

The SNSA surveillance of primary components after approval of the AMP at the Krško NPP

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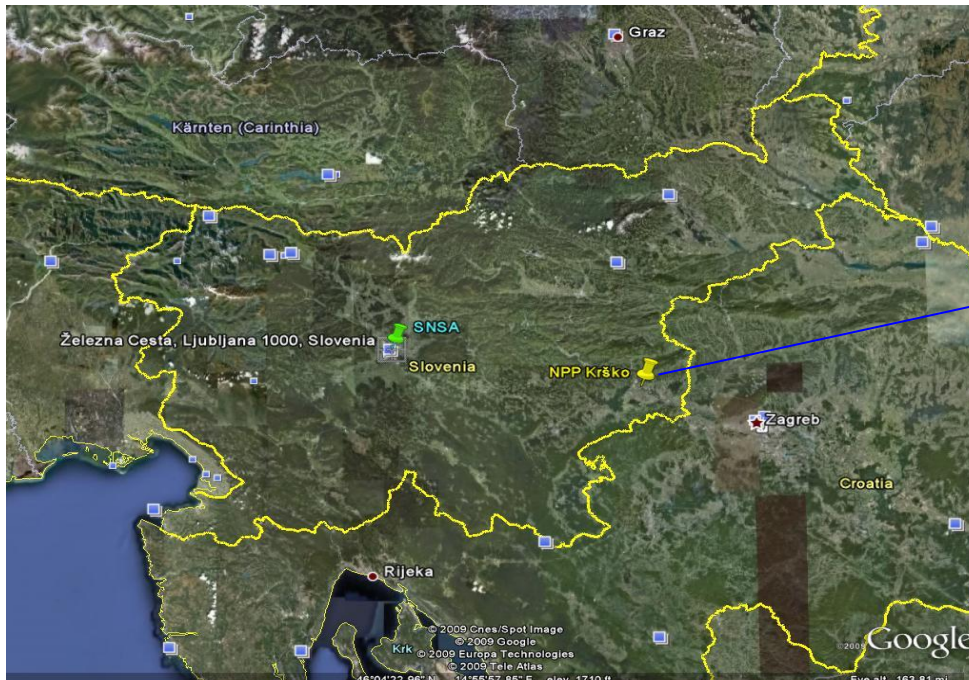
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Krško NPP

- Westinghouse, 2-loop PWR, 730 MWe
- app. 40 % of Slovenian electric production
- Commercial operation since 1983, design life time 40 years
- Owned by Slovenia and Croatia (50/50 %)
(generated electricity is also divided 50/50 %)



Krško NPP major upgrades

- Power uprate (2000): 6,3% -SGs replacement
- Rotors of LP turbines replacement (2006) -20MWe power increase
- Replacement of MSR (2007)
- Replacement of turbine control system (PDEH) (2009)
- New set of cooling towers (2009)
- Replacement of main generator stator (2010)
- Replacement of the RCP motor (2010)
- Reactor vessel head replacement (2012)
- Installation of third emergency diesel generator (2012)
- Replacement of main generator rotor (2012)
- After Fukushima improvements
 - some implemented in 2011, 2012
 - based on SNSA decision and NPP analysis Safety Upgrade Program to be implemented by the end of 2016



Krško NPP lifetime extension – Ageing management program

- Krško NPP intends to extend lifetime for another 20 years (2023->)
- Periodic Safety Review is used for checking the safety and to extend the operation license every 10 years
- US NRC approach followed for long-term operation
- Some parts of the Safety Analysis Report have had time limits
- AMP prepared in accordance with 10CFR54, NEI 95-10 guideline and supported by GALL (NUREG 1801)
- The aging management review was performed for mechanical components, electrical components and civil structures
- TLAA include detailed analysis of those SSCs with limited life time on the basis of design requirements



Ageing management program

Application:

- In march 2009 the Krško NPP submitted the application for AMP approval and SAR change reviewed by TSO
- SNSA review: expert opinion report, AMR reports, TLAA's and Programs/Procedures review, walkdowns

Approval:

- SNSA review was completed and open issues (SNSA and TSO review) are resolved
- SNSA decision for AMP approval and SAR change issued in June 2012
- Precondition requirement: Environmental Qualification and Maintenance Rule

Ageing management program (AMP) - programs

- AMP connects existing programs and activities with few changes
- some programs developed as a new
- some surveillance testing procedures and operating procedures modified
- no need for SSCs' modification or replacement



The aging management programs (primary components)

