Krško NPP Approach to Integrated Quality Assurance Program

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ABSTRACT

Since the beginning of Krško NPP construction, the overall Quality Assurance Program (QA Program) and its applicable procedures were in place to assure that all planned and systematic actions necessary to provide adequate confidence that an item or service will satisfy given requirements to quality, are in place. The overall requirements for quality as one of the major objective for Krško NPP operation are also set forth in the Updated Safety Analyses Report (USAR), Chapter 17.2 [1], as basic document for operating license.

The Krško NPP Quality Assurance Plan, QD-1 [2][2], incorporates various changes and improvements resulting from regulatory requirements (ZVISJV, JV-5), international standards (IAEA GS-R-3, ISO 14001, ISO 17025, BS OHSAS 18001, ASME NQA-1) and revised international guidelines (WANO, INPO, NRC…).

The integrated approach to Krško NPP Quality Assurance Program was established in the following way: Krško NPP has established an integrated management system, combining all requirements from various references in one single plan (QD-1); all Quality Assurance activities are performed in the manner to provide holistic and thorough evaluation of plant activities, all Quality Assurance activities are conducted and coordinated through a single point (QA Superintendent), Quality Assurance Department (SKV.QA) reports on all activities and issues through Quality and Nuclear Oversight Division (QNOD) Director.

Krško NPP Quality Assurance Plan defines the expectations for the implementation of following activities:
- Internal audits are performed periodically mostly in two-year cycles in accordance with international practices. Audits cover various plant processes and areas (operations, maintenance, engineering…).
- Supplier audits are performed periodically in three-year cycles in accordance with international practices. Local and mostly EU-based suppliers are being audited directly by Krško NPP. Suppliers from US are audited in cooperation with NUPIC organization.
- Preparation and implementation of modifications are being verified and approved through continuous SKV.QA involvement. Each Safety Related (SR) or Augmented Quality (AQ) classified modification involves a QA engineer as a team member.
- New or revised plant procedures classified as SR or Quality Related (QR) are being verified and approved within SKV.QA.
- Documentation for purchasing SR or AQ items or services (technical specifications, purchase orders, contracts…) are being verified and approved within SKV.QA.
- QA engineers are regularly involved in observations at the technological part of the plant (surveillance, maintenance…),
- QA engineers are involved in the review and approval of outage documentation (pre-outage packages, entrance meetings, outage reports, NCRs …),
- QA engineers are involved in the oversight of production and testing of modified or new plant components,

Based on the Krško NPP experience, the QA involvement in plant processes has fulfilled its important role and expectations in achieving overall quality goals. Krško NPP will continue to perform internal Quality Assurance processes and activities in the future. The most important objective of the entire organization – to ensure the safe and efficient power plant operation, will continue to be the most important goal of the QA Program.

1 INTRODUCTION

Quality Assurance includes all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform its function satisfactorily during the service. Quality is achieved by personnel possessing the competence, skills, knowledge, experience, training, resources and work ethic and motivation to do its job using qualified procedures, equipment and materials.

Since the beginning of Krško NPP construction, the overall Quality Assurance Program (QA Program) and its applicable procedures were in place to assure that all planned and systematic actions necessary to provide adequate confidence that an item or service will satisfy given requirements to quality, are in place. The overall requirements for quality as one of the major objective for Krško NPP operation are set forth in the Updated Safety Analyses Report (USAR), Chapter 17.2 [1], as basic document for operating license, and in Quality Assurance Plan, QD-1 [2].

2 STATEMENT OF POLICY AND AUTHORITY

The NEK policy is established by the Management’s Board Statement of Policy and Authority. This policy is implemented through NEK QA Program presented in QD-1 and procedures for the operations phase of the plant. The QA Program, which includes the Statement of Policy and Authority, QD-1 and the procedures, constitute a part of the Krško NPP Plant Manual.

The policy of Krško NPP is to establish and implement an integrated management system bringing together in a coherent manner all the requirements for managing the organization. The main aim of the management system is achieving and improvement of safety by planned and systematic actions necessary to provide adequate confidence that all these requirements are satisfied, and ensuring that health, environmental, security, quality and economic requirements are not considered separately from safety requirements to preclude their possible negative impact on safety.

Krško NPP management system is a set of interrelated and/or interacting elements that establishes policies and objectives and which enables those objectives to be achieved in a safe, efficient and effective manner. It integrates the principles of quality management, quality assurance and quality control and ensures that safety is not compromised by considering the implications of all actions. Safety is paramount element in the NEK management system,
overriding all other demands. The NEK integrated management system is defined in the QD-1 [2]. QA Program summary including QA activities during the Krško NPP operational phase is presented in the USAR Chapter 17.2 [1].

