



NPP KRŠKO AGING MANAGEMENT PROGRAM

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ABSTRACT

As a part of Periodic Safety Review Program (PSR) NEK will review and perform some activities related to Equipment Qualification (EQ) and Aging Management Program (AMP). (EQ) and AMP are safety factors, which need to be assessed during PSR. The goal of PSR and AMP is to determine aging effects and give the conclusion whether the plant has been managed to control aging related degradations and that safety margins are maintained. The parallel goal is also to establish AMP for future plant operation and provide basis for possible Life Extension Program.

NEK will develop NEK Aging and Life Cycle Management Program, similar by format and content to one determined by License Renewal program. The bases are in 10CFR54, and NEI 95-10 Industry Guidelines for 10 CFR 54 implementation.

The process of establishment the AMP is to be done in two steps. The first step is dealing with SSC's (Systems Structures and Components) scoping and screening and identification of TLAA's (Time Limited Aging Analyses). That means, that a database of all SSC's and TLAA's will be created and then evaluated within AMP program. Based on the scope in first phase an evaluation will be performed in step two. NEK will maintain AMP program as a living program that may be also used for Life Extension and Life Cycle Management.

This paper will present and describe AMP, scoping and screening process and the results achieved through the first phase of the project.

1 INTRODUCTION

Nuclear power plants are faced with effects of time with common term Aging Effect. That could be change in component characteristics, material property and other changes that happen with time and impact the (Systems, Structures and Component) SSC's performance of intended functions. The idea is to systematically review, analyze and correct these aging effects. The program for screening and scoping, based on that review of SSC's, is called Aging Management Program, which will be briefly described in the paper.

NPP Krško (NEK) will, as a part of the Periodic Safety Review (PSR) program, initiate a new program related to the Aging Management Program (AMP). The need to perform a PSR has been clearly recognized both by the NEK and the Slovenian Nuclear Safety Administration (SNSA). It is evident that a PSR for the NEK would be highly desirable both in the current trend in safety oversight practices and also because of many benefits that it is capable to provide. The AMP comes from the scope of PSR, where review of aging

management an Equipment Qualification (EQ) is required. Since NEK has not had a unique systematic program yet, a new task was initiated called Aging Management Program (AMP). This program was intended to be developed similar as License Renewal Program in content and format, which is common at the USA plants. In NEK case many existing programs will be systematically used and combined together to develop AMP.

The basic rule in the process of development of the AMP are two documents; first the 10 CFR PART 54 - REQUIREMENTS FOR RENEWAL OF OPERATING LICENSES FOR NUCLEAR POWER PLANTS and second NEI 95-10 "Industry Guidelines for 10 CFR 54 implementation".

2 DEVELOPMENT OF AGING MANAGEMENT PROGRAM

The basic principle used for the NEK AMP was adopted from 10 CFR 54 and the guidance of its implementation NEI 95-10.

In December 1991, the Nuclear Regulatory Commission (NRC) published 10 CFR 54 to establish the procedures, criteria, and standards for nuclear plant license renewal. It focuses on the effects of aging on long-lived passive structures and components and time-limited aging analyses (TLAAs). As the industry respond a NEI 95-10 was developed as a guideline with the purpose of:

- Identifying the systems, structures, and components within the scope of license renewal
- Identifying the intended functions of systems, structures, and components (SSC) within the scope of license renewal
- Identifying the structures and components subject to aging management review and intended functions
- Assuring that effects of aging are managed
- Application of new programs and inspections for license renewal
- Identifying and resolving time-limited aging analyses

Systems, Structures, and Components within the Scope of License Renewal

The bases for scoping and screening are described in 10CFR54.4:

§54.4

(a) *Plant systems, structures, and components within the scope of this part are --*

- (1) *Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined as in 10 CFR 50.49 (b)(1)) to ensure the following functions --*
 - (i) *The integrity of the reactor coolant pressure boundary;*
 - (ii) *The capability to shut down the reactor and maintain it in a safe shutdown condition; or*
 - (iii) *The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in § 50.34(a)(1), 50.67(b)(2), or § 100.11 of this chapter, as applicable.*
- (2) *All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section.*
- (3) *All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).*