- ASME Section XI - IWB, IWC, and IWD ISI Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Closed-Cycle Cooling Water Program
- Fatigue TLAA
- Flow-Accelerated Corrosion Program
- Nickel-Alloy Penetration Nozzles Inspection
- One-Time Inspection of ASME Code Class 1 Small-Bore Piping
- Reactor Head Closure Studs Inspection
- Reactor Vessel Internals Program
- Reactor Vessel Surveillance Program
- Steam Generator Tube Integrity Program
- Water Chemistry Control Program



Krško NPP programs

Inservice inspection program (4th inspection interval)

- 2012 – 2022
- Application of risk-informed methodology (RI-ISI) for class 1 and 2 piping
- Practically all inspections for 3rd inspection interval implemented (2 locations during Outage 2013)

Reactor vessel head and BMI penetrations surveillance program

- Reactor vessel head replacement in 2012
- Inspection requirements reduced (UT,ET -10 years, VT - 3 outages)

Krško NPP programs

Reactor Vessel Irradiation Surveillance Program

- 2 capsules removed in outage 2012 (1 capsule sent to testing)
- Ex-vessel neutron dosimetry system (dosimeters removed and being analysed, new dosimeters installed)

Steam generators program

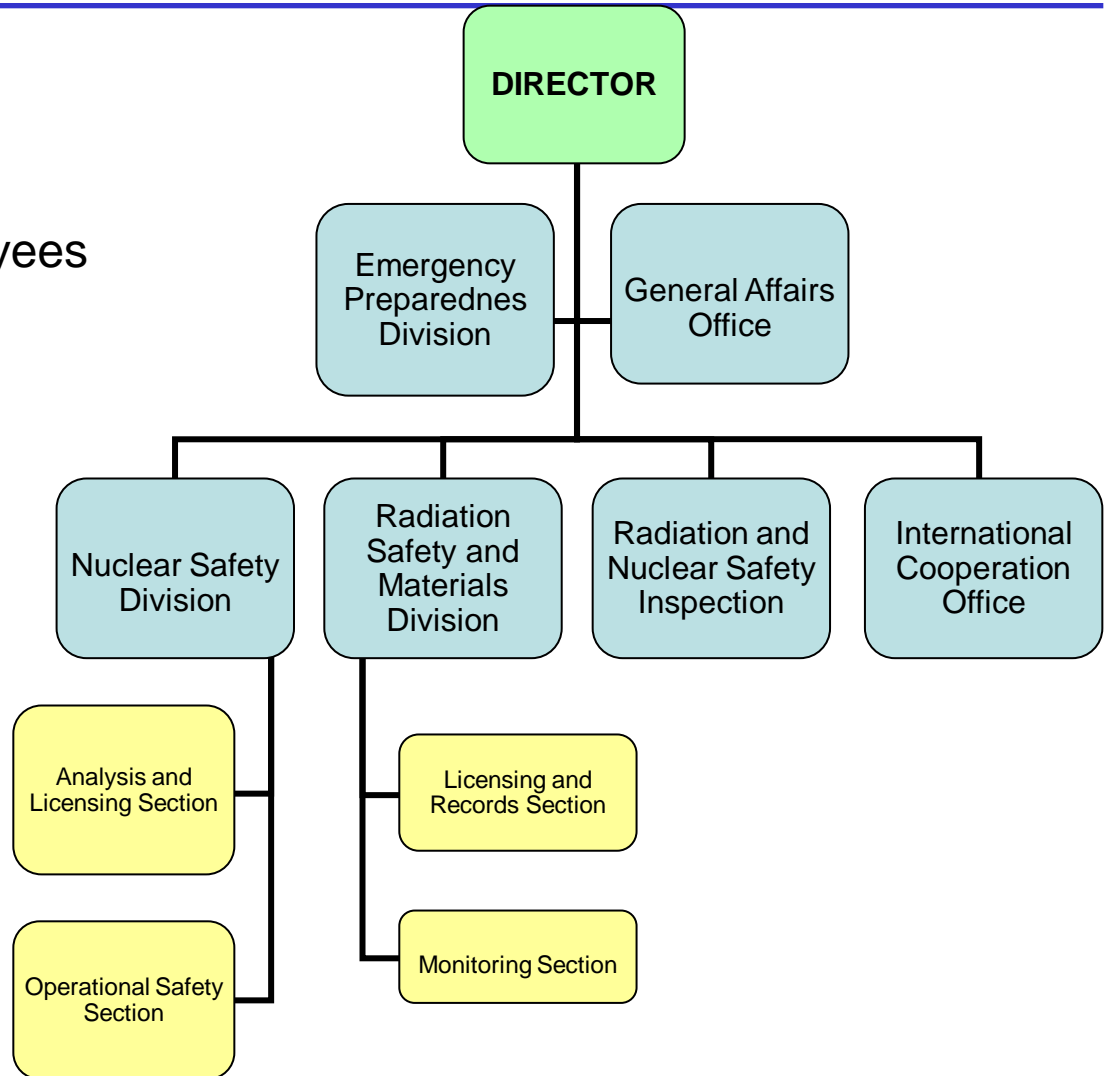
- 50% SG tubes inspected in 2012 outage
- Ongoing analyses after 2012 sludge lancing



Krško NPP programs

- Other AMP programs related to containment inspection, fire protection, civil structures, preventive maintenance of electric components, cable ageing, instrumentation equipment,...
- Some operational procedures are not in implementation phase yet or not yet fully developed
- SNSA supervision of Krško NPP programs implementation through thematic inspections

- Established in 1987
- Total SNSA staff of 40 employees
- 5 divisions, among others:
 - Nuclear safety division (12),
 - Inspection division (5)



SNSA work and legal bases

- Inspection and licensing processes in the area of radiation and nuclear safety (Krško NPP)
- development of regulatory infrastructure
- Preparation of legislation
- Review and assessment
- Preparation of reports on nuclear safety
- Preparedness to act in case of nuclear and/or radiation emergency
- Contact point according to international agreements
- Legal bases
 - Ionising Radiation Protection and Nuclear Safety Act
 - Regulations (in accordance to IAEA and WENRA)
 - International agreements
 - National Nuclear Emergency Plan
 - Inspection Act
 - Minor Offences Act



Supervision over nuclear safety at the Krško NPP

- Periodic safety review
- Inspection reviews
- Supervision of plant's outages and fuel cycles
- Surveillance of plant "Ageing Management"

- Review and assessment

Review and authorization of design modifications

- three categories
- review in accordance to regulation JV9 (10 CFR 50.59)

Review and assessment of the new plant's documents

- Ageing Management Program (AMP)
- Maintenance Rule Program (MR)
- Corrosion/Erosion Monitoring Program (CEMS)
- ...

Findings discussed with plant managers, most of findings taken into account by plant's specialists



SNSA surveillance of aging management at the Krško NPP

Basis:

- Development of SNSA procedure for monitoring of important NPP structures, systems and components for safe long-term NPP operation

Purpose:

- Monitoring and evaluating the adequacy of the Krško NPP programs, procedures and activities related to SSC testing, inspection and maintenance.

Goal:

- To determine that safe operation of the Krško NPP is assured at all stages, including the potential life time extension.

Main SNSA activities:

- ISI (In Service Inspection): review of the results and inspection supervision
- CEMS (Corrosion Erosion Monitoring System): review of the results and inspection supervision
- Control of pressure vessels: review of the results and inspection supervision
- Surveillance testing: presence and review of the results
- System health reports: review
- PSR action plan: review
- Transients: surveillance
- Outages: surveillance
- SNSA database: recording of findings and regulatory requests

The methodology is done in several steps:

- Selection of components
- Preparation for inspection
- Inspection supervision at the Krško NPP
- Evaluation of findings and input into the information system

SNSA information system –components (Ageing)

- Ogled kot administrator
 Prikaži vse komponente

skrbnik seznama: Jure Škodlar

Skupina oz. tip komponente:

Komponente 20 od 82274 komponent ustreza kriterijem

#	<u>MECL oznaka</u>	<u>Naziv</u>	<u>Sistem</u>	<u>Projektna funkcija</u>	<u>Način nadzora</u>	<u>Mehanizem staranja</u>	<u>Varnostni razred</u>	
i	20141	MS ISOLATION VALVE	MS	omejitev nekontroliranega iztoka pare in preprečitev povratnega toka pare	ASME XI ISI/IST, navarjanje in brušenje, UT, PT, čiščenje (poliranje)	obraba, degradacija drsnih površin, degradacija drsnih površin, degradacija drsnih površin	Varnostni razred II	<input checked="" type="checkbox"/>
i	20142	MS ISOLATION VALVE	MS	omejitev nekontroliranega iztoka pare in preprečitev povratnega toka pare	ASME XI ISI/IST, navarjanje in brušenje, UT, PT, čiščenje (poliranje)	obraba, degradacija drsnih površin, degradacija drsnih površin, degradacija drsnih površin	Varnostni razred II	<input checked="" type="checkbox"/>
i	AF101PMP-03C	TURBINE DRIVEN AUX FEEDWATER PUMP 03C	AF	dovajanje vode v uparjalnika	ASME XI ISI/IST	obraba	Varnostni razred III	<input checked="" type="checkbox"/>
i	CC101HEX-001	HEAT EXCHANGER	CC	odvod toplote	Vizualni pregled, ECT	erozija, stanjšanje debeline stene cevi	Varnostni razred III	<input checked="" type="checkbox"/>
i	CO101CND-001	CONDENSER A	CY		Vizualni pregled	erozija	Non safety	<input checked="" type="checkbox"/>
i	CO101CND-002	CONDENSER B	CY		Vizualni pregled	erozija	Non safety	<input checked="" type="checkbox"/>
i	CSAHL01	LETDOWN HEAT EXCHANGER	CS		ASME XI ISI/IST, ASME XI ISI/IST	erozija, zmanjšanje učinkovitosti prenosa toplote	Varnostni razred II	<input checked="" type="checkbox"/>
i	CSAHR01	REGENERATIVE HEAT EXCHANGER	CS	odvod toplote	ASME XI ISI/IST, ASME XI ISI/IST	erozija, zmanjšanje učinkovitosti prenosa toplote	Varnostni razred II	<input checked="" type="checkbox"/>
i	CSAHSW01	SEAL WATER HEAT EXCHANGER	CS		ASME XI ISI/IST, ASME XI ISI/IST	erozija, zmanjšanje učinkovitosti prenosa toplote	Varnostni razred II	<input checked="" type="checkbox"/>
i	CSAPCH01	CENTRIFUGAL CHARGING PUMP NO.1	CS	Vzdrževanje inventarja RCS	ASME XI ISI/IST, ASME XI ISI/IST	erozija, vibracije	Varnostni razred II	<input checked="" type="checkbox"/>



SNSA information system –processes (Ageing)

Ogled kot administrator

skrbnik seznama: Jure Škodlar

Procesi NEK

5 od 5 procesov NEK ustreza kriterijem

Naziv	<u>Glavne zahteve</u>	<u>Osnove</u>	<u>Št. ugotovitev</u>	
Program nadzora zadrževalnega hrama	<p>Program nadzora ZH mora vsebovati:</p> <ul style="list-style-type: none"> - tipe komponent , ki se pregledujejo, vrsto pregledov in ASME zahteve - listo vseh komponent zadrževalnega hrama - plan pregledov za inšpekcijski interval z razdelitvijo pregledov po posameznih periodah 	<ul style="list-style-type: none"> - US NRC je leta 1996 10CFR50.55a "Codes and standards" - ASME sekcija XI - NUREG 1801 - IAEA 	2	
Nadzor učinkovitosti vzdrževanja (NUV)	<p>Povzetek NRC zahtev iz 10 CFR 50.65 "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants", ki za nabor SSK na osnovi definiranih varnostnih kriterijev zahteva: (a)(1) Nadzor in spremljanje zmogljivosti ali stanja SSK glede na zastavljene cilje, tako da bo SSK zmožna opraviti predvideno funkcijo. Ko SSK ne zadostuje zastavljenim ciljem je potrebna izvedba korektivnih akcij. (a)(2) V primeru uspešnega izvajanja preventivnega vzdrževanja poseben nadzor SSK ni potreben. (a)(3) Nadzor zmogljivosti in stanja ter z njima povezani cilji ter preventivno vzdrževanje se morajo ovrednotiti vsaj enkrat na gorivni cikel. (a) (4) Pred izvajanjem vzdrževalnih aktivnosti je potrebno oceniti povečanje tveganja.</p>		1	
Nadzor procesa erozije/korozije (CEMS)	<p>Na osnovi EPRI izkušenj in industrije je NEK razvila program QD4 "Program erozije/korozije".</p> <p>Preverja se stopnja obrabe zaradi erozije/korozije v cevovodih, kjer se pretaka dvofazni medij. Osnova je sistematična UV kontrola posameznih komponent cevovodov ter posledično popravilo ali zamenjava obrabljenih delov.</p>		1	



Conclusions

- Combined approach for long term operation used at the Krško NPP (Licence renewal application and Periodic safety review)
- SNSA approval of AMP and Safety analysis report changes (June 2012) gives option for longer operation of NPP Krško
- Krško NPP have started with AMP (programs) implementation, some operational procedures still have to be developed
- After established AMP also surveillance of primary components is more systematic
- Independent SNSA surveillance of aging management at the Krško NPP (procedure, inspections, database)



Thank you for your attention!

