storage page which the **Contractor** can access. If **Contractor** personnel need access to that page, respective instructions will be provided by NEK engineer. Respective persons will then be enrolled as users and can access the page via user login and Tokencode provided via RSA SECURID.

The page is used to provide files which exceed normal file sizes which can be transmitted via email. The party which provides documents to the other party uses an official transmittal mail (numbered) to inform the other party about the upload and the location where the file is stored (most convenient is sending a link with the transmittal mail).

The URL for the page is:

To be filled later by NEK

6.6. IT-TOOLS AND SOFTWARE

Software shown in, Enclosure 9: List of software for project management, will (some optional) be used within the project implementation with regard to project management and communication on technical matters.

To be filled by the Contractor

Enclosure 9: List of software for project management

7. PROJECT CONTROLLING

7.1. PROJECT PLANNING AND SCHEDULING

7.1.1. TYPES OF SCHEDULES

An overall integrated project schedule for the complete project from contract signing until end of warranty was developed. The planning unit for this overall schedule is "day". This schedule refers to the project phases described in section 5.2 Phases of project, p.2.

A separated schedule is to be created for the installation and commissioning phases. Planning period is "hour". It starts with the outage start (NEK) and finishes with the outage

end of the plant. In between dismantling, transport, installation and commissioning activities are addressed.

7.1.2. UPDATING AND FOLLOW-UP

The overall integrated project schedule is updated regularly and is provided to NEK each month for project reporting. The contract dates in the original contract schedule are valid throughout the project as per contract. However a **Contractor** baseline is to be communicated to NEK for official approval, showing the current status of the baseline dates. Explanations on deviations shall be included (e.g. reason, background, consequences). An approved schedule gets a formal major revision number. Schedules for each monthly update only get minor revision numbers (separated by a dot behind the major revision number). Details of schedule documentation are determined (within contract range) by the assigned project scheduler, however. Changes in the schedule dates between two monthly reports are outlined. Input-information is retrieved from various partners (internal and external) by adequate tools / programs as digital information or via direct communication, e.g. phone supported by online-conferencing with MS-netmeeting.

The outage schedule shall be updated daily or more often if required by specific problem situations, with reliable methods of communication. This will be described in site-instructions and procedures. A schedule overview will be added to the Monthly Project Report.

7.1.3. PROJECT SCHEDULE FEATURES

The **Contractor** schedule has the following features:

- Critical path logic diagram for all work activities prior to the outage
- Identify the duration of these activities
- Indicate changes in the critical path during the job
- Identify slack time in work activities
- Allocate major resources where they are most needed
- Provide updated progress and activity reports during the project
- Accept, change and update as frequently as daily (outage schedule) or monthly (project schedule), to evaluate scope and/or schedule changes as they occur

7.2. PROJECT REPORTING

The **Contractor** provides written status reports on a bi-monthly basis for the work being performed. These reports will contain brief information but will convey all necessary information to the NEK Project Manager for evaluation the overall status and progress of the project.

The overall status of the work reports include:

1. Overall status of the project
2. Accomplishments from the previous report issued.
3. Technical, quality, management or other concerns, or emerging issues that could impact schedule, costs, or quality of work.

-
4. Work-arounds, or planned remedial actions and “path-forward” to ensure milestone dates are met.
 5. Four (4) week look-ahead, including the dates of measuring, testing and inspections of the equipment per the QST.
 6. Overall project management assessment.
 7. Project Schedule (overall view of the IPS)

Please see Attachment 2: Content of Project Reports, page I. Bi-Monthly Project Reports (MPR) will be provided approximately each 1st to 5th day of the 2nd month and report on the past months issues.

7.3. ACTION ITEM HANDLING AND ISSUE TRACKING

An Action Item list is administrated as a living document by the **Contractor** (assigned person). This document is attached to the bi-monthly progress report with its current status. The document will be update for action item tracking in PM-telcons.

Updates can be made available more often to NEK if necessary and if feasible with reasonable effort. Each time an Action item comes up it will be included into the AIL (Action item list). It can be communicated on an informal way (phone, email, direct verbal communication etc.) or formally, if necessary. To ensure proper recording and traceability it will come up in the monthly report next following the first occurrence and be discussed/ tracked in regular progress meetings until being closed which will be declared in mutual agreement.

7.4. CONTROLLING OF PROJECT SPECIFIC ISSUES, DEFICIENCIES AND NON-CONFORMANCES

The generator uprating project specific issue and deficiency controlling is specified for two periods: (a) from project beginning until SAT completion period and (b) after the SAT completion until end of warranty period.