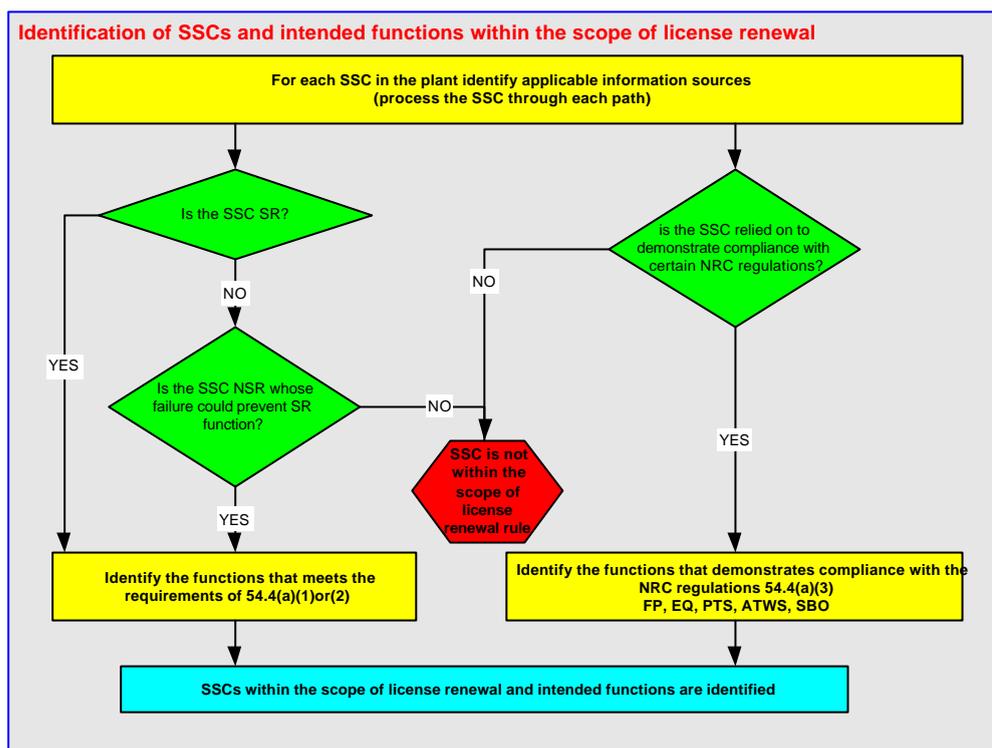


Figure 1: Identification of SSC and Intended Functions

The process of 10 CFR 54.4 is seen from Figure 1 and represents the basic flowchart used to identify SSC within scope of AMP. The detailed approach was used at NEK where systems have been divided into: mechanical, electrical, civil-structural SSC's and TLAAs's.

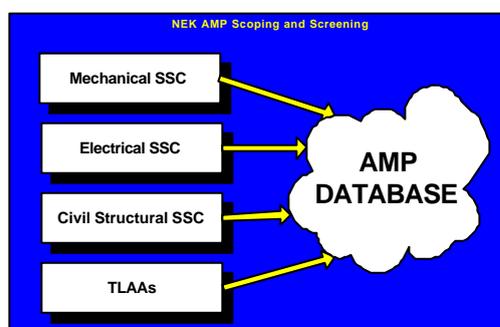


Figure 2: NEK AMP Scoping and Screening

Scoping and screening results form a database, which represents the overall scope of AMP is used in further steps named Aging Management Review (AMR).

The main intent is to find SSC's which are long-lived, passive and perform intended functions as described in 10CFR54.4. That means that (per §54.21(a)) for identified systems, structures, and components with rule 54.4, one should identify and list structures and components subject to an aging management review performing the following functions:

- That performs an intended function, as described in §54.4, without moving parts or without a change in configuration or properties. (e.g. the reactor vessel, the reactor coolant system pressure boundary, steam generators, the pressurizer, piping, pump casings, valve bodies, the core shroud, component supports, pressure retaining boundaries, heat exchangers, ventilation ducts, the containment, the containment liner, electrical and

mechanical penetrations, equipment hatches, seismic Category I structures, electrical cables and connections, cable trays, and electrical cabinets,

- excluding, but not limited to, pumps (except casing), valves (except body), motors, diesel generators, air compressors, snubbers, the control rod drive, ventilation dampers, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies;

In other words structures and components in scope generally should not be subject to replacement based on a qualified life or specified time period.

Next chapter will describe the NEK specific work on implementation of AMP.

3 EXAMPLES OF NEK SCOPING AND SCREENING

As already mentioned NEK approach is based on 10 CFR 54 rule. The first step was definition of scope - scoping and screening.

The major part of Scoping and Screening process was based on the following disciplines:

Scoping and screening of:

- mechanical
- electrical and
- civil structural SSC's.

There is also a portion of identification of the Time Limited Aging Analyses (TLAA's) that are subject of AMR as potential analyses with time as a variable.

3.1 Mechanical

The process uses plant information to determine scope. The idea is to screen what components are those, needed for specific system intended function or are needed for any of the NRC regulated events: fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

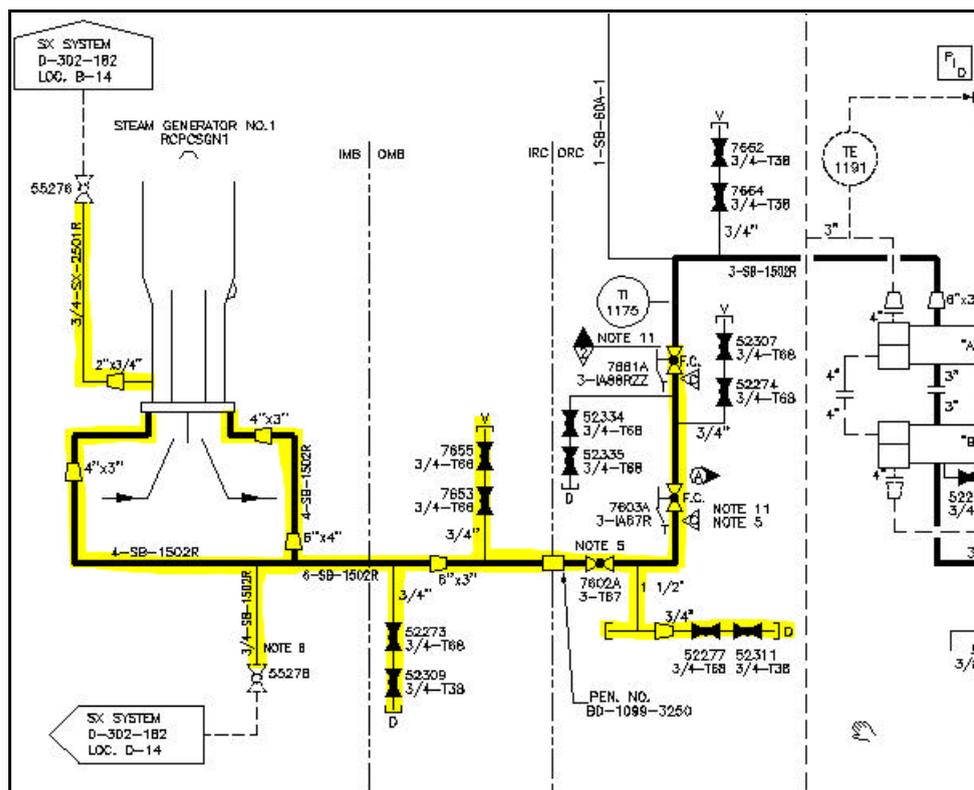


Figure 4: Scoping and Screening of Mechanical Systems
(Marked-up example of SG Blowdown System)

Figure 4 represents a marked-up flow diagram with screening of systems portions, which are within the scope of AMP. The steam generator blowdown (BD) system itself has intended functions per 10 CFR 54.4 definition:

- Provide reactor containment isolation.
- Maintain integrity of the pressure boundary.

Based on that principle, all systems were evaluated and AMP database was filled with data. The database items are listed at the level of component ID (like valve 7602A).

3.2 Electrical

Based on the same criteria, electrical systems were screened and intended functions determined to confirm or reject component from the AMP database list.

Figures 5 and 6 represent a few examples of final electrical systems evaluation.

<i>NEK Systems Intended Functions</i>	
System:	CP ROD CONTROL AND POSITION SYSTEM
<i>Function Description:</i>	
1	To provide fail safe rod drop on reactor trip actuation <i>Required for Safety. It is a function of the Reactor trip system USAR 7.2.1</i>
<i>References: ECD/ICD: Other:</i>	
	<i>USAR: 7.2, 7.7</i>
<i>Note:</i> 1E Equipment in Q-List 1E Equipment implies EQ	
System:	DC DC POWER SUPPLY AND DISTRIBUTION SYSTEM
<i>Function Description:</i>	
1	To feed two independent vital trains of Safety related loads after design basis accident. <i>Exclusively 1E class loads.</i>
<i>References: ECD/ICD: E-206-041 Other: Q-List</i>	
	<i>USAR: 8.3.2</i>
<i>Note:</i> 1E Equipment in Q-List 1E Equipment implies EQ Vital trains serve feed AMSAC. Vital Train A feeds FP annunciator rack	