It is the policy of NEK to comply with the Slovenian regulatory requirements (ZVISJV [3], JV-5 [4][1]), requirements of Appendix B to 10CFR50 [5] and the operating license, and to meet intention of IAEA safety standard GS-R-3 [1] and other applicable codes, international standards (ISO 14001, ISO 17025, BS OHSAS 18001, ASME NQA-1[11]), and guidelines (WANO, INPO, NRC etc.).

Krško NPP has the full responsibility for the Power Plant operation. Krško NPP has delegated to the Management Board the responsibility for all aspects of the activities related to the operation of the plant. The Management Board has the responsibility and authority to establish, implement, assess and improve the QA Program presented in QD-1.

QD-1 contains sections I.-XVIII. in accordance with eighteen criteria of 10CFR50 Appendix B [5], and meets intention of the IAEA GS-R-3[6], GS-G-3.1 and GS-G-3.2 documents, also. QD-1 is developed and maintained by the Quality and Nuclear Oversight Division (QNOD) and approved by the Management Board.

The authority and responsibility of each NEK Division, as well as the effective implementation of the requirements of the QA Program, is established by the Management Board through leadership and personal involvement of senior management. The Directors and Managers of each Division or Department are responsible for developing and maintaining the implementation activities of the QD-1.

The QNOD Director is responsible for preparing, reviewing, verifying, implementing, and evaluating the overall effectiveness of the QA Program, and reports on its effectiveness to the Management Board. The QNOD Director has the overall authority and organizational freedom to identify quality assurance or management control problems and to recommend relevant solutions. This authority and responsibility includes stop work authority in safety and seismic related activities. He may recommend plant shutdown and has direct access to the Management Board in this matter. He shall use this path when differences of opinion regarding quality assurance persist within NEK Divisions.

All personnel shall support the QA Program assuring adherence and effective implementation to the fullest degree.

3 KRŠKO NPP QUALITY ASSURANCE (QA) ORGANIZATION

In accordance with the requirements of reference codes and standards, organization and personnel performing quality assurance functions have sufficient authority and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions, and to verify implementation and efficiency of taken actions. Such organization and personnel performing QA functions report to a management level such that required authority and organizational freedom, including sufficient independence from cost and schedule when opposed to safety considerations, are provided. Irrespective of the organizational structures, the individuals assigned the responsibilities for assuring the effective execution of any portion of the QA Program at any location where activities subject to 10CFR50, Appendix B are being performed, have direct access to such levels of management as may be necessary to perform this function. Personnel performing the work achieve quality and personnel performing assessment, evaluate the effectiveness of management processes and work performance. The QA Program is binding for everybody.

Krško NPP QA Program applies to those safety and seismic related structures, systems and components (SSC), including their foundations and supports, and non-safety related SSC
(Augmented Quality) identified on Q-List listed in the NEK Master Equipment Component List (EAM-MECL) project database. Activities affecting the quality of these structures, systems, and components functions are controlled to an extent consistent with their importance to safety. The QA Program requirements are extended to all contractors and vendors consistent with the importance of their services and scope of supply to safety.

The Quality Assurance functions are those of:

a. Assuring that an appropriate QA Program is established and effectively executed.

b. Verifying, such as by checking, auditing, and inspection, that activities affecting the Safety Related functions have been correctly and satisfactorily performed.

QA activities within Krško NPP are performed in domain of Quality Assurance Department (SKV.QA). In accordance with approved plant organization scheme, QA Superintendent reports to QNOD Director, which reports to Krško NPP Management Board. Activities within the SKV.QA are organized in the manner of matrix organization, which enables involvement of QA engineers in various activities, explained in detail in the following chapter. The internal SKV.QA organization of activities also takes into account the qualification and expertise of individual QA engineers, which are involved in active oversight of plant programs, like Operations, Chemistry, Radiation protection, Maintenance, Engineering, Nuclear Fuel, etc. The QA engineers are also represented by various education backgrounds, like mechanical, electrical, civil, chemistry, etc. At this moment, the SKV.QA is manned by 18 engineers, which have various work experience in the plant, mostly more than 20-30 years. The actions are being taken to assure appropriate change of generations, because several QA engineers are approaching the retirement age. Currently, new workers are being sought to provide timely replacement, enabling appropriate transfer of knowledge to take place.