7.4.1. PROBLEM/ DEFICIENCY REPORT (PDR)

Applicability: The PDR is used for problems/ deficiencies or technical issues in the project period from project beginning until SAT completion. Furthermore all deviations from the contractual documents are handled by PDRs, including Technical Specification SP-Exxxx rev.0, if not requiring contract amendments (to be mutually agreed). Both sides, i.e. NEK and **Contractor** can initiate a PDR for addressing problems/ deficiencies, technical issues or deviations to the other party. In the PDR it is shown by whom it was initiated.

If a technical issue and/or problem/ deficiency are discovered by **Contractor** or its subcontractors, **Contractor** internally uses its standard issue reporting and issue resolution / disposition tools. These are described in the PQP. In case a PDR needs to be issued to NEK, the internal form will not be attached to the PDR but its content will be entered in

respective PDR fields and send to NEK officially. **Contractor** is permitted to hide proprietary/confidential information.

In case that NEK detects a technical issue or problem/ deficiency, it is reported to **Contractor** using the same PDR form with the only difference that it will be identified in the document head that it is initiated by NEK. Respectively NEK is author of included comments. For tracking purposes, the PDR form will have its unique PDR number and priority assignment. Numbering will be consecutively regardless by whom it was initiated. The basic workflow outlined as shown below applies.

Basic workflow for PDR, e.g. initiated by NEK:

- Detection of problem/ deficiency or technical issue or other deviation
- Rating (priority, A,B,C or D)
- Communicating to **Contractor** responsible
- Confirmation of reception to be sent to NEK
- Assigning capable personnel for resolving (**Contractor**)
- Including issue in the "Action item list" with category PDR, due date according to priority (**Contractor**)
- Workflow for PDR to be followed (share-point workflow: message, confirmation, status reporting). Contacting NEK personnel if necessary for resolution.
- Starting related **Contractor** internal quality workflows (such as PCM depending on issue, please see PQP)
- Follow up until resolution. Quality –controlled documentation
- Communication in Project reports.

PDR Priority	Required response time	Sender	Receiver at Contractor	Communication (all to be applied)	AIL priority
A	< 2 days	NEK PM	XXXX	Email with high priority Phone-call (reaching one of the receivers personally) Formal letter (sent or handed over)	High
B	< 5 working days			Email with high priority Phone-call (reaching one of the receivers personally) Formal letter (sent or handed over)	High
C	< 2 wks			Email with normal priority Formal letter (sent or handed over)	Normal
D	< 4 wks			Email with normal priority Formal letter (sent or handed over)	Normal

Enclosure 10: PDR priorities and handling

The following are the available priority assignments:

PDR Priority A: The issue needs urgent (within two days as maximum) response from **Contractor** / NEK technical personnel. System performance is degraded and ongoing (test) activity cannot be completed or the tasks that were planned to follow can not be executed.

PDR Priority B: The issue needs prompt response (within five working days as maximum). Considering some plan adjustments and rescheduling, part of the planned and scheduled work can be continued but not with the full system performance and not with the full system functionality as designed. If the issue is not resolved within the available time, (FAT & SAT) activities will have to be rescheduled for some another time.

PDR Priority C: The identified issue has no influence on ongoing activities and no influence on scope of work that is in progress. However, the system demonstrates obvious technical issue or deficiency that has to be resolved. The major part of problems, deviations and/or deficiencies that would belong to this priority group that are issues related to the manufacture and or assembly of the generator and related components. The appropriate time window for resolution of problems / deficiencies from the Priority 3 group is up to two weeks.

PDR Priority D: Minor issues that do not affect system functionality and system performance (equipment, cable, materials, inconsistencies in non-essential documentation). Those problems, deviations and/or deficiencies can not be seen by the NEK operators. The problem resolution should be achieved within 4 weeks.

All PDR's of priority 1 and 2 shall be closed while small number of the lower priority (3 & 4) PDRs (less than twenty) may still be open before taking-over the unit by NEK and starting the warranty period.

7.4.2. SYSTEM PERFORMANCE / WARRANTY ACTION REQUEST (SPWAR)

The SPWAR is used for all respective issues coming up between SAT completion and end of Warranty period, i.e. project phase-groups E (please see paragraph 7.4.1 Problem/ Deficiency Report (PDR), page 14).

For any technical issues and/or deficiencies in the works subject to warranty service discovered by NEK during the warranty period, NEK uses the form SPWAR provided in Attachment 5: System performance / Warranty Action Request (SPWAR), page I, to capture such findings. For tracking purposes, the SPWAR form will have its unique SPWAR number and priority assignment. The available priority assignments are shown in 7.4.1, page 14 (please compare PDR).

SPWAR Priority	Required response time	Sender	Responsible Persons <i>Contractor</i>	at Modalities	AIL priority
A	< 2 days	NEK PM	XXXXXX	Unit performance seriously degraded or system inoperable	High
B	< 5 working days			Unit performance below design requirements and/ or part of the unit unavailable	High
C	no later than			System performance/ functionality	Normal

	next maintenance outage			not significantly affected. Minor adjustments required.	
D	< 4 wks			All minor issues that do not affect system functionality/ performance. Not visible for NEK operators / maintenance personnel	Normal

Enclosure 11: SPWAR Priorities and modalities

7.4.3. NONCONFORMING PRODUCT

Handling of nonconforming products and related procedures are included or respectively referenced in the PQP.

8. PROJECT CHANGE MANAGEMENT

8.1. CONTROL OF DESIGN AND DEVELOPMENT CHANGES

All changes of the contractual requirements triggered by NEK are performed according to the Contract Section XXX. Fore those triggered by Contractor section XXX applies.

No.	Action	Responsibility
SCOPE IDENTIFIED IN ADVANCE OF OUTAGE		
1	Identify scope change which is outside of the existing contract.	NEK + Contractor
2	Agree on scope to be quoted by Contractor and DOR	NEK + Contractor
3	Submit offer for additional scope to be provided	Contractor
4	Review offer and provide feedback to Contractor	NEK
5	Finalize scope, schedule, DOR and final price of additional scope	NEK + Contractor
6	Issue contract modification to Contractor for additional scope	NEK
7	Contractor to provide scope as defined in the contract change modification	Contractor
SCOPE IDENTIFIED DURING OUTAGE		
1	Identify scope change which is outside of the contract scope of supply	NEK + Contractor
2	Agree on scope to be quoted by Contractor and DOR	NEK + Contractor
3	Provide budget estimate for the work to be performed	Contractor
4	NEK to sign authorization for extra work to be performed	NEK
5	Perform work as needed to prevent adverse affects to the outage schedule.	Contractor
6	Provide finalized offer to NEK for work performed	Contractor
7	Issue contract modification to Contractor for additional work performed	NEK

Enclosure 12: Division of responsibility on scope changes

Enclosure 12: Division of responsibility on scope changes shows the workflows for changes on design and development. Workflow starts with the identification of the matter and respective necessity. Different activities have to be performed by NEK or/ and Contractor to reach the final contractual fixed change as outlined in above show table.

9. QUALITY ASSURANCE

The QA and QC approach is described according to applicable sections in SP-Exxxx and applicable sections in QS 610 from NEK in the separate PQP (Project Quality Plan) for the project. The Project Quality Plan is briefly described in 4.2, p. 6. In some areas property rights from Contractor have to be regarded, especially for some detailed technical procedures which will be addressed in the PQP. Contractor standard procedures will not be changed. To ensure project specific implementation, workpackages which are basis for processing activities related to procedures may be changed.

There are three major QSTs for the project which are applicable on: (a) Phases 1,2,3,4, i.e. from design and manufacturing until end of transport (b) for Assembly at site (Krsko NPP) and lifting, which are Phase 5 and 6 and (c) for Installation and commissioning.

The part of the PQP for installation and commissioning requires detailed work-packages and work-plans which are to be developed according to document delivery schedule (please see section 11, page 19). Therefore this part of the PQP is only crucially covered at the project start. A list of testing procedures from **Contractor** is being administrated and updated during the project. To each procedure, its number, title, revision and owner are displayed.

10. SITE WORK

10.1. PLANNING

For planning of site work work-packages, work-plans and a respective outage are issued according to the document delivery schedule.

10.2. LOGISTICS

The amount of new equipment, materials and personnel, as well as old equipment handling during the Generator replacement project, requires close cooperation between **Contractor's** site management/logistics personnel with NEK security and receiving personnel.

Logistics coordination entails:

- receipt of equipment (forms, data, security issues etc.)
- development of the laydown plan
- pre-job set-up
- inspection and staging of material (tagging, protocols etc.)

Detailed workflows and interfaces will be identified in respective procedures. Since content of procedures is mostly confidential and intellectual property, contractual agreements on this matter apply. Confidential procedures could be looked at. Copies can not be provided.

11. DOCUMENT DELIVERABLES AND TRANSMITTAL SCHEDULE

11.1. DRAWING AND DOCUMENT NUMBERING SYSTEM

Drawings and documents which are included in the DMP use the NEK DCM numbering system.

Documents will also show **Contractor** document numbers in respective fields for document control and designation.

11.2. DOCUMENT STATUS (*CONTRACTOR*)

- Preliminary release
Documents which are provided to NEK for review will have the status “preliminary release”. This means that responsible *Contractor* personnel have approved the preliminary release to NEK.
- Final release
As soon as comments by NEK have been regarded and all issues are clarified/ solved, the documents will be sent to NEK for approval in the status of “final release”. The highest status for documents which were commented and the very comments replied by *Contractor*, is final release.
- Approved for construction
After having received written approval, all applicable documents will get the status approved for construction. This applies for NEK and *Contractor* documents. Approval of documents is to be made visible by stamping the hardcopy of the document.

11.3. DOCUMENT REVIEW BY NEK

11.3.1. PROCESS

Contractor will provide documents for review in electronic form to NEK. With the goal to make review effective and efficient NEK accepts marked up drafts, which should however be self-explaining and adequate.

Documents which are provided to NEK by *Contractor* for review in the status of preliminary release should be returned to *Contractor* redlined, red-circled or anyhow highlighted with accompanying comments explaining the matter of concern and change request. NEK returns the transmittal sheet (please see) with respective remarks and assigns the NEK approval status to the document. NEK provides comments to *Contractor* documents in pdf files with the “commenting” function (“note” or “text box”).

Contractor replies to comments using the “reply to” function directly assigned to the comment of NEK.

After a document was rejected, *Contractor* provides the next higher revision with NEK comments applied as well as the commented file with replies to the comments. The respective file shall be added a “_c” after NEK incorporated comments and an additional “_r_” when being replied by *Contractor*. Respective letters are added each time when commenting / replying is performed.

11.3.2. NEK APPROVAL STATUS

- Approval status “rejected”
This status constitutes that the provided document does not meet the contractual requirements as per NEK perspective.
- Approval status “approved with comments”
If NEK has comments on provided documents, they can be “approved” with comments if the significance of the comments is low, i.e. not affecting *Contractor* procurement specifications negatively with regard to fulfillment of final contract

requirements or in general not affecting schedule, costs and technical solution.

Respective comments shall be corrected by **Contractor** as soon as feasible and reasonable, but for sure well before issuing of the final DMP so that any aspects of the comments will be regarded. This document status constitutes that the content of the document is in compliance with the contractual requirement and justifies invoicing if an installment is associated with.

- Approval status “approved”

The final status constitutes that the document is in full compliance with contractual requirements. No further changes are needed on the document itself (however the document might have to be adopted during further processing within the DMP/ instruction book incorporation).

11.4. DOCUMENT TRANSMITTAL SCHEDULE

The applicable document transmittal schedule for the **Name of the project** is shown in SP-Exxxx, as Attachment x, page xx.

12. PROVISIONAL ACCEPTANCE PARAMETERS

Respective parameters are provided in SAT procedure.

13. ATTACHMENTS

Attachment 1: List of subcontractors and potential subcontractors

Attachment 2: Content of Project Reports

Table of Contents

1	Overall status of the project.....	3
2	Outlook.....	3
3	Accomplishments since last Report.....	3
4	Potential negative impacts (technical, quality, management).....	3
5	Outlook and mitigation measures if required.....	3
6	Attachments.....	4
6.1	Action Item List.....	4
6.2	PDR status	6

Attachment 3: Project Schedule

Attachment 4: Problem/ Deficiency Report (PDR)

NUCLEAR POWER PLANT KRŠKO PROJECT



PDR – Problem/Deficiency Report

Contractor
Logo

PDR Number (nnn):	Priority (A-D):	Date of PDR Issue (dd/mm/yy):		

Initiated by NEK ☐ / Contractor ☐

NEK/XXX: PDR Issue			
PROBLEM TITLE:			
Affected Components:			
Reference documents:			

NEK/Contractor: Scenario Identification

Environment description and order of events that were predecessors to the problem appearance:

Identified by:

NEK/Contractor: Description of the Problem or Deficiency

Problem/deficiency existence verified and approved by:	Date (dd/mm/yy):	Problem is repeatable:	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
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Contractor: Troubleshooting and Problem/Deficiency Root Cause Explanation