Figure 5: Example of Electrical Systems Intended Functions Evaluation Database

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<i>NEK Systems in Scope</i>												
<i>ID</i>	<i>Name</i>	<i>SR</i>	<i>NSR</i>	<i>FP</i>	<i>EQ</i>	<i>PTS</i>	<i>ATWS</i>	<i>SBO</i>	<i>AMR</i>	<i>ECD</i>	<i>USAR</i>	<i>Note</i>
AM	ATWS MITIGATION & ACTUATION CIRCUITRY	Yes	No	No	No	No	Yes	No	Yes	7250D sheet 16, 1N08014 Sheet 2	7.8	1E Equipment in Q-List No Environmental Qualification requirement
AS	ANNUNCIATORS AND ASSOCIATED PANELS	Yes	No	Yes	No	No	No	Yes	Yes			1E Equipment in MECL No Environmental Qualification requirement
CB	CONTROL BOARD SYSTEM	Yes	No	Yes	No	No	No	Yes	Yes		7.4,	1E Equipment in Q-List No Environmental Qualification requirement
CH	COMPUTER SYSTEM (SECONDARY)	No	Yes	No	No	No	No	No	Yes			1E Equipment in Q-List No Environmental Qualification requirement
CP	ROD CONTROL AND POSITION SYSTEM	Yes	No	No	Yes	No	No	Yes	Yes		7.2, 7.7	1E Equipment in Q-List 1E Equipment implies EQ
DC	DC POWER SUPPLY AND DISTRIBUTION SYSTEM	Yes	No	Yes	Yes	No	Yes	Yes	Yes	E-206-041	8.3.2	1E Equipment in Q-List 1E Equipment implies EQ Vital trains serve feed AMSAC. Vital Train A feeds FP annunciator rack
EE	AC POWER DISTRIBUTION	Yes	No	Yes	Yes	No	No	No	Yes	D-206-011	8.3.1	1E Equipment in Q-List

Figure 6: Electrical Systems Scoping and Screening Evaluation Database Example

The level of database is at the component level as described in NEK MECL (Master Equipment Component Database).

3.3 Civil-Structural

As already described for mechanical and electrical SSC's, the civil structural scoping and screening used the same criteria, first defining intended functions and second performing scoping evaluation to find which structures are within the scope of AMP.

The examples are shown on Figure 7.

<i>NEK Structures in Scope</i>												
<i>ID</i>	<i>Name</i>	<i>SR</i>	<i>NSR</i>	<i>FP</i>	<i>EQ</i>	<i>PTS</i>	<i>ATWS</i>	<i>SBO</i>	<i>AMR</i>	<i>DWG</i>	<i>USAR</i>	<i>Note</i>
AB	Auxiliary Building	Yes	No	Yes	No	No	No	No	Yes	E-004-230 sheets 1 to 3; Usar Fig. 1.2-4	1.2.2.4, 3.8.4.1.1	Category I, R.G 1.29
**	Component Bases & Supports	Yes	Yes	Yes	No	No	No	No	Yes			Attachment to structures and supports have an intended function
CCB	Component cooling Building	Yes	No	No	No	No	No	No	Yes	E-004-231, USAR Fig. 1.2-4	3.8.4.1.5	Category I, R.G 1.29
RB	Concrete Shield Building	Yes	No	No	No	No	No	No	Yes	USAR Fig 3.8-1 to 8	3.8.1.1	Category I, R.G 1.29
CY	Condensate Tanks	Yes	No	Yes	No	No	No	Yes	Yes	D-302-092	10.4.9	Within mechanical system boundary The foundation only has an intended function.
CB	Control Building	Yes	No	Yes	No	No	No	No	Yes	E-004-238, 236; USAR Fig. 1.2-7, 1.2-8	3.8.4.1.4	Category I, R.G 1.29
DO	Diesel Generator Fuel Oil Storage tank	Yes	No	No	No	No	No	No	Yes	D-302	8.3.1	The foundation only has an intended function. Within mechanical system boundary
DGB	Emergency Diesel generator Building	Yes	No	No	No	No	No	No	Yes		3.8.4.1.5	Category I, R.G 1.29
ESW	Essential Service Water Discharge	Yes	No	No	No	No	No	No	Yes		3.8.4.1.7	Category I, R.G 1.29
ESW	Essential Services Pump House and Fire	Yes	No	Yes	No	No	No	No	Yes	D-302-251 and D-	9.2.1	Category I, R.G 1.29

Figure 7: Example of Structures Scoping Database

The methodology presented to perform the step of “Scoping and Screening” within AMP has been used to develop a database. Based on that database, an AMR (Aging Management Review) will be performed.

The overall program is treated and will be maintained as a living program at NEK and will be updated. In future it could serve for license renewal process if needed.

CONCLUSION

NEK initiated and performed the first phase of AMP. The final result of that screening and scoping is a database with a list of equipment, components and structures which have been screened out based on 10 CFR 54.4 criteria and are part of the systems with safety-intended functions.

The final phase has not started yet. It will represent AMR where database components will be evaluated based on environmental conditions, material properties, and effects of aging that they are exposed to. The evaluation will identify appropriate activity-program that manage each specific equipment/aging effect or define new actions or programs extensions to be able to cover effect of aging at appropriate level.

REFERENCES

- [1] 10 CFR PART 54 - REQUIREMENTS FOR RENEWAL OF OPERATING LICENSES FOR NUCLEAR POWER PLANTS,
- [2] NEI 95-10 “Industry Guidelines for 10 CFR 54 implementation”,
- [3] NPP Krško Updated Safety Analyses Report, rev. 8.