In accordance with Krško NPP organization scheme, defined in USAR Chapter 13.1 [7] and other programs / procedures, the QA Committee was established as an independent group that deals mainly with quality-related issues. The Krško NPP QA Committee is responsible for advising the Management Board by providing an independent review and audit of QA implementing practices. The Krško QA Committee is responsible for reviewing and evaluating QA Program policies and activities. The Committee is the final authority for resolution of contested quality policies, differences of opinion, and stop-work or other corrective action requests when lower level agreement cannot be reached between SKV.QA and other departments. Committee working procedure is defined per USAR Chapter 13.4 [8].

QNOD (SKV) conducts periodic self-assessments of its activities to assure process integrity and effectiveness, and accomplishes its mission independent of the pressures and constraints of production. Division management annually evaluates nuclear oversight activities, and evaluates status and effectiveness of plant processes. They define recommendations for improvement and prepare annual report in accordance with procedure ADP-1.0.008 [9]. Annual report is presented to QA Committee.

4 ACTIVITIES PERFORMED BY SKV.QA DEPARTMENT

Krško NPP QA activities are being implemented in accordance with already mentioned QD-1 and applicable procedures. The plan defines the expectations for the implementation of following QA activities, presented in the following figure:
4.1 Internal Plant Audits

QD-1 establishes the requirements and responsibilities for documented and comprehensive audits system consisting of regularly scheduled internal audits and assessments of Krško NPP internal processes, to verify Quality Assurance Program compliance, adequacy, and effectiveness. Audits and assessments are conducted in accordance with written procedure and to the requirements of ANSI/ASME N45.2.12 [10] and ASME NQA-1 [11] to evaluate the assessed organization and to assure completion of required corrective actions, commitments, or improvements and determine effectiveness in meeting QA Program objectives. Internal audits covering various plant processes and areas are performed periodically, mostly in two-year cycles in accordance with international practices (Operations, Maintenance, Engineering, etc.), while some audits are performed each year (Industrial safety and environmental protection program, Laboratories, Radioactive waste management, etc.). In average, there are up to 8 internal audits performed annually in
accordance with the approved plan. Audit results and corrective actions are tracked through
the plant Corrective Action Program.

4.2 Supplier Audits

Supplier audits are performed periodically in three-year cycles in accordance with
international practices to evaluate implementation and efficiency of Supplier QA Program for
scope of supply. Local and mostly EU-based suppliers are being audited directly by Krško
NPP. Suppliers from US are being audited in cooperation with Nuclear Procurement Issues
Committee organization (NUPIC) as joint audit with other US utilities. Audit requirements to
assure supplier co-operation and recognition of the audit program are included in the
procurement documents. Audited companies cooperate with the auditing team and provide
whatever assistance is necessary in the performance and support of the audit. The audited
company shall take documented corrective actions for audit findings, and resolve non-
conformances and/or observations in a timely manner. During the last years, the upscale trend
of foreign supplier audits was observed and the number of initial audits of new suppliers is
increasing. In average, there are around 25 supplier audits performed by Krško NPP annually
and up to 8 in cooperation with NUPIC organization. Audit teams usually include a technical
specialist, providing technical expertise to improve audit results.

4.3 Oversight of Plant Modifications

Changes of plant systems and equipment are being performed due to various reasons
(improvement of safety, replacement of obsolete equipment, etc.). QA engineers are
reviewing plant design modifications and any subsequent changes, which involve nuclear
safety, fire protection, radwaste as well as major equipment replacement and major changes
important to the plant reliability and availability. Each modification with such classification
involves a QA engineer as a member of a modification team. Modification packages are being
reviewed to ensure that they confirm with applicable procedures and requirements and that
required hold and/or inspection points have been specified. The implementation of
modifications is being verified through continuous QA involvement. The concurrence with
the completion of a modification installation and acceptance of the installation is performed
by a walk down with the operations engineer and the responsible engineer.

4.4 Procedures Review and Approval

All plant new or revised procedures, classified as SR or QR are being verified and
approved by SKV.QA. New procedures are reviewed and approved in accordance with the
safety and quality requirements of the procedure. Existing procedures are periodically
reviewed for plant applicability, technical content, and organizational integrity. Safety-
Related (SR) procedures are reviewed once in every 2 years, while Quality-Related (QR) and
other procedures are reviewed once in every 5 years. QA engineers are conducting QA review
and approval of above mentioned procedures to verify support of the QD-1 and quality
requirements.

4.5 Procurement Documents Control

QD-1 establishes requirements and responsibilities for preparation, review, approval
and changes of procurement documents. The applicable QA requirements for purchasing SR
or AQ items or services are invoked on vendors, suppliers, or contractors through
procurement document requirements. As part of the purchasing process, the role of the QA is
to verify that Quality requirements are included in procurement documents (technical specifications, purchase orders, contracts...), provide support for identification of requirements for supplier records control and submittal, verification that all applicable quality requirements are specified in procurement documents by reviewing Purchase Requisitions, Request for Quote, Purchase Orders, and Contracts and changes thereof, reviewing and approval of Quality Assurance Program submitted by Suppliers prior to initiation of their activities, verification that Suppliers are on Approved Suppliers List, identification and resolution of any quality assurance problems, and verification that appropriate procurement control is maintained via the audit process.