Troubleshooting and Explanation Provided by: Date (dd/mm/yy):

Contractor: Corrective Action Proposal and Corrective Action Tracking Log and Tracking References

Corrective Action Description:

Corrective Action Performed by: Date (dd/mm/yy):

Contractor: Track Changes			
References:			
Other Applicable Documentation			
References and Attachments:			

NEK: Resolution and/or Answer Acceptance

NEK Comments:

Accepted by: Date (dd/mm/yy):

Template file: PDR.docx

Page 1 of 1

Attachment 5: System performance / Warranty Action Request (SPWAR)

Contractor

PMM Attachments
Page A-IV



SPWAR – System Performance/Warranty Action Request

SPWAR No. (nnn):	Priority (1-4):	SPWR Issue date (dd/mm/yy):

CONTRACTOR'S
LOGO

Form to be issued by NEK as problem reporting and problem resolution tracking tool during the generator warranty period

NEK: SPWAR Issue	
PROBLEM TITLE:	
Affected Components:	
Reference documents:	

NEK: Scenario Identification	
Environment description and order of events that were predecessors to the problem appearance:	
Identified by:	

NEK: Description of the Problem or Deficiency					
Problem/deficiency existence verified and approved by:	Date (dd/mm/yy):	Problem is repeatable:	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>

Contractor: Troubleshooting and Problem/Deficiency Root Cause Explanation	
Troubleshooting and Explanation Provided by:	Date (dd/mm/yy):

Contractor: Corrective Action Description, Corrective Action Tracking Log and Tracking References	
Corrective Action Description:	
Corrective Action Performed by:	Date (dd/mm/yy):
Contractor: Track Changes	
References:	
Other Applicable Documentation	
References and Attachments:	

NEK: Resolution and/or Answer Acceptance	
NEK Comments:	
Accepted by:	Date (dd/mm/yy):

Attachment 6: Work-package content

WORK PACKAGE CONTENTS

- Activity Identification Number(s)
- Technical Information
 - Drawings
 - Process specifications
 - Field procedures
 - Availability Information Bulletins (AIB's)
 - Operation and Maintenance Memos (OMM's)
 - Action Items List (AIL) = List of open points (LOP)
- Contingency Plans
- Special Tool Requirements
- Safety Requirements
- QA/QC Checklists - hold/verification points for work in progress
- Data Sheets - recording work performed and inspection findings
- Attachments - including special materials

Attachment 7: Transmittal Sheet

Attachment 8: Document-Cover-Sheet

Appendix 22.10

DEC System Controls and Indications – SUP Phase 3

DEC SYSTEM CONTROLS - SUP Phase 3				
Equipment			Power Supply	Control
Tag No	Description	Location	Location - Volts	Location
Alternate Safety Injection (ASI) (1005-SI-L)				
A-SI-PMP	Alternative Safety Injection Pump	BB2	BB1-MD3 - 6.3kV	MCR-ECR-Local (Breaker (BB1))
MOV-1	A-SI Flow isolation	IB	BB2-MCCD (400 V)	ECR, MCR , Local (Manually)
Alternative Auxiliary Feedwater (AAF) (1010-AF-L)				
A-AF-PMP	Alternative Auxiliary Feedwater Pump	BB2	BB1-MD3 - 6.3kV	MCR-ECR-Local (Breaker (BB1))
MOV-1	SG#1 AAF Flow Regulation	AB	BB2-MCCD (400 V)	ECR, MCR , Local (Manually)
MOV-2	SG#2 AAF Flow Regulation	AB	BB2-MCCD (400 V)	ECR, MCR , Local (Manually)

DEC SYSTEM INDICATIONS - SUP Phase 3				
Description	Process Parameter	INDICATION		
		MCR	ECR	LOCAL
Alternate Safety Injection (ASI) (1005-SI-L)				
A-SI-PMP	Discharge Pressure	YES	YES	YES
	Discharge Flow	YES	YES	YES
	Current 6,3kV bus	YES	YES	YES
ABWT	Alternate borated tank level	YES	YES	YES
Alternative Auxiliary Feedwater (AAF) (1010-AF-L)				
A-AF-PMP	Suction Pressure	YES	YES	YES
	Discharge Pressure	YES	YES	YES
	Total Flow - Discharge	YES	YES	YES
	Flow - Discharge SG#1	YES	YES	YES
	Flow - Discharge SG#2	YES	YES	YES
	Current 6,3kV bus	YES	YES	YES
ACYT	Alternate demineralized water tank level	YES	YES	YES