4.6 Evaluation and Approval of Suppliers

Measures are established to select suppliers based on evaluation of their capability to provide items or services in accordance with requirements of procurement documents prior to the award of contract. Suppliers capable of meeting such requirements are designated “approved”. The measures for source evaluation and selection are documented in applicable QA Program procedures. Suppliers are evaluated using any or all of the methods: Evaluation of the supplier’s history of providing an identical or similar product which performs satisfactorily in service, evaluation of the supplier’s current quality records supported by documented qualitative and quantitative information which can be objectively evaluated, evaluation of the supplier’s technical and quality capability as determined by evaluation of his facilities and personnel and implementation of his QA Program, evaluation of the Supplier’s quality capability as indicated by industrial guidelines (ASME, NUPIC, INPO, NRC). Results of the evaluation are documented. An Approved Supplier’s List is maintained in accordance with QA Program procedures.

4.7 Observations of Plant Activities

Compliance to procedures during plant activities is verified by quality control inspection, internal audit, observations and assessments. Observation of surveillance, operations, maintenance and other activities at the technological part of the plant is performed in accordance with appropriate plant procedure. The observations are expected to be performed by managers at various plant positions, but also by the QA engineers. The observations are important part of performance-based evaluation of plant activities. Observations results are documented, reported to responsible persons and inserted into appropriate databases (Electronic Business Suite (eBS), Corrective Action Program (CAP)).

4.8 Review and Approval of Outage Documents

QA engineers are involved in the review and approval of outage documentation, starting from purchase orders and attached specifications. The pre-outage packages of organizations, involved in outage activities are being reviewed and approved as part of preparation prior to the outage. QA engineers also take part at the outage entrance meetings where QA requirements are additionally verified. During the outage QA engineers observe work activities and documentation of work performed. After completion of outage activities, exit meeting is performed where preliminary documentation package is reviewed and all issued NCRs verified. Post outage packages, provided from outage contractors are also reviewed and approved by QA engineers.
4.9 Oversight of Equipment Manufacturing

QA engineers are involved in the oversight of production and testing of modified or new plant components. Purchased items shall be produced or fabricated under requirements at least equivalent to the original material, and measures shall be established to ensure proper inspection, control, packaging, transportation, and documentation. Oversight is performed in form of supervision and inspections during off-site equipment manufacturing and testing activities, and during on-site installation. The purpose of the oversight process is to assure that the equipment is conforming to the approved design package and quality requirements. Usually, the oversight is performed during design, manufacturing, testing, packaging and transport of plant equipment, important form the aspect of plant safety, reliability, complexity, financial value or other reasons. Oversight can be performed through continuous presence at the supplier location or by performing periodic witness and hold points inspection, previously defined in the manufacturing or quality plan.

4.10 Other Activities

Besides above described main Krško NPP QA activities, there are also some others, which play equally important part in plant processes (oversight of nuclear fuel, oversight of work management program, review and monitoring of corrective actions implementation through the Corrective Action Program (CAP), involvement in training of plant personnel, etc).

5 CONCLUSIONS

Based on the past Krško NPP experience, the QA activities and involvement of SKV.QA in various plant processes have fulfilled their important role and expectations in achieving the regulatory and standards quality requirements, while ensuring that overall plant safety and quality goals are met.

Krško NPP will continue to perform internal QA processes and activities in the future. The most important objective of the entire organization to ensure the safe and efficient power plant operation will continue to be the most important goal of the Quality Assurance Program.

REFERENCES

[1] Updated Safety Analysis Report, Chapter 17.2 Quality Assurance During the Operations Phase, Rev. 6

[2] Quality Assurance Plan, QD-1 Rev. 6

[3] Zakon o varstvu pred ionizirajočimi sevanji in jedrski varnosti, ZVISJV (Ur.L. RS 67/02, 110/02, 24/03, 50/03, 46/04, 102/04), 60/11);

[4] Pravilnik o dejavnikih sevalne in jedrske varnosti, JV5 (Ur.L. RS 92/09, 9/10);


[8] Updated Safety Analysis Report, Chapter 13.4 Review and Audit, Rev. 14

[9] Nuclear Oversight Activities, ADP-1.0.008, Rev. 0

[10] ANSI/ASME N45.2.12, 1977, Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants,