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MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING
SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

UPDATE OF THE SLOVENIAN POST-FUKUSHIMA ACTION PLAN

Revision 1

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Prepared by the **Slovenian Nuclear Safety Administration**

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Abbreviations

ASME	American Society of Mechanical Engineers
BDBA	Beyond Design Basis Accident
CNS EOM	Extraordinary Meeting of the Contracting Parties to the Convention of Nuclear Safety
DBA	Design Basis Accident
DEC	Design Extension Conditions
DG	Diesel Generator
ERDS	Emergency Response Data System
ENSREG	European Nuclear Safety Regulators Group
I&C	Instrumentation and Control
IRRS	IAEA's Integrated Regulatory Review Service
LOOP	Loss of Offsite Power
LP&SD	Low Power and Shutdown
NAcP	National Action Plan
NPP	Nuclear Power Plant
OEF	Operating Experience Feedback
PMF	Probable Maximum Flood
PORV	Power Operated Relief Valve
PSA	Probabilistic Safety Assessment
RAMP	Review of Accident Management Program
RCS	Reactor Coolant System
SA	Severe Accident
SAM	Severe Accident Management
SAME	Severe Accident Management Equipment
SAMG	Severe Accident Management Guidelines
SBO	Station Black-Out
SFP	Spent Fuel Pool
SG	Steam Generator
SNSA	Slovenian Nuclear Safety Administration
SORNS	State Office for Radiological and Nuclear Safety - Croatian regulator
SSE	Safe Shutdown Earthquake
SUP	Safety Upgrade Program
TSO	Technical Support Organization
UHS	Ultimate Heat Sink
US NRC	United States' Nuclear Regulatory Commission

Introduction

After the peer review workshop in April 2013 it was decided by ENSREG to organize a follow-up peer review workshop in April 2015 where the updates on the implementation of NAcP 2012 actions would be reviewed. Terms of reference for the 2015 workshop have set the format of the NAcP 2015 as to be more of an update of the existing (NAcP 2012) reports, rather than new reports. With that in mind, and also for easier review of the NAcP update, most of the changes and important updates of this report have been gathered in the new chapter 5 of Part IV and in the updated Table 4 with the Slovenian NAcP, while most of the chapters of the original report have stayed the same. Changes which are reflected in these original chapters have been marked with blue colored sentences.

In June 2016 ENSREG decided that countries would again report on the NAcP implementation in December 2017. The text from this latest update (December 2017) is colored in green.

The original report represents the Slovenian Action Plan (NAcP) prepared in December 2012 as a result of all activities executed in Slovenia in response to the nuclear accident in Fukushima Dai-ichi nuclear power plant (NPP) in March 2011. These activities include, but are not limited to, the implementation of European Stress test process, implementation of June 2011 short-term improvements (which also represent response to B.5.b requirements[1] [1]), review and analysis of possible long-term improvements based on which the Krško NPP's Safety Upgrade Program (SUP) was prepared, review of several reports, reviews and analyses regarding the Fukushima lessons learned, etc.

The core of the SLO-NAcP and post-Fukushima improvements in Slovenia represents the planned Krško NPP's Safety Upgrade Program (SUP), which was ordered, reviewed and approved by the Slovenian Nuclear Safety Administration (SNSA). This program of upgrades was already envisioned in the Slovenian legislation from 2009. It required from the plant to upgrade its systems, structures and components to enable coping with severe accidents after the plant lifetime was extended. After the Fukushima accident the SNSA ordered the plant to implement these measures in advance. The program incorporates several large modifications, which were to be implemented gradually until the end of 2016, but the final deadline was later extended first until 2018, and later again until 2021. The SUP is described in more detail in chapters 2 and 5 of Part IV.

Beside the implementation of SUP the SNSA identified 11 additional actions that could further enhance nuclear safety in Slovenia, either indirectly by changing in legislation, hosting additional peer reviews, performing additional studies, or directly by improving the NPP and regulatory body processes, enhancing of emergency preparedness and nuclear safety infrastructure or improving the safety culture of both the operator and the regulatory body. These recommended actions were identified having reviewed several reports, reviews and analyses including:

- ENSREG Compilation of recommendations and suggestions [2],
- 2nd Extraordinary Meeting of the Contracting Parties to the Convention of Nuclear Safety, topic and summary report (CNS EOM) [3],
- IAEA Action Plan on Nuclear Safety [4]
- US Nuclear Regulatory Commission's (US NRC) "Recommendations for Enhancing Reactor Safety in the 21st Century", The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident [5],

[1] B.5.b requirements were issued by NEI in the document NEI 06-12 "B.5.b Phase 2 & 3 Submittal Guideline" [1], which were later endorsed by the US NRC. These requirements concern provisions for coping with large fires and explosions, which could be caused by a large commercial aircraft crash.

- "Forging a New Nuclear Safety Construct", a report from the American Society of Mechanical Engineers (ASME) [6].

As suggested by the ENSREG Secretariat, the ENSREG compilation of recommendations and CNS EOM summary report and rapporteurs' reports were used as a basis to structure the topics of the NAcP report. Thus the SNSA's response to these two sets of recommendations is divided into the first two parts of the report, while the third part describes the rest of the national review and preparation of the Action Plan. Part IV describes the activities taken and planned.

Tables with reviews of individual recommendations, as well as the final compilation of the Slovenian NAcP with references to the individual recommendations are attached to this report.

The methodology for the preparation of the action plan was prepared by ENSREG [7]. Similar action plans are to be prepared by all countries that participated in the Stress Test process followed by the plans to be reviewed in a peer review process.

Part I: Topics 1 to 3: Natural Hazards, Design Issues and Severe Accident Management

For topics 1 to 3 (external events or natural hazards, design issues and severe accident management), the ENSREG Compilation of recommendations and suggestions and CNS EOM rapporteurs' reports' topics 1 to 3 were taken as a basis. All recommendations from these two compilations were reviewed and discussed. Responses to the recommendations are given in the attached Tables A2 and A3 (see Attachment 1).

In general, it can be concluded that the only Slovenian NPP, the Krško NPP, as well as the regulatory infrastructure comply quite well with these recommendations already. This will further be enhanced by the implementation of the Krško's Safety Upgrade Program (SUP).

Yet some additional actions were identified, mainly concerning legislation upgrade, as well as improvements in the emergency response area. The actions are compiled in the Table A1 of the Attachment 1, and are described shortly in Part IV of this report (Table 4).

Part II: Topics 4 to 6: National Organizations, Emergency Preparedness, International Cooperation

For topics 4 to 6 (national organizations, emergency preparedness and response, and international cooperation), the CNS EOM rapporteurs' reports' topics 4 to 6 were taken as a basis. All recommendations from those reports were reviewed and discussed. Responses to the recommendations are given in the attached Table A4 (see Attachment 1).

Again, a general conclusion is that the Slovenian regulatory infrastructure already complies quite well with the recommendations. Yet, some additional actions were identified, mainly concerning the upgrade of emergency preparedness and response. The actions are compiled in the Table A1 of the Attachment 1, and are described shortly in Part IV of this report (Table 4).

Part III: Additional Topics

Post-Fukushima actions in Slovenia started immediately after the accident. While the SNSA cooperated in the preparation and issuance of the ENSREG Stress test specifications, the Krško NPP implemented an analysis to identify short-term improvements. These were basically founded on NPP's previous preparation for implementing modifications that would

enable the plant to cope with an event which could cause large explosions and fires (e.g. large commercial aircraft crash) [1]. The operator applied a request to license these modifications at the end of May 2011, while modifications were mostly implemented by the end of June 2011. The short-term improvements are described in the first chapter of Part IV.

In the meantime, the SNSA also issued a decision requiring from the plant to perform an extraordinary safety review in line with the ENSREG Stress test specifications. The process of the stress tests was implemented and completed by the end of March, which also came up with the first recommendation to be followed in the NAcP. Namely, the Slovenian ENSREG Country Report identified a single recommendation, i.e. **"It is recommended that the regulator should consider requesting to update the seismic design basis for future design modifications and consequently the associated PSA model."**

In September 2011, the SNSA issued the second decision requiring from the plant to reassess the severe accident management strategy, existing design measures and procedures and to implement necessary safety improvements for prevention of severe accidents and mitigation of its consequences. As already stated in the introduction of this report, this program of upgrades was already envisaged in the Slovenian legislation from 2009. The plant is required to upgrade its systems, structures and components to enable coping with severe accidents after the plant lifetime is extended, but due to the Fukushima accident the SNSA ordered the plant to implement these measures in advance. The evaluation of existing measures and possible improvements [8] was finished in January 2012. Its action plan, i.e. "The Krško NPP Safety Upgrade Program" (SUP) [9] was reviewed and approved by the SNSA in February 2012. The proposed improvements that have tendency to increase reliability of AC power, core cooling, spent fuel pool (SFP) cooling and containment integrity, as well as to reduce possible fission products and to provide emergency control provisions in case of design extension conditions (DEC) are described in more detail in the fourth part of this report. The SUP is based on a detailed analysis taking into account the lessons learned from the Fukushima accident, the evaluated cliff-edge effects for the Krško NPP (done for the Stress tests process), and plant specific PSA level 1 and 2 analyses.

In January 2012, the SNSA issued the third decision regarding the Fukushima event, requiring from the Krško NPP to review the basis and assumptions for the National Radiological Emergency Response Plan. For more details see chapter 5.2.3.

It should be mentioned that the Expert Council for Radiation and Nuclear Safety was regularly informed of the activities planned and carried out. The Expert Council is a high level advisory body established according to the Nuclear Act to advise the Minister of Agriculture and Environment and the SNSA on nuclear safety matters. Thus, the SNSA got the Expert Council's support on the decisions regarding the reassessment of severe accident management strategies for the Krško NPP.

Further to the preparation of the long-term action plan, the SNSA reviewed the ENSREG's Peer Review Report, the US NRC's "Recommendations for Enhancing Reactor Safety in the 21st Century", The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident (SECY-11-0093), US NRC's "Recommended Actions to be Taken Without Delay from the Near-Term Task Force Report" (SECY-11-0124) [10] and US NRC's "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned" (SECY-11-0137) [11], the Japanese "The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission" [12], as well as the report "Das KKW Krško in Licht der Nuklear-Katastrophe von Fukushima" (Eng.: The Krško NPP in light of the nuclear disaster in Fukushima) prepared by the University of Natural Resources and Life Sciences in Vienna (Department of Water, Atmosphere and Environment; Institute of Safety and Risk Sciences) [13]. Furthermore, the SNSA prepared the report for and took part in the CNS EOM meeting and later reviewed and discussed the meeting recommendations. This review was followed by a review of ENSREG Compilation of recommendations and suggestions, IAEA's Action Plan on Nuclear Safety, as well as ASME's report "Forging a New Nuclear Safety Construct".

These reviews identified several proposals of actions and a draft action plan was prepared. The proposed action plan was then reviewed by the SNSA senior management, as well as by the Krško NPP and at the end the final Action Plan was issued and made public on the SNSA web site.

Part IV: Activities taken and planned

The Slovenian Post-Fukushima actions can be divided into three sets of actions:

1. The implemented short-term improvements
    a. Accelerated B.5.b requirements' actions
    b. Implementation of Slovenian Stress test action plan
2. The Safety Upgrade Program (SUP)
3. The additional long-term improvements/activities

1. The implemented short-term improvements

1.1. Accelerated B.5.b requirements' actions

Immediately after the Fukushima accident the operator of the Krško NPP initiated the event analysis with a purpose to identify possible short-term actions that would raise the plant's preparedness for severe accidents. The Krško NPP partly implemented this analysis in advance, when implementing B.5.b requirements (post 9/11 requirements endorsed by the US NRC [1]), which were required by the SNSA with a decision issued in 2008, so the post-Fukushima actions were also based on that analysis. The result was the procurement of additional portable equipment, e.g. AC diesel generators, pumps and compressors, implementation of quick connection points for this equipment, as well as amendments to the emergency operating procedures and severe management accident guidelines were made enabling the use of this new equipment to mitigate consequences in case of a severe accident. These modifications were to a large extent implemented by the end of June 2011 and were also considered in the stress test report submitted to the European Commission [14].

All the modifications and procurement of new equipment that resulted out of the above mentioned activities are shortly described in Table 1 below.

Table 1: Implemented short-term improvements in the Krško NPP – accelerated B.5.b requirements

Modification or equipment procurement	Description	Concerns topic
Portable generator 5 kW (2 pcs)	To be used as a backup source for powering essential instrumentation	All, particularly SBO
Portable generator 2.6 kW (2 pcs)	To be used as a backup source for powering essential instrumentation	All, particularly SBO
Mobile diesel generator 150 kW (3 pcs)	To be used as a backup source for powering essential instrumentation or equipment (e.g. motor operated valves)	All, particularly SBO
Mobile diesel generator 600 kW	To be used as a backup source for powering essential equipment (e.g. battery chargers, pumps)	All, particularly SBO

Modification or equipment procurement	Description	Concerns topic
Mobile diesel generator 1000 kW	To be used as a backup source for powering essential equipment (e.g. battery chargers, pumps)	All, particularly SBO
Portable oil free compressor (2 pcs)	To be used as a backup source of instrument air (e.g. for operating air valves)	All
Portable fire protection pump 60 m3/h / 1.5 MPa (2 pcs)	To be used as a backup source of feedwater for SGs	All
Submersible pump 2.8 kW / 7 m^3/h / 0.2 MPa (4 pcs)	To provide low pressure sources of water to high pressure pumps	All
Trailer with portable pump 60 m^3/h / 1.1 MPa / suction from 35 m	To be used as a backup source of water for filling steam generators (SG), spent fuel pool (SFP), containment, etc.	All
Portable transformer 230/118 V / 3 kVA (2 pcs)	To transform voltage for essential instrumentation	All
Tractor “Arion 630C” 103 kW, with additional equipment, e.g, air compressor, fork lift, equipment for ploughing (removing debris, etc.)	To be used as means of transportation of different equipment (e.g. portable diesel generators, pumps, barrels of oil, etc.), for transferring the fuel between tanks/barrels and equipment, for ploughing/clearing way at the site, etc.	All, particularly Severe Accident Management (SAM)
Installation of quick connection points for feeding the SGs	Installation of quick connection points (for standard fire hose connections) to enable feeding of SGs from several water sources	All
Installation of quick connection points for flooding the containment	Installation of quick connection points (for standard fire hose connections) to enable flooding the containment from several water sources	All
Installation of quick connection points for alternative sources of instrument air	Installation of quick connection points for quick connection of portable oil-free compressors to instrument air system or directly to end users	All
Installation of quick points for manual SG PORV control	Installation of quick connection points for quick connection of alternative sources of instrument air as well as manually controlled air regulator to enable manual control of SG's PORVs	All
Installation of quick connection points for filling the SFP	Installation of quick connection points (for standard fire hose connections) to enable filling the SFP from several water sources	All
Installation of alternative measurement system for SFP temperature and level	Installation of alternative measurement system with alternative independent power supply (portable DGs or batteries)	All

1.2. Implementation of the Slovenian Stress Test action plan

In the process of EU Stress Tests additional short-term actions were identified [14]. These additional actions, which were implemented by the end of 2011, are shortly described in Table 2 below.

Table 2: Implemented short-term improvements in the Krško NPP – implementation of the Slovenian Stress Test action plan

Modification or equipment procurement	Description	Concerns topic
Mobile diesel generator 2000 kW	To be used as a backup source for powering essential equipment (e.g. battery chargers, larger pumps, also backup for the 3rd (alternative) safety related DG)	All, particularly SBO
Portable fire protection high pressure pump 30 m^3/h / 3.2 MPa (2 pcs)	To be used as a backup source of feedwater for SGs	All
HFS HydroSub 450 floating unit 720 m^3/h / 1.1 MPa / suction from 45 m 2,900 m 8‘‘ hoses Trailer with hose layer container	Assure additional high capacity “portable water ring” around the plant (as a backup fire protection system, but with enough capacity that it could be used as alternative water source for heat removal from the reactor, containment and SFP)	All
Installation of additional quick connection points	Installation of additional quick connection points (for standard fire hose connections)	All

2. The Safety Upgrade Program (SUP)

The Slovenian legislation (Rules on radiation and nuclear safety factors – JV5 [15]) stipulates:

“Upon the plant life extension of the Krško nuclear power plant or extension of the service life of its SSCs, if approved, the facility operator shall undertake a study of the response of the nuclear power plant to severe accidents in accordance with Chapter 1.12 of Annex 1 and, based on the findings of this study, propose any appropriate measures and implement them as quickly as practicable.”

Due to the Fukushima accident and the progress in the licensing process for lifetime extension, the SNSA decided to speed up the plant’s above mentioned evaluation and implementation of severe accident management’ measures. Thus, in September 2011 the SNSA issued a decision requiring from the plant to reassess the severe accident management strategy, existing design measures and procedures and implement necessary safety improvements for prevention of severe accidents and mitigation of its consequences.

This evaluation was finished in January 2012 [8]. The action plan [9] was reviewed and approved by the SNSA and shall be completely implemented within the Safety Upgrade Program (SUP) by the end of the year 2016.

Additional systems, structures and components, which will be implemented within the SUP, will be designed and structured in accordance with the design extension conditions (DEC) requirements specific for the Krško NPP design and site location.

A set of DEC is derived on the basis of engineering judgment, deterministic assessment and probabilistic assessment based on the IAEA methodology defined in SSR-2/1, Safety of

Nuclear Power Plants: Design Specific Safety Requirements [16], Krško NPP's Individual Plan Examination and the Krško NPP Analyses of Potential Safety Improvements [8].

The DEC are described by:

- **earthquake**, extended design condition seismic value is 2xSSE[2] (0.6 g PGA),
- **flooding**, new maximum flood level is 157.53 m (above sea level) (existing flood protection dikes are at 157.10 m),
- **earthquake + flooding**, flood due to dikes damaged by earthquake with the river flow at current maximum PMF[3] flow,
- **earthquake + fire**, fire caused by DEC earthquake,
- **external low and high temperatures**, air temperatures with a return period of 10,000 years,
- **aircraft crash accident**, crash of large commercial aircraft at the maximum landing velocity,
- **fire**, fire due to DEC aircraft crash.

All other combinations of events/accidents are considered as Beyond Design Basis Accidents (BDBA) and will be addressed by mobile equipment (procedures are also in place; SAMGs).

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

- loss of off-site power (LOOP) for 7 days,
- station black-out (SBO) for 72 hours,
- loss of ultimate heat sink (UHS) for 30 days,
- loss of UHS combined with SBO for 72 hours,
- flooding water (from Sava river) retains for 7 days.

DEC systems, structures and components will be located in two new bunkered buildings, one already built and the other one to be built in phase III of the SUP (see chapter 5).

The new DEC equipment can be separated into the prevention and mitigation part. The prevention part of the equipment serves to preserve adequate fuel cooling in case of DEC events, taking into account prolonged duration of these events.

For the mitigation part, it is assumed that preventive DEC equipment will not be available for 24 hours and that core will be melted and corium relocated into containment. This is the basic assumption for DEC containment filtered vent system and passive autocatalytic recombiners. This assumption also led to the requirement that batteries for DEC equipment and emergency control room shall have a 24 hour capacity.

The SUP safety improvements (as planned in 2012) are shortly described in Table 3.

[2] SSE – Safe shutdown earthquake of PGA 0.3 g as a design basis for the Krško NPP.

[3] PMF – Probable maximum flood, 7081 m3/s, is a deterministically determined value of the highest still possible flood at the Krško site. (for comparison, the design basis flood for Krško NPP is probabilistically evaluated value of 4790 m3/s with a return period of 10,000 years).

Table 3: The Safety Upgrade Program (SUP)

Modification or equipment procurement	Description	For prevention and/or mitigation	Scheduled finish
Filtered venting system	Filtered venting system capable of depressurizing containment and filtering over 99.9% of volatile fission products and particulates (not including noble gasses)	mitigation	2013
Installation of passive auto-catalytic recombiners in the containment	Replacement of electric DBA recombiners with passive BDBA auto-catalytic recombiners in the containment[4]	mitigation	2013
Additional high pressure pump for RCS injection	Additional high pressure pump for RCS injection in the separated bunkered (2×SSE and PMF flood protected) building with dedicated source of borated water for 8 hours with provisions to refill by mobile equipment from different water sources	prevention (and mitigation)	2015
Additional high pressure pump for feeding SGs	Additional high pressure pump for feeding SGs in the separated bunkered (2×SSE and PMF flood protected) building with dedicated source of water for 8 hours with provisions to refill by mobile equipment from different water sources	prevention	2015
Additional high pressure pump for RCP seal injection	Additional high pressure pump will be installed (2×SSE and PMF flood protected) that will enable alternative injection into RCP seals	prevention	2015
Additional low pressure pump for spraying and flooding the containment	Additional low pressure pump for spraying (pressure control) and flooding the containment (preventing core concrete interaction in case of failed reactor pressure vessel). It will also enable injection into SFP through a new SFP spray system. This pump will also be located in the separated bunkered (2×SSE and PMF flood protected) building with dedicated source of water for 8 hours with provisions to refill by mobile equipment from different water sources.	prevention and mitigation	2015
Installation of additional pressurizer PORVs	Additional pressurizer PORVs will be installed, qualified for DEC events	prevention	2015
Alternative ultimate heat sink	Alternative ultimate heat sink (2×SSE and PMF flood protected)	prevention	2015
Mobile heat exchanger	Mobile heat exchanger (cooled by mobile equipment or air) with provisions to quick connect to SFP, containment sump or reactor coolant system	prevention (and mitigation)	2015
Installation of permanent sprays around the SFP	Installation of permanent sprays (2×SSE qualified) around the SFP with provisions for quick connection of mobile equipment and different sources of water. Spraying of SFP is needed in case of loss of SFP integrity.	prevention	2015

[4] The two electric DBA recombiners will be replaced with two DEC PARs. Additional DEC PARs will be installed into different containment compartments for managing severe accidents hydrogen.

Modification or equipment procurement	Description	For prevention and/or mitigation	Scheduled finish
Safety upgrade of AC supply	Within this action several modifications/upgrades will be performed on the AC power supply, including modification of alternative supply of non-safety related buses, requalification of 3rd 6.3 kV safety related bus (MD3), upgrade of connection between 400 V safety related bus (for charging batteries) and mobile diesel generators,…	Prevention	2015
Establishment of emergency control room	Relocation and expansion of existing remote shutdown panels into a new emergency control room in the separate bunkered (2×SSE and PMF flood protected) building with all I&C needed for safe shutdown of the plant and maintaining the safe shutdown conditions.	prevention and mitigation	2016
Installation of separate dedicated BDBA I&C	Installation of separate dedicated BDBA I&C capable of monitoring and controlling both from the existing as well as the new emergency control room	prevention and mitigation	2016
Long term habitability of emergency control room and support staff facility	The above-mentioned emergency control room will enable long term habitability of control room staff even during severe accidents (air filtering, radiation protection). For the same conditions also new facility for supporting staff will be designed and build	prevention and mitigation	2016
Acquiring the technology and material for quick filling of possible ruptures in SFP	Acquiring the technology and material for quick filling of possible ruptures in SFP	prevention	2016
Additional flood protection of nuclear island and newly installed equipment	Nuclear island and the above-described newly installed equipment will be additionally flood protected against the failure of flood protection dikes or high river flows exceeding flood protection dikes by 0.4 m	prevention and mitigation	2016
Protection against extreme air temperatures	The above-described newly installed equipment will be protected against extreme outside 10,000-year temperatures	prevention and mitigation	2016

In addition to the above-listed modifications, the operator has also reassessed possibilities for alternative spent fuel strategy [17]. The results show that the best strategy would be storing the spent fuel in a dry cask storage with a possibility to combine it with later reprocessing (also part of the NAcP).

3. The additional long-term improvements

The additional long-term improvements include all other proposals of actions from the review of reports, reviews and analyses regarding the Fukushima lessons learned (including ENSREG Compilation of recommendations and suggestions, CNS EOM summary and rapporteurs' reports, the IAEA Action Plan on Nuclear Safety, US NRC's "Recommendations for Enhancing Reactor Safety in the 21st Century" and other).

4. The National Action Plan

The National Action Plan is thus comprised of all actions still to be implemented. Namely, the SUP, and additional long-term improvements identified in the process of the preparation of NAcP. All NAcP actions are given in Table 4, as well as in the attached Table A1, where also referenced recommendations are included. It is assessed that up until the end of 2017 85% of the Slovenian NAcP has been implemented.

Table 4: Slovenian National Action Plan

No.	Future action / activity	Area	Status	Finalization	Level
1	SUP SUP comprises of a set of modifications/ improvements (see numbers 1.1 to 1.10) that will be implemented in steps until the end of 2021. Some of the discussed recommendations (see related recommendations) are to be verified within the licensing and implementation of the SUP. (for SUP details see chapter 2 in Part IV)	SUP	in progress 70%	2021	site
1.1	Safety upgrade of AC power supply	SUP, Phase II	in progress 85%	2018	site
1.2	New pump for supplying SGs; in a bunkered building, with a dedicated water supply	SUP, Phase III	in progress 15%	2021	site
1.3	Installation of alternative ultimate heat sink – revised into alternate long-term heat sink using SGs and underground well water (see 1.2 and Chapter 5.2.1)	SUP, Phase III	in progress 15%	2021	site
1.4	Additional pump for injecting into the reactor primary system, in a bunkered building, with a dedicated (borated) water supply	SUP, Phase III	in progress 50%	2021	site
1.5	Containment integrity safety upgrades including containment filtered vent systems and PARs	SUP, Phase I	implemented	2013	site
1.6	Establishment of emergency control room	SUP, Phase II	in progress 65%	2019	site
1.7	Installation of fixed spray system around the SFP with provisions for quick connection from different sources of water.	SUP, Phase II	in progress 65%	2018	site
1.8	Mobile heat exchanger with provisions to quick connect to SFP	SUP, Phase II	in progress 65%	2018	site
1.9	Flood protection upgrade (additional protection of nuclear island and bunkered buildings)	SUP, Phase II	implemented	2015	site
1.10	Establishment of new technical support center and upgrade of existing operational support center (emergency operating facilities)	SUP, Phase II	in progress 75%	2018	site
2.1	SNSA shall amend its legislation to include: • requirements regarding the use of advanced deteriorating weather warning systems • requirements regarding the use of seismic monitoring systems • PSA Level 3 requirements (at least for new NPPs) • requirements for Beyond Design Basis Accidents I&C for Spent Fuel Pool • emergency planning requirements for prolonged SBO in the areas of communications capability (onsite, e.g., radios for response teams and between facilities, and offsite, e.g., cellular telephones, satellite telephones), ERDS capability, training and exercises, and equipment and facilities	legislation	implemented	2016	national

No.	Future action / activity	Area	Status	Finalization	Level
2.2	The SNSA shall consider amending its regulation for the design basis by more stringent safety objectives for: • Prevention and mitigation of core-melt accident in reactor and in spent fuel storage to avoid off-site long term contamination • Large or early release to be practically eliminated (for new NPPs) • Increase robustness of NPPs to be able to face natural hazards more severe than the ones considered in the design basis (DEC); this should also include requirements for test and maintenance of equipment, training,... This will be done mainly by following WENRA/ENSREG new initiatives, updated RL... The SNSA shall also examine whether more detailed requirements are needed regarding LOOP, SBO and loss of UHS	legislation	implemented	2016	national
3	In January 2012 SNSA issued the third decision regarding the Fukushima event requiring from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan. This is to be finished by March 2013. The results of the review, possible proposals for improvements of the Radiological Emergency Response Plan, shall be implemented as appropriate. In addition the SNSA (together with other appropriate stakeholders) shall give further consideration to: • supplementing the national radiological emergency response plan with provisions for off-site support regarding to the long-term fuel supply and also some additional pieces of mobile equipment in case of widespread disruption of plant's infrastructure • within the supplementing of national radiological emergency response plan further consideration shall be given to: - Reference levels for importing food, - Trans-boundary processing of goods and services such as container transport - Approach / philosophy and associated limits and criterion to govern the 'remediation' phase of the event - Return to evacuated area criteria and criteria for return to normal from the emergency state - Establishing contamination monitoring protocols and locations during the recovery phase • preparing national strategy (also amending legislation if needed) regarding solutions for post-accident contamination and the treatment of potentially large volumes of contaminated water • enhancement of intervention personnel training, trans-boundary arrangements and education of the public and media • enhancing cooperation with neighboring countries (especially Croatia), including mutual exercises • enhancing exercises by including all interface points (National, Regional, Municipal…), performing longer term exercises for better reflection of the extreme events challenges, and incorporating failure of communication systems and radiation data availability into drill programs • enhancement of national radiological monitoring system	emergency response	in progress 85%	2018	national

No.	Future action / activity	Area	Status	Finalization	Level
4	SNSA shall assign dedicated inspections to: • verify the external hazard protection equipment; • systematically review and inspect SAME equipment, SAMGs, test and maintenance procedures, as well as full scale training events at the Krško NPP with the emphasis on how the limited number of staff are able to cope with equipment deployment and transfer of additional fuel to the users, what are the available and needed times, are there enough resources (human and equipment) available,… • check what are plant's capabilities to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones, satellite telephones) during a prolonged SBO; • additional inspection on radiological protection equipment, procedures for radiological mapping in case of an accident, staff training (added from action #5, additional studies)	Inspection	implemented	2017	site
5	The SNSA shall consider requiring the plant to perform additional studies regarding: • accident timing, including core melt, reactor pressure vessel (RPV) failure, basemat melt-through, SFP fuel uncovery, etc., using different computer codes • radiological protection equipment for SA response • analysis and identification of situations that would prevent performance of work for radiological reasons; • the question of stress on staff behavior including emotional, psychological and cultural aspects associated with emergency response and associated training and support	additional studies	implemented	2017	site
6	Nuclear safety infrastructure in Slovenia needs more political support. Only in such environment the human resource capacity and competence across all organizations in the field of nuclear safety can be further developed. SNSA shall organize a meeting, where this topic shall be brainstormed by all involved parties (the utility, the regulatory body, TSOs…). Special action plan shall be prepared and executed to enhance political support to nuclear safety infrastructure.	nuclear safety infrastructure	implemented	2016	national
7	To enhance its processes SNSA shall: • reconsider, which of the international meetings/groups are of outmost importance, since the decreasing number of staff and increasing number of international activities the quality of regular work may start to suffer • review its capability for evaluating defense-in-depth to see whether and how it could be further enhanced • enhance its staff training on severe accidents and SAMGs	SNSA processes	implemented	2017	national
8	The SNSA shall consider inviting the following peer review missions • additional RAMP mission (best after completion of SUP) to again properly and independently validate the SAMGs. Likewise consideration shall be given to inviting peer review missions to reassess the external hazards	peer reviews	in progress 75%	2022	site

No.	Future action / activity	Area	Status	Finalization	Level
	• a follow-up IRRS mission in 2014, and next IRRS mission in the next 5-6 years • OSART mission to review plant design safety features and related modifications (in next 3 years) • EPREV (Emergency Preparedness Review) mission				
9	SA plant parameters are being transferred to regulator premises. Still, this system needs a revision to include all needed SA parameters, increase reliability of the system…	ERDS	implemented	2015	site
10	A full scope PSA (including Level 2) for low power and shutdown modes shall be implemented for the Krško NPP by the end of 2015. SNSA shall consider requiring a PSA for the Krško's Spent Fuel Pool.	PSA	in progress 65%	2018	site
11	SNSA shall (together with the operator) analyze how the following topics are taken into account, maintained and improved: • Transparency; public discussion of safety issues • An open and trustful relationship between regulators, operators and the public with keeping in mind their respective roles and functions • Define appropriate actions to ensure that the desired safety culture characteristics are achieved in the regulatory and operational organizations • Methods to evaluate and detect degraded safety culture	safety culture	implemented	2014	national
12	Within the reassessment of its severe accident management strategy, existing design measures and procedures, the operator has also reassessed its possibilities for alternative spent fuel strategy [16]. The results showed that best strategy would be storing the spent fuel in dry cask storage with a possibility to combine it with later reprocessing. In accordance with the latest study further actions shall be implemented on the national level to change the national strategy and to enable licensing of the modification.	reviews and NPP improvements	in progress 30%	2020	national + site

5. Update of the NAcP

5.1. Response / clarification on issues identified in the rapporteurs' report

In the 2013 peer review report for Slovenia the rapporteurs identified two specific challenges:

- the revision of the 2004 Seismic Probabilistic Safety Assessment (SPSA), and
- the enhancement of off-site emergency preparedness and its harmonization with Croatia.

5.1.1. The revision of the 2004 SPSA

In last couple of years several investigations and studies ([18], [19] and [20]) were performed regarding the geotechnical, geological and seismological characteristics of the Krško site, initially to investigate the site for the possible new unit, and subsequently to determine potential activity or capability of the nearby fault (i.e. the Libna fault).

In addition to that further investigations were carried to analyze and determine detailed features and characteristics of Orlica and Artiče structures. Investigations included, but were not limited to, similar techniques as used for the geological and seismological evaluation / characterization of Libna fault.

The results of a recent study on faults in the near region of the Krško site show that the annual probability of displacements due to these faults that are significant to NPPs is extremely low (less than 1E-8 /year) [21]. The study conservatively assumed all those faults to be capable, although their actual capability has at that time not yet been confirmed.

According to a new map of active faults [22], there are no active, probably active or possibly active faults within the 25-km radius of the Krško site for which their lengths would suggest a potential for magnitude M>>7 full-length or M≥7 single segment ruptures.

Taking into account the results of investigations carried up to now it was concluded that the assumptions considered in 2004 seismic hazard analysis for the Krško site are defendable even against these new seismological assessments.

Thus, no immediate measures are planned to implement the recent findings into an existing seismic hazard assessment for the Krško NPP. Further revision of seismic hazard assessment as well as seismic probabilistic safety assessment will be considered when all ongoing investigations are complete.

5.1.2. The enhancement of off-site emergency preparedness and its harmonization with Croatia

Since 2012 the two countries, Slovenia and Croatia, have enhanced their cooperation in the area of emergency preparedness. They have been holding regular meetings. In addition Croatia participated in the Slovenian national exercise in November 2014.

Croatia is also participating in a working group to review emergency planning basis for the Krško NPP (see also chapter 5.2.3). Croatia and Slovenia are cooperating in a working group, which is preparing mutually acceptable guidelines for issuing harmonized protective measures and informing the public.

In addition, the SNSA has given the Croatian regulator, State Office for Radiological and Nuclear Safety (SORNS) full access to its emergency communication and coordination system called MKSID. With access to MKSID the SORNS has full overview of the situation in the Krško NPP during the emergency as well as the emergency preparedness measures being implemented in Slovenia.

5.2. Main changes and updates of the NAcP

In the following chapters a review is given for each action of the NAcP (see Table 4). A status of each action is given with a description of changes, causes for changes and new deadlines (if applicable).

5.2.1. Action #1: The SUP

SUP (Safety Upgrade Program) comprises of a set of modifications/improvements (see numbers 1.1 to 1.10) that will be implemented in steps until the end of 2016. Some of the discussed recommendations (see related recommendations) are to be verified within the licensing and implementation of the SUP.

- *1.1 Safety upgrade of AC power supply*
- *1.2 New pump for supplying SGs; in a bunkered building, with a dedicated water supply*
- *1.3 Installation of alternative ultimate heat sink*
- *1.4 Additional pumps (low and high pressure, as well as a special pump for seal injection) in a bunkered building, with a dedicated water supply*
- *1.5 Containment integrity safety upgrades including containment filtered vent systems and PARs*
- *1.6 Establishment of emergency control room*
- *1.7 Installation of fixed spray system around the SFP with provisions for quick connection from different sources of water.*
- *1.8 Mobile heat exchanger with provisions to quick connect to SFP, containment sump or reactor coolant system*
- *1.9 Flood protection upgrade (additional protection of nuclear island and bunkered buildings)*
- *1.10 Establishment of new technical support center and upgrade of existing operational support center (emergency operating facilities)*

In September 2013, the Krško NPP applied for the extension of the final SUP deadline. The main reasons for the delay were the magnitude of the project, complexity of design documentation, delivery times of some of the main components, as well as inclusion of the Krško NPP into the Public Procurement in Water Management, Energy, Transport and Postal Services Area Act, which further complicated, delayed, and finally failed the bidding of the project. The SNSA approved the extension of the deadline until the end of 2018.

Then, in the beginning of 2014 the Krško NPP notified the SNSA that the implementation of the SUP until the end of 2018 is going to be challenged due to financial constraints. Namely, the two owners of the Krško NPP (the Slovenia's state owned GEN Energija d.o.o. and the Croatia's stated owned HEP d.d.) became unwilling to finance the SUP (especially the larger part of it, the "BB2 project") due to doubts that the plant could, after the implementation of the project, still continue to provide electricity at a competitive price. The owners ordered the financial viability study, after which they would decide about the continuation of the "BB2 project". The result was in favor of the SUP implementation and life time extension of the Krško NPP, thus the owners decided to continue with the implementation of SUP improvements. Due to the delay of the implementation of the BB2 project, the Krško NPP again applied for the extension of the deadline for the third SUP phase (the BB2 project), and also some conceptual changes of the SUP. The major change is the revision of alternative ultimate heat sink, which will be assured with the use of steam generators fed by additional dedicated sources of water capable of replenishing from underground wells. This way the cooling of the reactor will be assured for at least 30 days even with the complete loss of the existing UHS. The SNSA reviewed the revision of the SUP and supporting analyses and in the beginning of 2017

approved the new SUP program and the extension of the third SUP phase's deadline until the end of 2021.

Thus, at the moment the SUP is divided into three phases:

Phase I was already implemented in 2013:

- Replacement of active hydrogen recombiners with passive ones (PARs); also capable of managing hydrogen from severe accidents
- Installation of passive containment filtered venting system

Phase II is underway and is to be implemented until end of 2018:

- Flood protection of the nuclear island - implemented
- Operation support center reconstruction - underway
- Installation of pressurizer PORV bypass - underway
- Spent fuel pool (SFP) alternative cooling - underway
- Alternate cooling of reactor coolant system (RCS) and containment - underway
- Installation of emergency control room (ECR) - underway
- Upgrade of bunkered build 1 (BB1)[5] electrical power supply - underway
- ECR / Technical support center ventilation and habitability system - underway
- Replacement and upgrade of critical instrumentation - underway

Phase III is to be implemented by the end of 2021:

- Installation of the additional ultimate heat sink - revised into alternate long-term heat sink through alternate SG injection system. This alternate SG injection system will be comprised of a dedicated pump and reservoir of water, located in a bunkered building (the BB2). The reservoir will also have means to replenish from an underground well, thus ensuring alternate cooling of the reactor in case of complete loss of UHS for at least 30 days.
- The second part of the BB2 project is the independent system for injecting the cooling water into the reactor cooling system and the containment. It comprises of a dedicated pump and a large reservoir of borated water, both located in the BB2 building.
- Construction of dry spent fuel storage facility (the owners have included this project under the SUP; See also 5.2.12).

5.2.2. Action #2: Legislation

2.1 SNSA shall amend its legislation to include:

- *requirements regarding the use of advanced deteriorating weather warning systems*
- *requirements regarding the use of seismic monitoring systems*
- *PSA Level 3 requirements (at least for new NPPs)*
- *requirements for Beyond Design Basis Accidents I&C for Spent Fuel Pool*
- *emergency planning requirements for prolonged SBO in the areas of communications capability (onsite, e.g., radios for response teams and between facilities, and offsite, e.g., cellular telephones, satellite telephones), ERDS capability, training and exercises, and equipment and facilities*

[5] BB1 is already existing bunkered building, which contains the 3rd alternative (safety related) diesel generator. This building will in future also contain the ECR and the new technical support center (emergency center)

2.2 The SNSA shall consider amending its regulation for the design basis by more stringent safety objectives for:

- *Prevention and mitigation of core-melt accident in reactor and in spent fuel storage to avoid off-site long term contamination*
- *Large or early release to be practically eliminated (for new NPPs)*
- *Increase robustness of NPPs to be able to face natural hazards more severe than the ones considered in the design basis (DEC) ; this should also include requirements for test and maintenance of equipment, training,...*

This will be done mainly by following WENRA/ENSREG new initiatives, updated RL,... The SNSA shall also examine whether more detailed requirements are needed regarding LOOP, SBO and loss of UHS

The SNSA finished amending / revising its legislation based on the above stated commitments and/or considerations. The two amended rules, Rules on radiation and nuclear safety factors – JV5 and Rules on operational safety of radiation and nuclear facilities – JV9, which incorporate the latest WENRA SRL updates (adopted in September 2014), were adopted in December 2016.

5.2.3. Action #3: Emergency response

In January 2012 SNSA issued the 3rd decision regarding the Fukushima event, with which it requires from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan. This work is to be finished until March 2013. The results of the review, possible proposals for improvements of the Radiological Emergency Response Plan, shall be implemented as appropriate.

In addition the SNSA (together with other appropriate stakeholders) shall give further consideration to:

- *supplementing the national radiological emergency response plan with provisions for off-site support in regard to long-term fuel supply and also some additional pieces of mobile equipment for the case of widespread disruption of plant's infrastructure*
- *within the supplementing of national radiological emergency response plan further consideration shall be given to:*
  - *Reference levels for importing food,*
  - *Trans-border processing of goods and services such as container transport*
  - *Approach / philosophy and associated limits and criterion to govern the 'remediation' phase of the event*
  - *Return to evacuated area criteria and criteria for return to normal from the emergency state*
  - *Establishing contamination monitoring protocols and locations during the recovery phase*
- *preparing national strategy (also amending legislation if needed) regarding solutions for post-accident contamination and the treatment of potentially large volumes of contaminated water*
- *enhancement of intervention personnel training, trans-border arrangements and education of the public and media*
- *enhancing cooperation with neighboring countries (especially Croatia), including mutual exercises*
- *enhancing exercises by including all interface points (National, Regional, Municipal…), performing longer term exercises for better reflection of the extreme events challenges,*

and incorporating failure of communication systems and radiation data availability into drill programs

- *enhancement of national radiological monitoring system*

Regarding the review of the basis and assumptions for the National Radiation Emergency Plan the work is ongoing from 2012. During this review several analysis and calculations of different accident scenarios were performed to verify existing or propose new emergency planning zones by the Krško NPP and the SNSA. To further develop proposals and to elaborate a national solution the Slovenian inter-ministerial commission on radiation emergency planning established a working group in early 2014, with representatives from the SNSA, Administration for Civil Protection and Disaster Relief, the Krško NPP, Jozef Stefan Institute and Croatian representatives from SORNS and National Protection and Rescue Directorate. Based on analyses and calculations the majority of the working group concluded that no changes are needed regarding the size of existing emergency planning zones. Representatives of SORNS, however, despite the results of analyses performed insisted that emergency planning zone 10 km around the plant should be expanded beyond the national border to the size recommended in IAEA and HERCA-WENRA documents.

Nuclear regulatory bodies of Slovenia and Croatia are jointly preparing the reference document which should help harmonizing communication to public in case of nuclear emergency. Although the response organizations will try to order the same or similar protective actions on both sides of the state border, there might be cases when protective actions across the border will be different. The reference document identifies all possible combinations of such differences and will contain also proposals for plausible explanations for public why the protective measures across the border are different. This document will be finished in 2018.

In addition, the SNSA has given the Croatian regulator (SORNS) full access to its emergency communication and coordination system called MKSID. With access to MKSID the SORNS has full overview of the situation during an emergency in the Krško NPP as well as the emergency preparedness measures being implemented in Slovenia.

The National Radiation Emergency Plan has been reviewed and also draft changes of it have been prepared. These include:

- provisions for off-site support regarding to the long-term fuel supply, and
- provisions for providing additional pieces of mobile equipment in case of widespread disruption of plant's infrastructure

The new revision of the national emergency response plan is planned to be adopted in 2018.

The national procedures and responsibilities for determining reference levels for importing food and trans-border processing of goods and services have been reviewed. Based on that, the SNSA supplemented its own procedures for emergency events.

Also a new SNSA procedure for dealing with post-accidental emergency situation has been developed, which covers topics such as:

- protection of the population from ionizing radiation,
- providing assistance and support to affected populations,
- reviving the affected area, socially and economically.

The program of intervention personnel training was prepared was implemented in 2016. The regular training of intervention personnel was performed in 2016 and 2017.

Regarding the large, longer term exercises, which also include all interface points (e.g. national, regional and municipal), as well as the neighbouring countries, a five year exercise plan was prepared and is being revised each year. The plan defines the severity of scenario, time duration, and participants years. A national exercise is planned every three years and out

of those an exercise of longer duration is to be every five. The exercise performed in November 2014 was of this type.

For the enhancement of national early warning system a review of the current status and comparison with the world practice was done. Based on that the proposals for improvements were prepared, of which the first part (replacing obsolete monitors with new ones) has been implemented in 2015. The second part of the improvements, the replacement of the obsolete interface, was implemented in 2017.

5.2.4. Action #4: Inspections

SNSA shall assign dedicated inspections to:

- *verify the external hazard protection equipment.*
- *systematically review and inspect SAME equipment, SAMGs, test and maintenance procedures, as well as full scale training events at the Krško NPP with the emphasis on how the limited number of staff are able to cope with equipment deployment and transfer of additional fuel to the users, what are the available and needed times, are there enough resources (human and equipment) available,…*
- *check what are plant's capabilities to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones, satellite telephones) during a prolonged SBO.*
- *additional inspection on radiological protection equipment, procedures for radiological mapping in case of an accident, staff training (added from action #5, additional studies).*

Most of the abovementioned inspections were performed by the SNSA inspection in years 2013 – 2014. Some of those inspections are performed periodically, e.g. inspection of SAME equipment, SAME test and maintenance procedures, etc.

By the end of 2017 all the post-Fukushima inspections have been performed. In addition to the original list, also a special inspection on radiological protection equipment, procedures for radiological mapping in case of an accident, staff training was added from action #5 (additional studies) and was performed in June 2017. SNSA will ensure that such inspections are performed on a regular basis.

5.2.5. Action #5: Additional studies

The SNSA shall consider requiring the plant to perform additional studies regarding:

- *accident timing, including core melt, reactor pressure vessel (RPV) failure, basemat melt-through, SFP fuel uncovery, etc., using different computer codes*
- *radiological protection equipment for SA response*
- *analysis and identification of situations that would prevent performance of work for radiological reasons.*
- *the question of stress on staff behavior including emotional, psychological and cultural aspects associated with emergency response and associated training and support*

In the framework of licensing the PAR modification in 2013, the SNSA also required from the Krško NPP to perform additional analyses regarding accident timing (core melt, reactor pressure vessel failure, basemat melt-through) using a different computer code (Krško NPP's safety analyses are originally done by MAAP, so these analyses shall be done by MELCOR code). The deadline for these analyses is the end of 2014. These analyses were complete in 2015. The results mostly confirmed the analyses done by MAAP, however several possibilities for model improvements were noted.

The other three potentially additional analyses have been considered, but based on the results no additional analyses were required. Instead additional special inspections were performed in 2017 (see action #4, 4th bullet).

At the end of January and beginning of February 2014 sleet hit almost the entire country, which caused large damage to the electrical network due to which around 250,000 people were left with no power for weeks. The Krško NPP survived the event without a problem (the sleet was less severe in eastern part of the country), yet the SNSA requested from the plant to perform a detailed sleet survivability analysis taking into account even more severe scenario of the event (loss of offsite power for one week, no connection to the dedicated gas power plant Brestanica, ventilation openings blocked due to ice formation on walls (15-20 cm thick), load on roofs more than 150 kg/m^2, etc.). The analysis was completed in the beginning of 2015. The results showed that risk due to sleet event is very low (order of 1E-8 /year). Still, several improvements were suggested, mostly in the plant's procedures.

5.2.6. Action #6: Nuclear safety infrastructure

Nuclear safety infrastructure in Slovenia needs more political support. Only in such environment the human resource capacity and competence across all organizations in the field of nuclear safety can be further developed.

SNSA shall organize a meeting, where this topic shall be brainstormed by all involved parties (the utility, the regulatory body, TSOs…). Special action plan shall be prepared and executed to enhance political support to nuclear safety infrastructure.

In recent years, the SNSA has been drawing attention to the situation regarding financing of the Slovenian nuclear safety infrastructure, which is not in its best state. This was done by preparing the proposal of national resolution on nuclear and radiation safety, which gives stress on importance of stable financing of nuclear safety infrastructure (the resolution was adopted by the Government of Slovenia in 2013), and also by calling attention on it in its annual reports to the Parliament.

In addition, the SNSA has organized two special conferences, at which all Slovenian nuclear industry was gathered and discussed different topics, such as political support, research financing, cooperation of stakeholders, etc.

The situation regarding the financing of nuclear safety infrastructure has improved in recent years. Even though this action is deemed complete, the SNSA will continue to strive to make progress in the area of improving and stabilising the Slovenian nuclear safety infrastructure.

5.2.7. Action #7: SNSA processes

To enhance its processes SNSA shall:

- *reconsider, which of the international meetings/groups are of outmost importance, since the decreasing number of staff and increasing number of international activities the quality of regular work may start to suffer*
- *review its capability for evaluating defense-in-depth to see whether and how it could be further enhanced*
- *enhance its staff training on severe accidents and SAMGs*

For this action the SNSA has:

- reviewed its priority order of participation in international meetings and based on that issued a revision of its own procedure, which administers international cooperation;
- reviewed its training plan in the area of severe accident and severe accident management guidelines (SAMGs). No additions were required;

- reviewed its capability for evaluating defense-in-depth. Based on that two new projects are being developed that would further enhance SNSA defense-in-depth evaluating capabilities.

In addition, both severe accident and defense-in-depth are now included in the SNSA's systematic approach to training (SAT).

5.2.8. Action #8: Peer reviews

The SNSA shall consider inviting the following peer review missions:

- *additional RAMP mission (best after completion of SUP) to again properly and independently validate the SAMGs. Likewise consideration shall be given to inviting peer review missions to reassess the external hazards.*
- *a follow-up IRRS mission in 2014, and next IRRS mission in the next 5-6 years*
- *OSART mission to review plant design safety features and related modifications (in next 3 years)*
- *EPREV (Emergency Preparedness Review) mission*

SNSA hosted an IRRS follow-up mission in September 2014, which also highlighted the problems of financing the SNSA and research activities on nuclear safety among others.

Likewise, the SNSA invited two additional missions, namely the OSART and EPREV missions. Both were implemented in 2017. The missions confirmed good performance of the Krško NPP as well as good readiness for emergency events, but also gave several recommendation and suggestions for improvements, which all involved stakeholders will see to implement by the time of the follow-up missions.

As already stated in the action itself, the RAMP mission will be invited after the completion of the SUP (deadline is end of 2021).

5.2.9. Action #9: ERDS

SA plant parameters are being transferred to regulator premises. Still, this system needs a revision to include all needed SA parameters, increase reliability of the system,…

In March 2014 the SNSA issued a decision by which the Krško NPP must upgrade the Emergency Response Data System (ERDS) by April 2015. The upgrade was completed by February 2015. It includes new more reliable data connection, more reliable data storage, interface with enhanced review capabilities, better maintenance and upgrade capabilities, as well as a higher level of cyber security. The new ERDS also includes approx. 4.5 times more parameters (ca. 900), including all parameters needed for evaluating SA.

5.2.10. Action #10: PSA

A full scope PSA (including Level 2) for low power and shutdown modes shall be implemented for the Krško NPP by the end of 2015.

SNSA shall consider requiring a PSA for the Krško's Spent Fuel Pool.

Significant progress was made in the area of PSA. The Krško NPP has started preparing the PSA for the spent fuel pool on its own initiative in 2014. It also started a project of developing the PSA for the low power and shutdown modes. The low power and shutdown PSA was completed in late 2015, after which it was reviewed by the SNSA. Currently the analysis and the model is being revised.

PSA for SFP is still under development.

Regarding the legislation, the SNSA added a requirement for PSA for spent fuel pool in the amended JV5 regulation (Rules on radiation and nuclear safety factors).

5.2.11. Action #11: Safety culture

SNSA shall (together with the operator) analyze how the following topics are taken into account, maintained and improved:

- *Transparency; public discussion of safety issues*
- *An open and trustful relationship between regulators, operators and the public with keeping in mind their respective roles and functions*
- *Define appropriate actions to ensure that the desired safety culture characteristics are achieved in the regulatory and operational organizations*
- *Methods to evaluate and detect degraded safety culture*

The SNSA reviewed the current status of transparency, relationships between regulators, operators and the public, and its processes for assessing, achieving and maintaining high level of safety culture. The view of the SNSA is that this action is already being implemented on a daily basis with available processes and procedures in place. Currently no additional measures are necessary.

5.2.12. Action #12: Reviews and NPP improvements

Within the reassessment of its severe accident management strategy, existing design measures and procedures, the operator has also reassessed its possibilities for alternative spent fuel strategy [16]. The results showed that best strategy would be storing the spent fuel in dry cask storage with a possibility to combine it with later reprocessing.

In accordance with the latest study further actions shall be implemented on the national level to change the national strategy and to enable licensing of the modification.

The amended Resolution on the 2016-2025 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel was adopted in 2016.

The Krško commenced with the project of the spent fuel dry storage in 2015. After a delay of more than a year caused by an unsuccessful bidder's complaint, the contract with the chosen bidder was signed in March 2017 and is to be completed by the end of 2020.

Part V: Additional information

The implementation of the Action Plan will be completely followed by the SNSA. Most of the actions will be performed by the SNSA itself in scope of legislation changes, decision issuance or special theme inspections. Actions concerning changing or enhancing nuclear safety infrastructure will require involvement of other stakeholders, including the operator, utility, technical support organizations, and others.

The Action Plan will be periodically reviewed once a year until the end of its implementation.

The Action Plan and its updates will be publicly available on the SNSA's web page.

This Action Plan has been prepared and approved by the SNSA.

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Conclusion

In Slovenia, proactive preparation of improvements was initiated by the Krško NPP immediately after the Fukushima accident. The implemented short-term improvements, which were credited in the European stress tests process have shown to have a great impact on the robustness of the power plant.

Yet the SNSA ordered the plant to make a deeper reassessment of its severe accident management strategy, existing design measures and procedures and to implement necessary safety improvements for prevention of severe accidents and mitigation of its consequences. The Krško plant prepared the Safety Upgrade Program (SUP), which was to be implemented gradually by the end of 2016. The SUP represents a radical improvement of the Krško NPP and its nuclear safety taking into account all the key Fukushima lessons learned, as well as the results from the cliff-edge effects analysis prepared for the process of stress tests. With the implementation of SUP, the Krško NPP will cut its risk of core damage in half, while risk for radioactive releases in case of a severe accident will be reduced by 70%.

In addition, the SNSA reviewed several reports, reviews and analyses prepared by different organizations, in which additional lessons learned and recommendations were identified. The SNSA reviewed and discussed all the recommendations and finally extracted a set of applicable ones, representing the Slovenian National Action Plan in this report. The SNSA commits itself to implement this plan in the following 6 years. In the meantime, the SNSA will make sure that the plan is regularly updated and publicly available, and in accordance with its regular practice, that the process of the NAcP is as transparent as possible.

In 2013 the Krško NPP applied for the extension of deadline for the implementation of the SUP due to several different reasons. The SNSA approved the extension of the deadline until the end of 2018. Due to additional delays caused by owners' reconsideration of financial sustainability of the investment, the plant again applied for another deadline extension in 2015. The latest revision of the Krško NPP Safety Upgrade Program was approved by the SNSA in 2017. The final deadline of the SUP is set to 2021 (phase III of the SUP), while majority of improvements will be implemented by the end of 2018 (phase I and phase II).

In addition to that, significant progress was done for most other actions of the NAcP, like revising the legislation, enhancing emergency response and cooperation with Croatia, performing additional inspections, performing additional studies, inviting and hosting peer review missions, enhancing ERDS system, extension of PSA analyses, and preparing for the construction of a dry storage for the spent fuel pool.

All together it is assessed that 85% of the Slovenian NAcP is implemented. By the end of 2018 around 90% of the NAcP actions will be implemented, remaining mostly the SUP phase III improvements, which are to be completed by 2021.

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[17] Evaluation of Spent Nuclear Fuel Storage Options, NEK ESD-TR-03/12, September 2012

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[19] Characterization of the Libna Feature, Proposed Krško 2 Nuclear Power Plant, Rev. 0, Rizzo, 2013

[20] Probabilistic fault displacement Hazard Analysis, Rev. 1, Rizzo, 2013

[21] Fact Finding Workshop on the Active Tectonics of the Krško Region, Technical Workshop, Report REP-0612, Decker K., Klagenfurt/Celovec, April 2016, Umweltbundesamt, Vienna, 2017

[22] Karta aktivnih prelomov v Sloveniji (=Map of active faults in Slovenia), Report, Geological Survey of Slovenia, Atanackov, J., Celarc, B., Jamšek Rupnik, P., Jež, J., Markelj, A., Milanič, B. 2016

Attachment 1: Development of the Slovenian National Action Plan

Tables with reviews of individual recommendations:

Table A1: Compiled Slovenian National Action Plan

Table A2: Review of ENSREG Compilation of recommendations and suggestions, Topics 1 to 3

Table A3: Review of CNS EOM rapporteurs' reports', Topics 1 to 3

Table A4: Review of CNS EOM rapporteurs' reports', Topics 4 to 6

Table A5: Additional national review of other reports, reviews and analyses regarding Fukushima lessons learned

No.		Future action / activity	Related recommendation on European level	Related recommendation on national level	Area	Status	Finalization	Level
1	SUP SUP comprises of a set of modifications/ improvements (see numbers 1.1 to 1.10) that will be implemented in steps until the end of 2016. Some of the discussed recommendations (see related recommendations) are to be verified within the licensing and implementation of the SUP. (for SUP details see chapter 2 in Part IV of NAcP)		103, 104, 107, 110, 113, 114, 115, 117, 118, 119, 120, 121, 122, 123, 124, 126, 130, 131, 139, 142, 145, 207, 211, 212, 213, 214, 215, 216, 221, 223, 224, 226, 311	401, 403, 404, 406, 414, 417, 418	SUP	in progress	2016	site
	1.1	Safety upgrade of AC power supply			SUP	in progress	2015	site
	1.2	New pump for supplying SGs; in a bunkered building, with a dedicated water supply			SUP	in progress	2015	site
	1.3	Installation of alternative ultimate heat sink			SUP	in progress	2015	site
	1.4	Additional pumps (low and high pressure, as well as a special pump for seal injection) in a bunkered building, with a dedicated water supply			SUP	in progress	2015	site
	1.5	Containment integrity safety upgrades including containment filtered vent systems and PARs			SUP	in progress	2013	site
	1.6	Establishment of emergency control room			SUP	in progress	2016	site
	1.7	Installation of fixed spray system around the SFP with provisions for quick connection from different sources of water.			SUP	in progress	2015	site
	1.8	Mobile heat exchanger with provisions to quick connect to SFP, containment sump or reactor coolant system			SUP	in progress	2015	site
	1.9	Flood protection upgrade (additional protection of nuclear island and bunkered buildings)			SUP	in progress	2015	site
	1.10	Establishment of new technical support center and upgrade of existing operational support center (emergency operating facilities)			SUP	in progress	2015	site
2	2.1	SNSA shall amend its legislation to include: • requirements regarding the use of advanced deteriorating weather warning systems • requirements regarding the use of seismic monitoring systems • PSA Level 3 requirement (at least for new NPPs) • requirements for Beyond Design Basis Accidents I&C for Spent Fuel Pool • emergency planning requirements for prolonged SBO in the areas of communications capability (onsite, e.g., radios for response teams and between facilities, and offsite, e.g., cellular telephones, satellite telephones), ERDS capability, training and exercises, and equipment and facilities	108, 109	408, 414, 418	legislation	planned	2014	national

No.	Future action / activity		Related recommendation on European level	Related recommendation on national level	Area	Status	Finalization	Level
	2.2	SNSA shall consider amending its regulation for design basis by more stringent safety objectives for: • Prevention and mitigation of core-melt accident in reactor and in spent fuel storage to avoid off-site long term contamination • Large or early release to be practically eliminated (for new NPPs) • Increase robustness of NPPs to be able to face natural hazards more severe than the ones considered in the design basis (DEC) ; this should also include requirements for test and maintenance of equipment, training,... This will be done mainly by following WENRA/ENSREG new initiatives, updated RL,... Also SNSA shall consider whether more detailed requirements are needed regarding LOOP, SBO and loss of UHS	209, 217, 218	402, 411, 414, 416, 423	legislation	to consider	2014	national

No.	Future action / activity	Related recommendation on European level	Related recommendation on national level	Area	Status	Finalization	Level
3	In January 2012 SNSA issued the 3rd decision regarding the Fukushima event, with which it requires from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan. This work is to be finished until March 2013. The results of the review, possible proposals for improvements of the Radiological Emergency Response Plan, shall be implemented as appropriate. In addition the SNSA (together with other appropriate stakeholders) shall give further consideration to: • supplementing the national radiological emergency response plan with provisions for off-site support in regard to long-term fuel supply and also some additional pieces of mobile equipment for the case of widespread disruption of plant's infrastructure • within the supplementing of national radiological emergency response plan further consideration shall be given to: - Reference levels for importing food, - Trans-border processing of goods and services such as container transport - Approach / philosophy and associated limits and criterion to govern the 'remediation' phase of the event - Return to evacuated area criteria and criteria for return to normal from the emergency state - Establishing contamination monitoring protocols and locations during the recovery phase • preparing national strategy (also amending legislation if needed) regarding solutions for post-accident contamination and the treatment of potentially large volumes of contaminated water • enhancement of intervention personnel training, trans-border arrangements and education of the public and media • enhancing cooperation with neighboring countries (especially Croatia), including mutual exercises • enhancing exercises by including all interface points (National, Regional, Municipal…), performing longer term exercises for better reflection of the extreme events challenges, and incorporating failure of communication systems and radiation data availability into drill programs • enhancement of national radiological monitoring system	116, 140, 143, 222, 303, 307, 308, 309, 310	406, 407, 442	emergency response	to consider	2016	national

No.	Future action / activity	Related recommendation on European level	Related recommendation on national level	Area	Status	Finalization	Level
4	SNSA shall assign dedicated inspections to: • verify the external hazard protection equipment. • systematically review and inspect SAME equipment, SAMGs, test and maintenance procedures, as well as full scale training events at the Krško NPP with emphasis on how the limited number of staff are able to cope with equipment deployment and transfer of additional fuel to the users, what are the available and needed times, are there enough sources (human and equipment) available,… • check what are plant's capabilities to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones, satellite telephones) during a prolonged SBO.	203, 218	415, 416	inspection	planned	2014	site
5	The SNSA shall consider requiring the plant to perform additional studies regarding: • accident timing, including core melt, reactor pressure vessel (RPV) failure, basemat melt-through, SFP fuel uncovery, etc., using different computer codes • radiological protection equipment for SA respond • analysis and identification of situations that would prevent performance of work for radiological reasons. • the question of stress on staff behavior including emotional, psychological and cultural aspects associated with emergency response and associated training and support	145, 227		additional studies	to consider	2017	site
6	Nuclear safety infrastructure in Slovenia needs more political support. Only in such environment the human resource capacity and competence across all organizations in the field of nuclear safety can be further develop. SNSA shall organize a meeting in which this topic shall be brainstormed by all involved parties (the utility, the regulatory body, TSOs…). Special action plan shall be prepared and executed to enhance political support to nuclear safety infrastructure.	306, 314	437	nuclear safety infrastructure	planned	2014	national
7	To enhance its processes SNSA shall: • reconsider, which of the international meetings/groups are of outmost importance, since with decreasing number of staff and increasing number of international cooperation the quality of regular work may start to suffer • review its capability for evaluating defense-in-depth to see whether and how it could be further enhanced • enhance its staff training on severe accidents and SAMGs	313	427, 428	SNSA processes	planned	2015	national

No.	Future action / activity	Related recommendation on European level	Related recommendation on national level	Area	Status	Finalization	Level
8	The SNSA shall consider inviting the following peer review missions • additional RAMP mission (best after completion of SUP) to again properly and independently validate the SAMGs. Likewise consideration shall be given to inviting peer review missions to reassess the external hazards. • a follow-up IRRS mission in 2014, and next IRRS mission in next 5-6 years • OSART mission for reviewing plant design safety features and related modifications (in next 3 years) • EPREV (Emergency Preparedness Review) mission	134, 204, 302, 312	405, 430, 431, 432, 433	peer reviews	to consider	2017	site
9	SA plant parameters are being transferred to regulator premises. Still, this system needs revision to include all needed SA parameters, increase reliability of system,…	138, 309	424	ERDS	planned	2013	site
10	A full scope PSA (including Level 2) for low power and shutdown modes shall be implemented for the Krško NPP by the end of 2015. SNSA shall consider requiring a PSA for the Krško's Spent Fuel Pool.	144, 145	405	PSA	planned	2015	site
11	SNSA shall (together with the operator) analyze how the following topics are taken into account, maintained and improved: • Transparency; public discussion of safety issues • An open and trustful relationship between regulators, operators and the public with keeping in mind their respective roles and functions •Define appropriate actions to ensure that the desired safety culture characteristics are achieved in the regulatory and operational organizations • Methods to evaluate and detect degraded safety culture	210		safety culture	to consider	2014	national
12	Within the reassessment of its severe accident management strategy, existing design measures and procedures, the operator has also reassessed its possibilities for alternative spent fuel strategy [16]. The results showed that best strategy would be storing the spent fuel in dry cask storage with a possibility to combine it with later reprocessing. In accordance with the latest study further actions shall be implemented on national level to change the national strategy and to enable licensing of the modification.		443	reviews and NPP improvements	planned	2018	national

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
101	European guidance on assessment of natural hazards and margins The peer review Board recommends that WENRA, involving the best available expertise from Europe, develop guidance on natural hazards assessments, including earthquake, flooding and extreme weather conditions, as well as corresponding guidance on the assessment of margins beyond the design basis and cliff-edge effects.	HLG Compilation/ Recommendation 2.1	natural hazards	This recommendation is meant for the WENRA to develop guidance on natural hazards assessment. This is due to reason that most countries did not make appropriate assessment of margins and cliff edge effects within the stress tests. Slovenia was one of the few who did include in its report a very detailed cliff-edge effect analysis for both earthquakes and floods.	
102	Periodic Safety Review The peer review Board recommends that ENSREG underline the importance of periodic safety review. In particular, ENSREG should highlight the necessity to re-evaluate natural hazards and relevant plant provisions as often as appropriate but at least every 10 years.	HLG Compilation/ Recommendation 2.2	natural hazards	The 10 year PSRs are already implemented in Slovenia and based on them external hazards are regularly reviewed.	
103	Containment integrity Urgent implementation of the recognised measures to protect containment integrity is a finding of the peer review that national regulators should consider. The measures to be taken can vary depending on the design of the plants. For water cooled reactors, they include equipment, procedures and accident management guidelines to: • depressurize the primary circuit in order to prevent high-pressure core melt; • prevent hydrogen explosions; • prevent containment overpressure.	HLG Compilation/ Recommendation 2.3	design issues	All this is included in the Krško's Safety Upgrade Program (SUP).	1
104	Prevention of accidents resulting from natural hazards and limiting their consequences Necessary implementation of measures allowing prevention of accidents and limitation of their consequences in case of extreme natural hazards is a finding of the peer review that national regulators should consider. Typical measures which can be considered are bunkered equipment to prevent and manage severe accident including instrumentation and communication means, mobile equipment protected against extreme natural hazards, emergency response centres protected against extreme natural hazards and contamination, rescue teams and equipment rapidly available to support local operators in long duration events. Such possible measures as identified by the peer review, are detailed in the report.	HLG Compilation/ Recommendation 2.4	natural hazards	Already included in the Krško's Safety Upgrade Program.	1
105	Hazard Frequency The use a return frequency of 10-4 per annum (0.1g minimum peak ground acceleration for earthquakes) for plant reviews/back-fitting with respect to external hazards safety cases.	HLG Compilation/ Recommendation 3.1.1	natural hazards	Return frequency of 10-4 per annum is already used in the Krško NPP's reviews and back-fitting.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
106	Secondary Effects of Earthquakes The possible secondary effects of seismic events, such as flood or fire arising as a result of the event, in future assessments.	HLG Compilation/ Recommendation 3.1.2	natural hazards	This has already been done in the implemented Krško's PSA analyses.	
107	Protected Volume Approach The use a protected volume approach to demonstrate flood protection for identified rooms or spaces.	HLG Compilation/ Recommendation 3.1.3	natural hazards	Included in the planned SUP.	1
108	Early Warning Notifications The implementation of advanced warning systems for deteriorating weather, as well as the provision of appropriate procedures to be followed by operators when warnings are made.	HLG Compilation/ Recommendation 3.1.4	natural hazards	SNSA shall add legal requirements into JV5.	2
109	Seismic Monitoring The installation of seismic monitoring systems with related procedures and training.	HLG Compilation/ Recommendation 3.1.5	natural hazards	The Krško NPP is already equipped with state-of-the-art seismic monitoring system. Also the appropriate procedures and training are in place. Still SNSA shall add legal requirements into JV5.	2
110	Qualified Walkdowns The development of standards to address qualified plant walkdowns with regard to earthquake, flooding and extreme weather – to provide a more systematic search for non-conformities and correct them (e.g. appropriate storage of equipment, particularly for temporary and mobile plant and tools used to mitigate beyond design basis (BDB) external events).	HLG Compilation/ Recommendation 3.1.6	natural hazards	Seismic and flooding protection walkdowns were performed within the implementation and updates of sesimic and flooding PSA. Additional walkdowns will be performed within the planned Safety Upgrade Program of the Krško NPP.	1
111	Flooding Margin Assessments The analysis of incrementally increased flood levels beyond the design basis and identification of potential improvements, as required by the initial ENSREG specification for the stress tests.	HLG Compilation/ Recommendation 3.1.7	natural hazards	The Krško NPP performed a detail cliff-edge analysis for both earthquakes and flooding (it was described in the National stress test report).	
112	External Hazard Margins In conjunction with recommendation 2.1 and 3.1.7, the formal assessment of margins for all external hazards including, seismic, flooding and severe weather, and identification of potential improvements.	HLG Compilation/ Recommendation 3.1.8	natural hazards	The Krško NPP performed a detail cliff-edge analysis for both earthquakes and flooding (it was described in the National stress test report).	
113	Alternate Cooling and Heat Sink The provision of alternative means of cooling including alternate heat sinks. Examples include steam generator (SG) gravity alternative feeding, alternate tanks or wells on the site, air-cooled cooling towers or water sources in the vicinity (reservoir, lakes, etc) as an additional way of enabling core cooling.	HLG Compilation/ Recommendation 3.2.1	design issues	This recommendation is already implemented in the Krško NPP by possible use of mobile equipment, different sources of cooling water and procedures in place. In addition to that several other BDBA dedicated means will be additionally installed within the SUP.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
114	AC Power Supplies The enhancement of the on-site and off-site power supplies. Examples include adding layers of emergency power, adding independent and dedicated backup sources, the enhancement of the grid through agreements with the grid operator on rapid restoration of off-site power, additional and/or reinforced off-site power connections, arrangements for black start of co-located or nearby gas or hydro plants, replacing standard ceramic based items with plastic or other material that are more resistant to a seismic event. Another example is the possible utilisation of generator load shedding and house load operation for increased robustness, however, before introducing such arrangements the risks need to be properly understood.	HLG Compilation/ Recommendation 3.2.2	design issues	The Krško NPP has all these measures already in place (layers of emergency power, agreements with the grid operator on rapid restoration of off-site power, additional and/or reinforced off-site power connections, arrangements for black start of nearby gas plant,... In additon AC power supplies will be further improved within the SUP.	1
115	DC Power Supplies The enhancement of the DC power supply. Examples include improving the battery discharge time by upgrading the existing battery, changing/diversifying battery type (increasing resistance to common-mode failures), providing spare/replacement batteries, implementing well-prepared loadshedding/staggering strategies, performing real load testing and on-line monitoring of the status of the batteries and preparing dedicated recharging options (e. g. using portable generators).	HLG Compilation/ Recommendation 3.2.3	design issues	The Krško NPP has in place several mobile diesel generators for recharging the batteries (with needed cables, quick connection points and procedures in place). In addition, additional improvement for the connection between diesel generators and charging buses is planned within the Krško NPP's Safety Upgrade Program, as well as installation of additional train of batteries. In an extreme case when none of the mobile diesel generators are available, the Krško NPP has in place additional (EOP) procedures, which instruct the operators to shed loads, thus prolonging the battery capacity to more than 13 hours.	1
116	Operational and Preparatory Actions Implementation of operational or preparatory actions with respect to the availability of operational consumables. Examples include, ensuring the supply of consumables such as fuel, lubrication oil, and water and ensuring adequate equipment, procedures, surveillance, drills and arrangements for the resupply from off-site are in place.	HLG Compilation/ Recommendation 3.2.4	design issues	In the Krško NPP operational consumable are in place, as well as appropriate procedures, equipment, surveillance and drills. In addition the SNSA shall consider supplementing the national radiological emergency response plan with provisions for off-site support in regard to long-term fuel supply and also some additional pieces of mobile equipment for the case of widespread disruption of plant’s infrastructure.	3
117	Instrumentation and Monitoring The enhancement of instrumentation and monitoring. Examples include separate instrumentation and/or power sources to enable monitoring of essential parameters under any circumstances for accident management and the ability to measure specific important parameters based on passive and simple principles.	HLG Compilation/ Recommendation 3.2.5	design issues	Dedicated BDBA I&C will be installed in the Krško NPP within SUP.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
118	Shutdown Improvements The enhancement of safety in shutdown states and mid-loop operation. Examples of improvements include, reducing or prohibiting mid-loop operation, adding dedicated hardware, procedures and drills, the use of other available water sources (e.g. from hydro-accumulators), requiring the availability of SGs during shutdown operations and the availability of feedwater in all modes.	HLG Compilation/ Recommendation 3.2.6	design issues	The Krško NPP has in place strategies and procedures for events during shutdown modes. The shutdown safety shall be further enhanced with installation of additional BDBA safety train within the SUP.	1
119	Reactor Coolant Pump Seals The use of temperature-resistant (leak-proof) primary pump seals.	HLG Compilation/ Recommendation 3.2.7	design issues	The Krško NPP has considered installing temperature resistant primary pump seals, but decided not to instal them. Instead additional BDBA dedicated charging pump will be installed within the SUP. Even now there is a special safety related PDP charging pump available, which can be powered also by mobile diesel generators.	1
120	Ventilation The enhancement of ventilation capacity during SBO to ensure equipment operability.	HLG Compilation/ Recommendation 3.2.8	design issues	The ventilation capacity will be additionally taken into consideration within the implementation of SUP.	1
121	Main and Emergency Control Rooms The enhancement of the main control room (MCR), the emergency control room (ECR) and emergency control centre (ECC) to ensure continued operability and adequate habitability conditions in the event of a station black-out (SBO) and in the event of the loss of DC (this also applies to Topic 3 recommendations).	HLG Compilation/ Recommendation 3.2.9	design issues	This will also be improved within SUP.	1
122	Spent Fuel Pool The improvement of the robustness of the spent fuel pool (SFP). Examples include reassessment/upgrading SFP structural integrity, installation of qualified and power-independent monitoring, provisions for redundant and diverse sources of additional coolant resistant to external hazards (with procedures and drills), design of pools that prevents drainage, the use of racks made of borated steel to enable cooling with fresh (unborated) water without having to worry about possible recriticality, redundant and independent SFP cooling systems, provision for additional heat exchangers (e. g. submerged in the SFP), an external connection for refilling of the SFP (to reduce the need for an approach linked to high doses in the event of the water falling to a very low level) and the possibility of venting steam in a case of boiling in the SFP.	HLG Compilation/ Recommendation 3.2.10	design issues	The SFP robustness will be enhanced within SUP (installation of fixed BDBA spraying system, BDBA I&C, mobile heat exchanger,...)	1
123	Separation and Independence The enhancement of the functional separation and independence of safety systems. Examples include the elimination of full dependence of important safety functions on auxiliary systems such as service water and the introduction of an alternate source of cooling.	HLG Compilation/ Recommendation 3.2.11	design issues	Functional independence is alreadyy in place in the Krško NPP (e.g. cooling for emergency diesel generators). Furthermore functional separation and independance will be enhanced with the implementation of SUP.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
124	Flow Path and Access Availability The verification of assured flow paths and access under SBO conditions. Ensure that the state in which isolation valves fail and remain, when motive and control power is lost, is carefully considered to maximise safety. Enhance and extend the availability of DC power and instrument air (e. g. by installing additional or larger accumulators on the valves). Ensure access to critical equipment in all circumstances, specifically when electrically operated turnstiles are interlocked.	HLG Compilation/ Recommendation 3.2.12	design issues	The Krško NPP has developed plant specific SAMGs, which were validated (within the RAMP mission) and are regularly exercised on the full scope simulator. The SAMGs are plant specific, so the status of needed equipment and flow paths is acknowledged and instructions are given to the operators on use of the equipment and available flow paths. The Krško NPP also has available on site several pieces of mobile equipment (diesel generators, air compressors,...) that assure adequate supply and control of the actuators/equipment. Still SNSA shall pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.	1
125	Mobile Devices The provision of mobile pumps, power supplies and air compressors with prepared quick connections, procedures, and staff training with drills. Mobile devices are intended to enable the use of existing safety equipment, enable direct feeding of the primary or secondary side, allow extended use of instrumentation and operation of controls, allow effective fire-fighting, and ensure continued emergency lighting. The equipment should be stored in locations that are safe and secure even in the event of general devastation caused by events significantly beyond the design basis (this also applies to Topic 3 recommendations).	HLG Compilation/ Recommendation 3.2.13	design issues	The Krško NPP has in place several pieces of mobile equipment that are stored in the special buiding with increassed seismical and flooding capacity. Also some pieces of mobile equipment are stored on different location (also safe against earthquakes and floods).	
126	Bunkered/Hardened Systems The provision for a bunkered or "hardened" system to provide an additional level of protection with trained staff and procedures designed to cope with a wide variety of extreme events including those beyond the design basis (this also applies to Topic 3 recommendations).	HLG Compilation/ Recommendation 3.2.14	design issues	The SUP represents installation of bukered train of safety related systems.	1
127	Multiple Accidents The enhancement of the capability for addressing accidents occurring simultaneously on all plants of the site. Examples include assuring preparedness and sufficient supplies, adding mobile devices and fire trucks and increasing the number of trained and qualified staff (this also applies to Topic 3 recommendations).	HLG Compilation/ Recommendation 3.2.15	design issues	N/A for Krško (1 unit)	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
128	Equipment Inspection and Training Programs The establishment of regular programs for inspections to ensure that a variety of additional equipment and mobile devices are properly installed and maintained, particularly for temporary and mobile equipment and tools used for mitigation of BDB external events. Development of relevant staff training programmes for deployment of such devices.	HLG Compilation/ Recommendation 3.2.16	design issues	Such programs and procedures are already in place in the Krško NPP. The SA equipment (including mobile) is regularly test and maintained. Likewise, the operators are regularly trained in using this equipment.	
129	Further Studies to Address Uncertainties The performance of further studies in areas were there are uncertainties. Uncertainties may exist in the following areas: • The integrity of the SFP and its liner in the event of boiling or external impact. • The functionality of control equipment (feedwater control valves and SG relief valves, main steam safety valves, isolation condenser flow path, containment isolation valves as well as depressurisation valves) during the SBO to ensure that cooling using natural circulation would not be interrupted in a SBO (this is partially addressed in recommendation 3.2.10). • The performance of additional studies to assess operation in the event of widespread damage, for example, the need different equipment (e.g. bulldozers) to clear the route to the most critical locations or equipment. This includes the logistics of the external support and related arrangements (storage of equipment, use of national defence resources, etc.).	HLG Compilation/ Recommendation 3.2.17	design issues	These topics have already beem addressed in the Krško NPP; detailed fragility analysis has been prepared for the SFP, functionality of equipment during SBO has been evaluated, and also studies of events with widespread damage have been prepared (e.g. the plant acquired a multifunctional vehicle for removing debris).	
130	WENRA Reference Levels The incorporation of the WENRA reference levels related to severe accident management (SAM) into their national legal frameworks, and ensure their implementation in the installations as soon as possible. This would include: • Hydrogen mitigation in the containment - Demonstration of the feasibility and implementation of mitigation measures to prevent massive explosions in case of severe accidents. • Hydrogen monitoring system - Installation of qualified monitoring of the hydrogen concentration in order to avoid dangerous actions when concentrations that allow an explosion exist. • Reliable depressurization of the reactor coolant system - Hardware provisions with sufficient capacity and reliability to allow reactor coolant system depressurization to prevent high-pressure melt ejection and early containment failure, as well as to allow injection of coolant from low pressure sources. • Containment overpressure protection - Containment venting via the filters designed for severe accident conditions. • Molten corium stabilization - Analysis and selection of feasible strategies and implementation of provisions against containment degradation by molten corium.	HLG Compilation/ Recommendation 3.3.1	severe accident management	WENRA RL regarding SAM are already included in Slovenian legislation. These requirements will be fulfiled with the implementation of SUP.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
131	SAM Hardware Provisions Adequate hardware provisions that will survive external hazards (e.g. by means of qualification against extreme external hazards, storage in a safe location) and the severe accident environment (e.g. engineering substantiation and/or qualification against high pressures, temperatures, radiation levels, etc), in place, to perform the selected strategies.	HLG Compilation/ Recommendation 3.3.2	severe accident management	Some of these provisions are already in place (qualification against external hazards, adequate protection, mobile equipment stored in a storage qualified against extreme external hazards), while additional provisions will be installed within the SUP.	1
132	Review of SAM Provisions Following Severe External Events The systematic review of SAM provisions focusing on the availability and appropriate operation of plant equipment in the relevant circumstances, taking account of accident initiating events, in particular extreme external hazards and the potential harsh working environment.	HLG Compilation/ Recommendation 3.3.3	severe accident management	SAMGs were reviewed immediately after the Fukushima accident. Changes were incorporated and additional equipment was acquired to account extreme external hazards and harsh working environment.	
133	Enhancement of Severe Accident Management Guidelines (SAMG) In conjunction with the recommendation 2.4, the enhancement of SAMGs taking into account additional scenarios, including, a significantly damaged infrastructure, including the disruption of plant level, corporate-level and national-level communication, long-duration accidents (several days) and accidents affecting multiple units and nearby industrial facilities at the same time.	HLG Compilation/ Recommendation 3.3.4	severe accident management	SAMGs were reviewed immediately after the Fukushima accident. Changes were incorporated and additional equipment (also satellite telephones) was acquired to account extreme external hazards and harsh working environment. Also scenarios like a significantly damaged infrastructure, including the disruption of plant level, corporate-level and national-level communication, long-duration accidents (several days) were taken into account.	
134	SAMG Validation The validation of the enhanced SAMGs.	HLG Compilation/ Recommendation 3.3.5	severe accident management	Krško SAMGs have been validated in 2001 (RAMP mission). immediately after Fukushima SAMGs were reviewed and revised to include additional scenarios, like significantly damaged infrastructure, prolonged SBO,… These scenarios were already tested within the regular exercizes with a full scope plant specific simulator. Still the SNSA shall consider inviting additional RAMP mission in next years (best after completion of SUP) to again properly and independently validate the SAMGs.	8
135	SAM Exercises Exercises aimed at checking the adequacy of SAM procedures and organisational measures, including extended aspects such as the need for corporate and nation level coordinated arrangements and long-duration events.	HLG Compilation/ Recommendation 3.3.6	severe accident management	Immediately after Fukushima SAMGs were reviewed and revised to include additional scenarios, like significantly damaged infrastructure, prolonged SBO,… These scenarios were already tested within the regular exercizes with a full scope plant specific simulator.	
136	SAM Training Regular and realistic SAM training exercises aimed at training staff. Training exercises should include the use of equipment and the consideration of multi-unit accidents and long-duration events. The use of the existing NPP simulators is considered as being a useful tool but needs to be enhanced to cover all possible accident scenarios.	HLG Compilation/ Recommendation 3.3.7	severe accident management	This is a regular practice in the Krško NPP.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
137	Extension of SAMGs to All Plant States The extension of existing SAMGs to all plant states (full and low-power, shutdown), including accidents initiated in SFPs.	HLG Compilation/ Recommendation 3.3.8	severe accident management	Krško SAMGs include all plant states, and SFP accidents as well.	
138	Improved Communications The improvement of communication systems, both internal and external, including transfer of severe accident related plant parameters and radiological data to all emergency and technical support centre and regulatory premises.	HLG Compilation/ Recommendation 3.3.9	severe accident management	The communication system was improved after Fukushima accident by acquiring of satellite telephones. SA plant parameters are transferred to all emergency and technical support centers. SA plant parameters are also transferred to regulator premises, even though this system needs revision (to include all needed SA paramters, increase reliability of system,...)	9
139	Presence of Hydrogen in Unexpected Places The preparation for the potential for migration of hydrogen, with adequate countermeasures, into spaces beyond where it is produced in the primary containment, as well as hydrogen production in SFPs.	HLG Compilation/ Recommendation 3.3.10	severe accident management	This topic will be covered with the analysis that will represent basis for the installation of PARs within the SUP (in 2013).	1
140	Large Volumes of Contaminated Water The conceptual preparations of solutions for post-accident contamination and the treatment of potentially large volumes of contaminated water.	HLG Compilation/ Recommendation 3.3.11	severe accident management	SNSA shall consider preparing national strategy (also amending legislation if needed) in this regard.	3
141	Radiation Protection The provision for radiation protection of operators and all other staff involved in the SAM and emergency arrangements.	HLG Compilation/ Recommendation 3.3.12	severe accident management	Plant specific analyses regarding this topic were already performed at the Krško NPP. Some provisions were already implemented (radiation protection walls, radiation monitors,...), while some are still being considered (enhancing radiation monitor system, additional protection, relocating the equipment,...)	
142	On Site Emergency Center The provision of an on-site emergency center protected against severe natural hazards and radioactive releases, allowing operators to stay onsite to manage a severe accident.	HLG Compilation/ Recommendation 3.3.13	severe accident management	A new emergency center will be built within the SUP that will assure long-term habitability of operators.	1
143	Support to Local Operators Rescue teams and adequate equipment to be quickly brought on site in order to provide support to local operators in case of a severe situation.	HLG Compilation/ Recommendation 3.3.14	severe accident management	Krško is the only NPP in Slovenia, thus an offiste support team is not considered reasonable. Still SNSA shall consider whether it would be reasonable to require the operator to reconsider off-site support in regard to long-term fuel supply and also some additional pieces of mobile equipment for the case of widespread disruption of plant's infrastructure.	3

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
144	Level 2 Probabilistic Safety Assessments (PSAs) A comprehensive Level 2 PSA as a tool for the identification of plant vulnerabilities, quantification of potential releases, determination of candidate high-level actions and their effects and prioritizing the order of proposed safety improvements. Although PSA is an essential tool for screening and prioritising improvements and for assessing the completeness of SAM implementation, low numerical risk estimates should not be used as the basis for excluding scenarios from consideration of SAM especially if the consequences are very high.	HLG Compilation/ Recommendation 3.3.15	severe accident management	The Krško has in place PSA Level 2 analysis for full power modes, including all external hazards. A full scope PSA (including Level 2) for LP&SD events shall be implemented by the end of 2015.	10
145	Severe Accident Studies The performance of further studies to improve SAMGs. Examples of areas that could be improved with further studies include: • The availability of safety functions required for SAM under different circumstances. • Accident timing, including core melt, reactor pressure vessel (RPV) failure, basemat melt-through, SFP fuel uncovery, etc. • PSA analysis, including all plant states and external events for PSA levels 1 and 2. • Radiological conditions on the site and associated provisions necessary to ensure MCR and ECR habitability as well as the feasibility of AM measures in severe accident conditions, multi-unit accidents, containment venting, etc. • Core cooling modes prior to RPV failure and of re-criticality issues for partly damaged cores, with un-borated water supply. • Phenomena associated with cavity flooding and related steam explosion risks. • Engineered solutions regarding molten corium cooling and prevention of basemat melt-through. • Severe accident simulators appropriate for NPP staff training.	HLG Compilation/ Recommendation 3.3.16	severe accident management	The Krško has in place PSA Level 1 and 2 analysis for full power modes, including all external hazards. A full scope PSA (including Level 2) for LP&SD events shall be implemented by the end of 2015. PSA analysis, including all plant states and external events for PSA levels 1 and 2. Analyses regarding radiological conditions on the site and associated provisions necessary to ensure MCR and ECR habitability as well as the feasibility of AM measures in severe accident conditions, containment venting have already been prepared and will be further revised within the implementation of SUP. Also the analyses regarding topics of core cooling modes prior to RPV failure, re-criticality issues for partly damaged cores, phenomena associated with cavity flooding and related steam explosion risks, and solutions regarding molten corium cooling and prevention of basemat melt-through have been prepared. The SNSA shall consider requiring the plant to perform additional studies regarding accident timing, including core melt, reactor pressure vessel (RPV) failure, basemat melt-through, SFP fuel uncovery, etc.	1, 5, 10

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
201	Deterministic methods should form the basis for hazard assessment. Probabilistic methods, including probabilistic safety assessment (PSA), are useful to supplement the deterministic methods	KJV – Topic #1, External Events/ Licensing basis	natural hazards	For the Krško NPP hazard analysis is based on deterministic methods and then supplmeneted by probabilistic ones.	
202	External hazards and their influence on the licensing basis should be reassessed periodically using state-of-the-art data and methods; PSR was identified as one good tool	KJV – Topic #1, External Events/ Licensing basis	natural hazards	The 10 year PSRs are already implemented in Slovenia and based on them external hazards are regularly reviewed.	
203	Licensing basis protection against external hazards (e.g. flood seals and seismic supports) should be verified to be effective	KJV – Topic #1, External Events/ Licensing basis	natural hazards	The Krško NPP has in place procedures for regular test and mainenance of protection against external hazards. Still, SNSA shall put more attention (in form of inspections) to verification of hazard protection equipment.	4
204	Peer reviews of assessments should be considered in order to avoid blind spots	KJV – Topic #1, External Events/ Licensing basis	natural hazards	The SNSA shall consider inviting peer review missions to reassess the external hazards.	8
205	There are differences in licensing basis among CPs in use of deterministic and probabilistic methods, and probabilistic thresholds. This was proposed as an opportunity for international harmonization of licensing basis methods	KJV – Topic #1, External Events/ Licensing basis	natural hazards	This is a general comment and not a concrete recommendation.	
206	Importance of sound safety margins was emphasized Margin assessments should be based on periodic reevaluation of licensing basis for external events considering possible cliff- edge effects Margin assessments should inform safety improvements, e.g. enhancing current design or adding diverse approaches to achieve safety functions	KJV – Topic #1, External Events/ Safety margin	natural hazards	External hazards are reevaluated within each PSR taking into account new data and methodologies/ standards. As an example for Krško case, the upgrading of flood protection dikes and installation of alternative DG (3rd safety related DG) were results from the PSR.	
207	Several CPs described specific safety improvements (e.g. three levels of defense against flooding, extreme weather protection) based on the reassessment of external events Reassessment of hazards which impact the licensing basis may require additional improvements with emphasis to prevent large releases resulting from large scale external events.	KJV – Topic #1, External Events/ Implementation of safety improvements	natural hazards	The Krško NPP is preparing a large improvement program, i.e. the SUP. This will include improvements that will enhance the robustness of the plant for all external and internal hazards.	1
208	1) Updated technical studies will provide new data and methods for future assessments, e.g. influence of climate change on historical meteorological data 2) Multi-unit site risk considerations planned to be evaluated 3) Effects of units on each other and effects of other nearby industry on NPP risk planned to be studied 4) Further studies should use state-of-the-art data and methods and address trends in hazard data	KJV – Topic #1, External Events/ Further technical studies	natural hazards	1) Technical studies concerning external hazards are revised every PSR, if needed taking into account new data and methodologies. 2) N/A 3) Krško site is a single unit site. The effects of nearby industry as well as other external hazards are regularly reassessed every PSR. 4) See comment #1.	
209	Some CPs are considering changes in regulation concerning external events (e.g. additional requirements for external events that exceed the design basis, and international harmonization of standards for new reactors)	KJV – Topic #1, External Events/ Changes in regulation	natural hazards	SNSA shall consider whether additional requirements are needed for external hazards that can exceed the design basis (e.g. seismic events, external flooding).	2

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
210	1) Public discussion of safety issues should be encouraged (Transparency) 2) An open and trustful relationship between regulators, operators and the public with keeping in mind their respective roles and functions is essential 3) Recognizing differences in national cultures, each CPs should define appropriate actions to ensure that the desired safety culture characteristics are achieved in the regulatory and operational organizations 4) Methods to evaluate and detect degraded safety culture are needed	KJV – Topic #1, External Events/ Safety Culture	natural hazards	The communication of all nuclear stakeholders with the public is preatty well developed and there are no major problems evident. During the recent years there were several nuclear emergencies and "emergencies" with increased public interest. In all cases nuclear stakeholders have succesfully communicated so that reasonable level of trust by the media and the public is established. Relationship with the public is very much infuenced and based on national culture. There is no evident need for changes in established communication practices. Still SNSA (together with the operator) shall analyze how these topics are taken into account, maintained and improved.	11
211	Further actions should be taken to ensure continuous availability of adequate power supply and reliable information on plant status – Improving robustness/reliability of off-site power under severe environment conditions – Improving protection of on-site electrical distribution network – Having additional power source (new EDGs, mobile power sources, diversity) – Improving reliability and protection of on site power sources – Enabling easy connections of (off-site/mobile) supplies and designing appropriate storage to ensure availability of mobile power sources. – Switchyard robustness enhancement – Longer autonomy of AC and DC emergency power sources (fuel supply, lubrication, batteries) – Ensuring the adequacy and reliability of key I&C for monitoring key parameters in all conditions (reactor and spent fuel pool) – Addressing specific plant conditions, e.g. total loss of electrical power while fuel handling is ongoing.	KJV – Topic #2, Design Issues / Upgrades to Electrical Power Supplies and I&C	design issues	Most of these suggestions will be covered by the Krško's SUP. Still SNSA should pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.. The recommendation on longer autonomy of AC and DC sources (fuel supply, lubrication, batteries) shall be specially considered. Also addressing specific possible plant conditions (e.g. total loss of electrical power while fuel handling is ongoing) shall be considered.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
212	Further actions should be taken to ensure adequate cooling of core and spent fuel – Protecting Pumping station and on-site water sources – Multiple and diverse means of heat removal •Develop alternative provisions for SG feeding, core and SF pool cooling in all conditions by using fixed and mobile means for water feeding •Increase the reliability and the availability of the fire extinguishing system for its use in all conditions, also as a robust alternative cooling system for SF pool, emergency diesel generators, reactor secondary system, etc. •Alternate heat sink (atmosphere…) to be available – Spent fuel accident scenario and cooling issues •Hydrogen generation in case of loss of cooling •Spent fuel pool integrity in case of prolonged loss of cooling – Study of RCP pump seal leakage following long term AC power failure	KJV – Topic #2, Design Issues / Upgrades to Cooling Systems and Containment	design issues	Most of these suggestions will be covered by the Krško's SUP. SNSA shall pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.	1
213	Further actions should be taken to prevent challenge to containment and having means to ensure containment integrity – Preventing challenges to containment •Avoiding high pressure core melt, steam explosion •Hydrogen risk control and mitigation in the containment and fuel building •Containment heat removal – Avoiding over pressurization of containment and avoiding potential radioactive releases •Analysis/Design Basis for filtered and robust containment venting •Containment venting for new NPPs? •Filtration efficiency (decontamination factor) – Ensuring reliability / availability of equipment required for maintaining containment integrity in all conditions. – R&D related to •In vessel corium retention •Hydrogen risk studies (e.g. large scale test…)	KJV – Topic #2, Design Issues / Upgrades to Cooling Systems and Containment	design issues	Most of these suggestions will be covered by the Krško's SUP. SNSA shall pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
214	- To more systematically and explicitly, at short and long terms: •clarify the BDBA/DEC scenarios considered in the safety assessment •evaluate safety margins and identify cliff-edge effects (and grace period) •include organizational and human aspects - Use of PSA as complementary to deterministic analysis - Considering the site as a whole for a multi-units site - Safety assessment should benefit from timely operational experience feedback - PSR are opportunities to revisit as a whole safety assessment - Updating regulations and regulatory guidance accordingly	KJV – Topic #2, Design Issues / Safety Assessment	design issues	The BDBA/DEC scenarios will be identified within the SUP and also included in USAR. Safety margins and cliff-edge effects were identified within the stress test process. PSA is already used as complementary to deterministic analysis. Krško site is a single unit site. Learning from operational experience feedback is a long time practice of the Krško NPP. This is also a requirement in the regulation. PSR is being performed regularly every 10 years. New standards, data, operating experience, etc. is taken into account.	1
215	Protection of “critical” staff - Habitability of control rooms/emergency centers under DEC conditions - The recent IAEA SSR 2-1 safety standard provide a sound basis, lessons learned from Fukushima should be added to it - Avoid loss of a safety function •By longer “grace” period (e.g. by considering a prolonged SBO…) •By having multiple means to perform a safety function -Existing systems (e.g. : fire fighting system) now used for a safety (related) function, in addition to its original function -New (permanent) systems (e.g. diesel driven pumps, feed and bleed without AC power…) -Mobile/off-site equipment •Permanent hook-up points •Robust storage (hazard resistant) -Protection of critical equipment (e.g. hardened safety core, bunkerized system…) -Adequate diversity and independence vs complexity •Interconnections within the plant •Mutual support capabilities between reactors at the same site •Equipment used for all the reactors at a same site	KJV – Topic #2, Design Issues / Design Expectations	design issues	Most of these suggestions are already covered. The rest will be covered by the Krško’s SUP. SNSA shall pay special attention to these topics within the SUP’s licensing process to make sure they are taken into account.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
216	Careful consideration of the SSC design basis and associated safety requirements - Concern for existing equipment which may be used for purposes other than their original purpose - What requirements for equipment used in BDBA/DEC Defining safety classification of equipment used in DEC - Up to now, non safety classified equipment could be used for BDBA. And after TFPCO Fukushima accident ?	KJV – Topic #2, Design Issues / Design Expectations	design issues	For the Krško NPP BDBA/DEC requirements are mostly set by prepared cliff-edge analyses of extreme external hazards. The DEC systems (mobile equipment excluded) will be safety related and mostly not complying with single-failure criteria, except where single failure criteria is of most importance (e.g. valves in the filtered venting system).	1
217	As a important safety objectives for new plants • Prevention and mitigation of core-melt accident in reactor and in spent fuel storage to avoid off-site long term contamination • Large or early release to be practically eliminated -Delaying fuel-melt in vessel and preventing fuel uncovery in spent fuel pool Safety as high as reasonably achievable • Increase robustness of NPPs to be able to face natural hazards more severe than the ones considered in the design basis Basis for design: IAEA SSR2-1 safety standard + lessons learned from Fukushima provide a sound basis • Design basis accident vs Design Extension Condition (DEC) vs Beyond DEC: additional work is needed	KJV – Topic #2, Design Issues / New NPPs	design issues	In Slovenia there are no short-term plans to build new NPP. Still, SNSA shall consider whether these recommendations should be incorporated in the Slovenian regulation (JV5).	2
218	- Review of regulatory framework with respect To inclusion of BDBEs and make changes To reactor oversight process - Analysis of resources and procedures for BDBAs - Revision of regulations on measures for SAs and to testing and maintenance of AM equipment - Rulemaking on prolonged SBO	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 1.1: Review of regulatory framework	severe accident management	SNSA shall amend its legal framework with BDBA / DEC requirements (including the test and maintenance of equipment, training,...). SNSA shall consider whether more detailed requirements are needed regarding LOOP, SBO and loss of UHS	2, 4

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
219	- Licensee emergency response coordination: EOPs, SAMGs - EDMG concept being developed in one CP may be a valuable approach - Development of SAMGs for low-power shutdown (LPSD) conditions, multi-unit SAs and SFPs - Review, update and enhancement of SAMGs and training - Validation of SAMG through emergency exercises	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 1.2: Improvement of EOP, SAMG and Training	severe accident management	Krško NPP has developed plant specific EOPs and SAMGs. The "EDMG concept" guides are included in the EOPs (ECA-0.0). The Krško NPP has in place SAMGs, EOPs and AOPs that are in combination capable of mitigating accidents in all plant's modes, as well as for SFP. Krško SAMGs were reviewed (RAMP mission in 2001). They are regulary updated to include changes in plant equipment and procedures and are also regulary trained. SAMGs are also validated through exercises and full scope plant specific simulator.	
220	- In addition to deterministic approaches, ensure that adequate Level 2 PSAs are undertaken and the results used for further consideration of AM measures for all operational states. - PSA for full range of external events	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 1.3: use of PSA	severe accident management	Already implemented in Krško NPP.	
221	- Identification of essential systems and procedures and enhance their robustness to withstand the extreme hazard conditions. - New connections to diverse water sources - Review and analysis of accident sequences for long-term severe accidents to identify appropriate repair and recovery strategies - Analysis of radiological situation in the plant expected during SA and resulting restrictions - Prevention of the transfer of radioactive contamination to ground and surface waters in case of ex-vessel scenarios.	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 1.4: Other	severe accident management	These items are already considered in the Krško NPP or are to be considered as a part of SUP.	1
222	- Use of mobile pumps, diesel fuel, generators, heat exchangers, compressors for instrument air, etc. - Installation / improvement of hook-up points, hoses, cables, etc. - Off-site support and storage of equipment for long lasting accidents - Diversity of locations to store equipment - Consideration of widespread disruption of infrastructure and ways to transport additional resources to and from the site. - Strategies and procedures in place for long term maintenance for all type of mobile equipment including associated training materials.	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 2.1: Use of mobile equipment	severe accident management	Most of these items are already taken into account in the Krško case. The off-site support and storage of equipment is not implemented nor planned. The mobile equipment is stored in a special building, which is a 2xSSE qualified and also protected against the PMF. It is also located around 100 m away from the nuclear island, which is expected to be sufficient even in the case of large commercial aircraft crash. Still it would be usefull to reconsider off-site support in regard to long-term fuel supply and also some additional pieces of mobile equipment for the case of widespread disruption of plant's infrastructure.	3

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
223	- Hydrogen management in the containment, reactor building and SFP building and improvement in its instrumentation - Installation of passive autocatalytic recombiner (PARs), igniters or inertisation - Enhancement of measures for depressurization of pressure vessel to prevent high pressure melt ejection and to permit injection of water through low pressure sources. - Improvement of filtered venting system and the development of filtering strategies considering resistance to hazards, hydrogen combustion risks, manual operation, etc. and performance of filtered venting system over the long term. - R&D related to the corium-water and corium-concrete interaction issues - Installation of onsite and offsite voice and data emergency communication systems - Installation of separate dedicated BDBA instrumentation	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 2.2: Improvement of permanently installed systems	severe accident management	Most of these suggestions will be covered by the Krško's SUP. SNSA shall pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.	1
224	- Habitability of MCR and ECR in design basis and beyond design basis accidents - Emergency Management Centre designed to withstand external events and use over the long term - Setting up of an Emergency Support Centre (ESC) common to all the plants - Establishment of Accident Management Centre off-site NPP including consideration of mobile centre. - Diversity in design such as application of seismic base isolation	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 3: Addition / Improvements in buildings	severe accident management	Suggestions that are applicable to the Krško NPP will be covered by the Krško's SUP. SNSA shall pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.	1
225	- Reassessment of capability to deal with multi-unit SAs - Expand the scope of SAMGs to include multi-unit events - Multi-unit on-site emergency plan - Consideration of pros and cons of sharing systems in case of SAs - Study on team sizes permanently present in NPPs - Influence of other nearby industries on NPPs in the event of SA	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 4: Multi-unit aspects	severe accident management	N/A for Krško NPP	
226	- Additional measures for water make-up - SFP instrumentation including post event monitoring - Expansion of the scope of SAMG to include SFPs - Analyzing strategies for internal and external spray to the SFP and leakage control of pool - Spent fuel inventory management strategy - Studies related to H2 production and accumulation in SFP building and for improving water level monitoring in pool - Influence of SFP location inside/outside containment	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 5: Spent Fuel Pool Aspects	severe accident management	These topics have already been considered or are planned to be considered within the Krško's SUP. SNSA shall pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
227	- Consideration of stress on staff behaviour including emotional, psychological and cultural aspects associated with emergency response and associated training and support - Human resources and radiological protection equipment additional to those already in place to respond to SAs - Analysis and identification of situations that would prevent performance of work for radiological reasons - Integrated management system in place for decision making including prioritization and internal and external communication. - Ensuring clarity in role and responsibilities during severe accident management - Analysis of lessons learnt from Fukushima with a focus on safety culture and other human aspects. - Guidelines and training for operator decision making during BDBA	KJV – Topic #3, Severe Accident Management and Recovery/ Theme 6: Human and organizational aspects	severe accident management	Most of these topics have already been considered in the Krško NPP. Additional consideration (by both, SNSA and Krško NPP) shall be given to the following topics: - question of stress on staff behaviour including emotional, psychological and cultural aspects associated with emergency response and associated training and support - radiological protection equipment additional to those already in place to respond to SAs - analysis and identification of situations that would prevent performance of work for radiological reasons.	5

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
301	- It will take time to analyse all the lessons to be learned and, when necessary, reflect these lessons into the legal frameworks. There are other tools available to regulators to require operators to make timely safety improvements. - Where the RB is constituted of more than one entity, it is important to ensure efficient coordination. - Emphasis on the need for comprehensive periodic reviews of safety, using state-of-the-art techniques. - To remind CP that national safety frameworks include the RB, TSO and Operating Organisations. - Wide participation in safety networks for operating organizations, RB and TSOs will strengthen them.	KJV – Topic #4, National Organizations / Theme 1: Review and revision of nuclear and/or radiation protection Laws, Regulations and Guides	national organizations	Regulation changes should be done in long-term. Timely safety improvements can be required by other means, e.g. 2nd decision in SNSA case.	
302	Effective independence of the RB is essential, including the following aspects: - To take decisions independently - Transparency in communicating its regulatory decisions to the public. - Competent and sufficient human resources. - Adequate legal powers (eg suspend operation). - Adequate financial resources. Importance of inviting IRRS missions, and to: - Effectively implement the findings. - Make the findings and their means of resolution publicly available. - Invite follow-up missions.	KJV – Topic #4, National Organizations / Theme 2: Changes to functions and responsibilities of the RB	national organizations	The SNSA is fully independent in its decision making. IRRS mission was invited in 2010. Follow-up mission is planned in 2013.	8
303	• How to routinely exercise: - all involved organizations, up to ministerial level - scenarios based on events at multi-unit sites • How to train intervention personnel for potentially severe accident conditions? • Rapid intervention teams to provide support to sites. • Determination of the size of the EPZ is variable. • Trans-border arrangements need to be further considered and exercised. • The use of regional centres to provide support to sites. • Education of the public and media in aspects related to emergencies (eg radiation doses and their effects)	KJV – Topic #4, National Organizations/ Theme 3: Review and improvements to aspects of National EP&R	national organizations	Emergency preparedness is regulary exercised in Slovenia. It is exercised also on the ministerial level, but less often. In January 2012 SNSA issued a decision for the Krško NPP to reassess its basis and assumptions for emergency preparedness and response taking into account the Fukushima accident. The outcome will be included in the appropriate on-site (operator's) and off-site (local and national) emergency plans. Still further reconsideration should be given to training of intervention personnel, trans-border arrangements and education of the public and media.	3

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
304	• Communication with stakeholders is a continuous activity not just in an emergency. • Active stakeholder engagement in the decision-making process builds public confidence. • International bilateral cooperation is beneficial (eg joint regulatory inspections) • The proper balance of understandable information provided to informed groups and the general public needs to be addressed. • The transparency of the operators' activities needs to be enhanced.	KJV – Topic #4, National Organizations/ Theme 4: Openness, transparency and communication improvements	national organizations	The communication of all nuclear stakeholders with the public is preatty well developed and there are no major problems evident. During the recent years there were several nuclear emergencies and "emergencies" with increased public interest. In all cases nuclear stakeholders have succesfully communicated so that reasonable level of trust by the media and the public is established. Relationship with the public is very much infuenced and based on national culture. There is no evident need for changes in established communication practices.	
305	• All CP should perform a safety re-assessment and the resolution of their findings should be progressed through a national action plan or other transparent means and should not be limited to NPPs in operation. • Established safety networks should be efficiently used by CP to disseminate and share relevant information.	KJV – Topic #4, National Organizations/ Theme 5: Post-Fukushima safety re-assessments and action plans	national organizations	The SNSA and the Krško NPP performed the European stress tests. The results of the stress tests, together with results of the peer review are publicly available.	
306	• There is a need to further develop human resource capacity and competence across all organizations in the field of nuclear safety. • Governmental level commitment is needed to ensure a long-term approach is developed for capacity building. • Collaborative work is needed in the area of improving and assessing HOF, including safety culture. • The role of sub-contractors may be important; can they be harnessed quickly ?	KJV – Topic #4, National Organizations/ Theme 6: Human and organizational factors (HOF)	national organizations	This topics shall be reviewed and brainstormed by all involved parties (the utility, the RB, TSOs…). Only in such manner really worthy ideas could be generated to enhance development of human resources.	6

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
307	• Expansion of the set of scenarios on which the plan was based – NPP plus infrastructure – Approaches can vary but the expansion of the set of scenarios on which the plan is based is common – Approaches to multiple NPP's reported included aspects of scenarios of multiple units on a site, multiple sites, multiple sites – initiating event impacts in more than one Country – CP's continue to evolve this area • Structure of organizations and plans varies from CP to CP – Discussion in this area stressed the importance of clarity of roles, competency and interface • Need to have following aspects reflected in Emergency Plans to be complete: – Ability to deal with `ex-patriots' (persons residing abroad from home Country –Plans for recovery and return to normal phases • Many are looking at resource adequacy to support the increased basis of their plan • Some CP's are considering restructure of zones and criteria in their plan structure	KJV – Topic #5, Emergency Preparedness and Response/ Theme 1: Update to Emergency Plans	emergency preparedness and response	In January 2012 SNSA issued a decision for the Krško NPP to reassess its basis and assumptions for emergency preparedness and response taking into account the Fukushima accident. The outcome will be included in the appropriate on-site (operator's) and off-site (local and national) emergency plans. Further consideration is needed in following aspects: plans for recovery, coordination with neighboring countries (especially Croatia),…	3
308	• Most Contracting Parties (CPs) are increasing scope of drill and exercise programs to reflect NPP plus external infrastructure simultaneous problems (such as NPP plus earthquake) • A need to blend mobile resources (power, water, air, HXs…) into planning and drill programs • Increasing emphasis on drilling with neighbouring Countries • All interface points (National, Regional, Municipal …) must be exercised • Consideration should be given to longer term exercises for better reflection of the extreme events challenges.	KJV – Topic #5, Emergency Preparedness and Response/ Theme 2: Planning and Off-Site Exercises	emergency preparedness and response	Emergency preparedness is exercised regulary in Slovenia. Still this suggestions should be taken into account to further increase the level of national preparedness.	3
309	• Provide additional diversification/ redundancy in radiation monitoring and communication systems • Incorporate failure of communication systems and radiation data availability into drill programs – to reflect Fukushima experience • It is emphasised that aspects like transparency, common source term estimation approaches and effort to continuously communicate with other Countries to harmonize approaches and Public communication are key aspects of success • Access to a `big picture' of radiological conditions is a key element - the international picture – particularly given the initial communication of on site conditions at the NPP may be compromised	KJV – Topic #5, Emergency Preparedness and Response/ Theme 2: Planning and Off-Site Exercises	emergency preparedness and response	Diverse communication systems are available on and off-site. Emergency preparedness drills shall be enhanced by incorporating falure of communication systems and radiation data availability into drill programs. SNSA shall strive to enhance the cooperation with neighbouring countries in the area of emergency preparedness. Further enhancement of radiological monitoring system shall be considered.	3, 9

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
310	• Reference levels are available for importing food but some difficulties were encountered with trans-border processing of good and services such as container transport • Approach / philosophy and associated limits and criterion to govern the 'remediation' phase of the event need to be re-examined with the experience from Fukushima • Return to evacuated area criteria and criteria for return to normal from the emergency state require additional clarity • Some Contracting Parties reported difficulties with approaches to establishing contamination monitoring protocols and locations during the recovery phase	KJV – Topic #5, Emergency Preparedness and Response/ Theme 4: Recovery Phase Aspects	emergency preparedness and response	These topics shall be reconsidered within the revision of national radiological emergency reponse plan.	3
311	Hardening of the support infrastructure (Emergency Response Centres, Sheltering facilities, essential support facilities (like Corporate Offices) with back-up power, environmental radiological filtering, etc.	KJV – Topic #5, Emergency Preparedness and Response/ Theme 5: Adequacy of Emergency Response 'Headquarters' and Sheltering Centres	emergency preparedness and response	SNSA shall pay special attention to these topics within the SUP's licensing process to make sure they are taken into account.	1
312	• Effectiveness of IAEA peer review processes should be reviewed in response to concerns raised by the public and Non Governmental Organisations. • The CNS national reports should include how peer review and mission findings have been addressed. • Processes and initiatives should be strengthened to ensure implementation of findings of the peer review and missions. • CNS review meetings should ensure robust peer reviews and reporting of peer review results and findings. • Plant design safety features and related modifications should be considered in WANO and OSART missions. • Better coordination of WANO and IAEA peer review activities should be established. • International experience gained from the review of Russian designs after Chernobyl could be considered as an example of good international practice.	KJV – Topic #6, International Cooperation/ Theme a: Strengthening the peer reviews process of CNS and of missions (IAEA, WANO and Industry)	international cooperation	Mostly general recommendations concerning the CNS. Useful recommendation is in 5th bullet on reviewing plant design safety features and related modifications by OSART missions.	8

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
313	• Primary responsibility for safety remains with operators. • The collective responsibility of the various institutions and organisations should be optimised. • The growing number of international meetings, assessments, peer reviews and expanding mandates is placing high demands on existing human resources, which may become counter productive. • Efforts should be continued to reduce duplication of initiatives and actions by various organisations such as IAEA, NEA, EU, WANO, etc. • The respective roles and objectives of the various organisations, institutions and missions should be recognised in the optimisation process.	KJV – Topic #6, International Cooperation/ Theme b: Optimisation of the Global Safety Regime	international cooperation	This is again general recommendation. The interesting observation is one about the growing number of international meetings and duplication of initiatives, which is becoming counter productive. For the SNSA it would be maybe useful to reconsider, which of these meetings are of outmost importance, since with decreasing number of staff and increasing number of international cooperation the quality of regular work may start to suffer.	7
314	• Initiatives relating to the Regional Crisis center for operators of NPPs with VVER type reactors as being implemented by Moscow WANO Center and also considered by some other vendor countries. • Bilateral agreements between vendor countries and new embarking countries, complemented by IAEA Standards and review processes, have been reported to be effective and should be encouraged. • Strong support of political leaders is important to establish the necessary nuclear safety infrastructure. • Countries with established nuclear programmes should assist with the establishment of nuclear and regulatory infrastructure. • Countries should cooperate with neighbouring and regional countries and exchange information on their civil nuclear power programmes.	KJV – Topic #6, International Cooperation/ Theme c: Strengthening communication mechanisms through regional and bilateral cooperation	international cooperation	General recommendations. Interesting for SLO: Nuclear safety infrastructure in Sovenia needs more political support – in last years the financial support is decreasing, thus the nuclear safety infrastructure is loosing knowledge, tools, skils.	6
315	• Information exchange and feedback should be enhanced by using the established mechanisms (eg. IRS, INES) and organisations (eg. WANO). • The sharing and utilisation of information is limited and not always necessarily well coordinated or disseminated. This has been identified as an area for improvement. • All nuclear power plants should share Operating Experience. • The current focus is on reporting events and not necessarily on learning from the events. Effectiveness of Operating Experience Feedback should be assessed and its implementation should be included in peer reviews.	KJV – Topic #6, International Cooperation/ Theme d: Effectiveness of experience feedback mechanisms	international cooperation	Both SNSA and the operator are regulary using OEF systems like IRS, INES, WANO,… The SNSA regularly (annually) performs inspections of operator's OEF to verify that the NPP is a learning organization. Likewise the SNSA has its own OEF system for screening and reviewing the international events and comparing them with the operator's practice.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
316	• The Safety Fundamentals remain appropriate as a sound basis for nuclear safety when properly implemented. • Implementation should strike the right balance between prevention and mitigation. • The IAEA Safety Standards should be taken into account in developing national nuclear safety regulations. • These Safety Standards have a role to play in seeking continuous improvements to safety at existing nuclear power plants.	KJV – Topic #6, International Cooperation/ Theme e: Strengthening and expanded use of IAEA Safety Standards	international cooperation	The Slovenian regulation is based on WENRA RL, which are based on IAEA safety standards.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
401	ENSREG country report recommendation: “It is recommended that the regulator should consider requesting to update the seismic design basis for future design modifications and consequently the associated PSA model.”	ENSREG Peer Review Country Report for Slovenia/ 2.1.3/ 9	natural hazards	The SUP and future modifications will be based on the extended seismic design basis (2xSSE). Furthermore, the Krško NPP's operating license shall be amended with a requirement for the extended seismic design basis for future modifications.	1
402	Essential elements of the new safety construct should include: · Capability to address potential events beyond the design basis and possible cliff-edge effects; · Confirmation that the design basis or extended design basis includes rare yet credible events; · Use of an all-risk approach; ensuring core cooling for all phases of accident progression; and · Improved human performance, organizational infrastructure, command and control, accident management, and emergency preparedness.	ASME report/ 1.6/ 6	general	These elements are already being taken care of in the Krško NPP, some are required by Slovenian legislation, others come from following good international and WOG practice. Still there is room for improvement in the Krško NPP’s principles of operation, as well as in the SNSA’s. Amend the legislation to address beyond design basis (design extension conditions) and possible cliff-edge effects.	2
403	The margins inherent in nuclear power plant designs are an important element of the existing safety construct. The Fukushima Dai-ichi accident warrants a reconsideration of the margin inherent in current designs. Such reconsideration is ongoing, world-wide. In most cases, these margins provide some assurance that equipment and structures will function beyond their design requirements. This means, for example, that there might be significant margin for earthquakes and high winds. On the other hand, margins for large flooding events, from either internal or external sources, deserve further attention because, as shown at Fukushima, the potential consequence of catastrophic flooding can be extensive equipment failures.	ASME report/ 4.7/ 38	natural hazards	The stress tests for the Krško NPP have shown that the plant has sufficient margins and is well protected against external and internal floodings. Further improvements are planned within the SUP, which will further enhance the protection against external floodings (PMF combined by seismic failure of protection dikes), as well as the protection against internal floodings hazard. SNSA will continue to pay much of its attention to the issue of flood protection, both external and internal, especially within the implementation of the SUP.	1

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
404	Accident prevention should continue to be the principal strategy in the New Nuclear Safety Construct. This will require that the design basis be thoroughly reexamined to ensure it includes adequate treatment of rare yet credible events and appropriate combinations of internal failures, including common-mode failures.	ASME report/ 4.8/ 38	design issues	The stress tests for the Krško NPP have shown that the plant is well protected even against most rare but credible events. Further improvements are planned within the SUP. Especially the new bunkered building with alternative pumps and water supplies for reactor cooling, SG cooling, flooding and spraying the containment, with a new emergency control room and dedicated BDBA I&C will strengthen the plant's robustness and increase its resilience to common-mode failures. SNSA shall supervise the SUP's implementation with special attention to possible combinations of internal failures and common-mode failures.	1
405	The proposed all-risk approach to accident management, with appropriate consideration of probability of occurrence, associated uncertainties, and potential consequences, including cliff-edge effects, would address a broad range of challenges to safety of nuclear power reactors and spent fuel facilities, including internal hazards, external hazards, and security threats, during all modes of plant operation. These challenges would be addressed in a risk-informed manner for both design-basis events and events exceeding the design basis, including rare yet credible events. The effectiveness of the capability to mitigate challenges and their consequences for all risks is key to identifying the appropriate enhancements to be considered. This approach is likely to result in changes to all phases of accident management, including equipment, procedures, guidance, and training and qualification of personnel. Finally, there is a need for a uniform global standard of excellence for accident management capability including the definition of the level of extreme external events against which plants, plant workers, and the general public must be protected. That is, there should be accident management measures in place, and maintained in a state of readiness, as part of the design basis and coping capabilities to deal with rare yet credible events.	ASME report/ 6.7/ 53	general	One can not claim that the Krško NPP uses all-risk approach. For example the low power and shutdown (LP&SD) modes, which are a major risk contributer, are still not covered by full-scope PSA. For the SFP there are no risk informed analyses, while security threats are not supervised by the SNSA(?). The PSA for LP&SD modes is planned to be developped until the end of 2015. The whole PSA shall be licensed (included in the USAR) till end of 2016. The PSA analyses of all external events are reviewed every PSR (every 10 years) and revised if necessary. Severe accident management in the Krško NPP is well developed and maintained, but could be additionaly reviewed for use with extreme external events (extreme external floods, winds,…), as well as combinations of extreme external events (e.g. extreme temperatures and severe winds). Actions: SNSA shall consider requiring a PSA for the Krško's SFP. The Krško's SAM shall be reviewed for use with extreme external events and combinations of events. Additional RAMP mission shall be considered.	8, 10

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
406	List of important Fukushima emergency preparedness (EP) – related lessons: · Staffing for multi-unit events including extreme external events that could disrupt local infrastructure · Protective measures and equipment for emergency responders during multi-unit events · Command and control for multi-unit events · Dose assessment capability for multi-unit events · Need for improved onsite and offsite radiation monitoring including AC independence and real time availability (via internet or satellite) · Communications equipment effectiveness during a prolonged Station Blackout (SBO) · Need for accurate, automated, real time data on plant status · Drills and training under more realistic accident conditions · Adequacy of EP facilities during prolonged SBO and multi-unit events · Need for enhanced emergency response resources in light of potential for disruptions of onsite and offsite infrastructure · Need for enhanced EP decision-making framework including expansion of response beyond plume exposure EPZ and recovery and reentry · Gaps in public awareness of radiation and radiation safety · Need for better scientific basis for reentry (return home) criterion including low level radiation effects · Need for improved crisis communication systems recognizing the revolution in social media of the last decade · Need for building transparency and public trust in nuclear safety · Need for updated basis for EPZ size · Need for risk-informed, performance-based approach to EP	ASME report/ 7.2/ 55	emergency preparedness	The following elements should be reviewed to help identify possible improvements: · Protective measures and equipment for emergency responders · Dose assessment capability · Need for improved onsite and offsite radiation monitoring including AC independence and real time availability (via internet or satellite) · Communications equipment effectiveness during a prolonged Station Blackout (SBO) · Need for accurate, automated, real time data on plant status · Drills and training under more realistic accident conditions · Adequacy of EP facilities during prolonged SBO · Need for enhanced emergency response resources in light of potential for disruptions of onsite and offsite infrastructure · Need for enhanced EP decision-making framework including expansion of response beyond plume exposure EPZ and recovery and reentry · Gaps in public awareness of radiation and radiation safety · Need for better scientific basis for reentry (return home) criterion including low level radiation effects · Need for improved crisis communication systems recognizing the revolution in social media of the last decade · Need for building transparency and public trust in nuclear safety · Need for updated basis for EPZ size · Need for risk-informed, performance-based approach to EP (Level 3 PSA??)	1, 3
407	...A better understanding of nuclear power gained by the public in advance, or even in the absence of an accident is also important for public support of normal operations because people with little or no knowledge of nuclear power often have the perception that the risk from nuclear power is higher than it actually is…	ASME report/ 8.2/ 65	public relations	SNSA shall (together with other appropriate stakeholders) give further consideration to education of the public and media.	3
408	The construct must be predicated on all modes of plant operations, all-risk, full-scope risk assessments, including PRA Level 3 (consequence) analysis, that are well integrated with deterministic approaches, to achieve a greater level of defense-in-depth for all nuclear power plants.	ASME report/ 9.6.2/ 76	general	The Krško NPP should expand its PSA to full-scope PSA for all operating modes (including LP&SD modes) and also to Level 3 analyses. SNSA shall amend its legislation to include the PSA Level 3 requirement (at least for new NPPs).	2

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
409	Order licensees to reevaluate the seismic and flooding hazards at their sites against current NRC requirements and guidance, and if necessary, update the design basis and SSCs important to safety to protect against the updated hazards.	NRC Tier 1: Recommendation 2.1/ SECY-11-0124, SECY-11-0093	natural hazards	The Krško NPP regularly reevaluates its seismic and flooding hazards in the framework of PSR. Furthermore the seismic and flooding protection will be further enhanced with the planned SUP of the Krško NPP.	
410	Order licensees to perform seismic and flood protection walkdowns to identify and address plant-specific vulnerabilities and verify the adequacy of monitoring and maintenance for protection features such as watertight barriers and seals in the interim period until longer term actions are completed to update the design basis for external events.	NRC Tier 1: Recommendation 2.3/ SECY-11-0124, SECY-11-0093	natural hazards	Seismic and flooding protection walkdowns were performed within the implementation and updates of sesimic and flooding PSA. Additional walkdowns will be performed within the planned Safety Upgrade Program of the Krško NPP.	
411	Initiate rulemaking to revise 10 CFR 50.63 to require each operating and new reactor licensee to: 1) establish a minimum coping time of 8 hours for a loss of all ac power, 2) establish the equipment, procedures, and training necessary to implement an “extended loss of all AC” coping time of 72 hours for core and spent fuel pool cooling and for reactor coolant system and primary containment integrity as needed, and 3) preplan and prestage offsite resources to support uninterrupted core and spent fuel pool cooling, and reactor coolant system and containment integrity as needed, including the ability to deliver the equipment to the site in the time period allowed for extended coping, under conditions involving significant degradation of offsite transportation infrastructure associated with significant natural disasters.	NRC Tier 1: Recommendation 4.1/ SECY-11-0124, SECY-11-0093	design issues	SNSA shall consider whether to amend the legislation to set the minimum coping time for SBO to 8 hours as well as to include requirements for the equipment, procedures and training for the extended SBO up to 72 hours and beyond.	2

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
412	Order licensees to provide reasonable protection for equipment currently provided pursuant to 10 CFR 50.54(hh)(2) from the effects of design-basis external events and to add equipment as needed to address multiunit events while other requirements are being revised and implemented.	NRC Tier 1: Recommendation 4.2/ SECY-11-0124, SECY-11-0093	design issues	The 10 CFR 50.54(hh) incorporated B.5.b into the NRC regulations. The recommendation concerns the adequate protections of the B.5.b equipment aginast external threats as well as assuring that there is enough equipment for all units on site. The requirements regarding B.5.b are to certain (very general) extent already included in the Slovenian requirements (JV5). Straight after Fukushima accident the Krško plant acquired several pieces of portable equipment (e.g. pumps, diesel generators, compressors,…), implemented several modifications and prepared and updated EOPs and SAMGs to provide means to use this portable equipment. The equipment is adequately stored in the dedicated buiding which is protected against DBA as well as BDBA external hazards. Furthermore the protection of the plant will be further enhanced with the planned SUP of the Krško NPP.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
413	Order licensees to include a reliable hardened vent in BWR Mark I and Mark II containments.	NRC Tier 1: Recommendation 5.1/ SECY-11-0124, SECY-11-0093	design issues	Concerns the BWR type of reactor.	
414	Order licensees to provide sufficient safety-related instrumentation, able to withstand design-basis natural phenomena, to monitor key spent fuel pool parameters (i.e., water level, temperature, and area radiation levels) from the control room.	NRC Tier 1: Recommendation 7.1/ SECY-11-0124, SECY-11-0093	design issues	Currently the SFP instrumentation is not safety related. The JV5 rule requires that the plant must have I&C qualified for BDBA conditions, even though the SFP is not included. In the framework of Safety Upgrade Program also the BDBA I&C is planned. It is recommended that SNSA assures that BDBA I&C also includes the SFP I&C. SNSA shall consider amending legislation (JV5) with requirements for BDBA I&C for SFP. Also SNSA shall assure within the SUP that BDBA I&C is appropriately qualified as well as it also includes the SFP I&C.	1, 2
415	8.1 Order licensees to modify the EOP technical guidelines (required by Supplement 1, “Requirements for Emergency Response Capability,” to NUREG-0737, issued January 1983 (GL 82-33), to: 1) include EOPs, SAMGs, and EDMGs in an integrated manner, 2) specify clear command and control strategies for their implementation, and 3) stipulate appropriate qualification and training for those who make decisions during emergencies. 8.2 Modify Section 5.0, “Administrative Controls,” of the Standard Technical Specifications for each operating reactor design to reference the approved EOP technical guidelines for that plant design. 8.3 Order licensees to modify each plant’s technical specifications to conform to the above changes. 8.4 Initiate rulemaking to require more realistic, hands-on training and exercises on SAMGs and EDMGs for all staff expected to implement the strategies and those licensee staff expected to make decisions during emergencies, including emergency coordinators and emergency directors.	NRC Tier 1: Recommendation 8/ SECY-11-0124, SECY-11-0093	severe accident management	The EDMGs are somewhat already included in the Krško NPP’s EOPs, i.e. the ECA-0.0. The SNSA does not have detailed information about the background documentation regarding the EDMGs/ECA-0.0. The plant has developed plant specific SAMGs, which have separate background documentation and are not integrated with the EOPs. The plant is regularly performing training and exercises for use of SAMGs and EDMGs/ECA-0.0, even though this is not required by Slovenian regulation. There is no need to amend legislation with a requirements, that would consider these recommendations, since Slovenian legislation is too general to do this. Instead SNSA shall systematically review and inspect SAME equipment, SAMGs and test and maintenance procedures. Likewise, the SNSA will inspect how the plant is compliant with these new NRC orders.	4

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
416	Recommendation 9.3: Order licensees to do the following until rulemaking is complete: • Determine and implement the required staff to fill all necessary positions for responding to a multiunit event. • Add guidance to the emergency plan that documents how to perform a multiunit dose assessment (including releases from spent fuel pools) using the licensee's site-specific dose assessment software and approach. • Conduct periodic training and exercises for multiunit and prolonged SBO scenarios. Practice (simulate) the identification and acquisition of offsite resources, to the extent possible. • Ensure that EP equipment and facilities are sufficient for dealing with multiunit and prolonged SBO scenarios. • Provide a means to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones, satellite telephones) during a prolonged SBO. • Maintain ERDS capability throughout the accident. For the Tier 1 the Recommendation 9.3 is limited to staffing and communication issues, i.e. bullets 1 and 5.	NRC Tier 1: Recommendation 9.3/ SECY-11-0124, SECY-11-0093	emergency preparedness	For the Tier 1 the Recommendation 9.3 is limited to staffing and communication issues, i.e. bullets 1 and 5. The bullet 1 is concerning multiunit sites and is thus not applicable to the Krško NPP. The recommendation in bullet 5 suggests that regulatory body requires from licensee to provide these means immediately, while the requirements should also be included in the legislation subsequently (NRC requirement 9.2). Some of these means are already available on site. SNSA shall check what are plant's capabilities to power these communication means in the event of prolonged SBO. In the long run, the SNSA shall consider amending its legislation with such requirements.	2, 4

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
417	7.2 Order licensees to provide safety-related AC electrical power for the spent fuel pool makeup system. 7.3 Order licensees to revise their technical specifications to address requirements to have one train of onsite emergency electrical power operable for spent fuel pool makeup and spent fuel pool instrumentation when there is irradiated fuel in the spent fuel pool, regardless of the operational mode of the reactor. 7.4 Order licensees to have an installed seismically qualified means to spray water into the spent fuel pools, including an easily accessible connection to supply the water (e.g., using a portable pump or pumper truck) at grade outside the building. 7.5 Initiate rulemaking or licensing activities or both to require the actions related to the spent fuel pool described in detailed recommendations 7.1–7.4.	NRC Tier 2: Recommendation 7/ SECY-11-0137, SECY-11-0093	design issues	Some of these measures are already in place in the Krško NPP. Furthermore the SNSA shall assure that all these recommendations are fulfilled within the framework of SUP.	1
418	Recommendation 9.3: Order licensees to do the following until rulemaking is complete: • Determine and implement the required staff to fill all necessary positions for responding to a multiunit event. • Add guidance to the emergency plan that documents how to perform a multiunit dose assessment (including releases from spent fuel pools) using the licensee's site-specific dose assessment software and approach. • Conduct periodic training and exercises for multiunit and prolonged SBO scenarios. Practice (simulate) the identification and acquisition of offsite resources, to the extent possible. • Ensure that EP equipment and facilities are sufficient for dealing with multiunit and prolonged SBO scenarios. • Provide a means to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones, satellite telephones) during a prolonged SBO. • Maintain ERDS capability throughout the accident. The Tier 1 "Recommendation 9.3" is limited to staffing and communication issues, i.e. bullets 1 and 5, while Tier 3 is limited to the last bullet, i.e. ERDS capability. Thus Tier 2 concerns bullets 2, 3 and 4.	NRC Tier 2: Recommendation 9.3/ SECY-11-0137, SECY-11-0093	severe accident management	The Tier 1 "Recommendation 9.3" is limited to staffing and communication issues, i.e. bullets 1 and 5, while Tier 3 is limited to the last bullet, i.e. ERDS capability. Thus Tier 2 concerns bullets 2, 3 and 4. Most of these recommendations (bullets 2, 3 and 4) are concerning multi-unit sites, and are thus not applicable to the Krško NPP. For the Krško case the only (partially) meaningful recommendation is the in the 4th bullet, "Ensure that EP equipment and facilities are sufficient for dealing with (multiunit and) prolonged SBO scenarios". These recommendations suggest that regulatory body requires from licensee to provide these means immediately, while these requirements should also be included in the legislation subsequently (NRC requirement 9.2). For the Krško case these recommendations will be fulfiled with the implementation of ths SUP.	1, 2
419	Initiate rulemaking to require licensees to confirm seismic hazards and flooding hazards every 10 years and address any new and significant information. If necessary, update the design basis for SSCs important to safety to protect against the updated hazards.	NRC Tier 3: Recommendation 2.2/ SECY-11-0137, SECY-11-0093	natural hazards	This requirement is already included in Slovenian legislation.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
420	The Task Force recommends, as part of the longer term review, that the NRC evaluate potential enhancements to the capability to prevent or mitigate seismically induced fires and floods.	NRC Tier 3: Recommendation 3/ SECY-11-0137, SECY-11-0093	design issues	This is a recommendation to the NRC to consider possible lon-term enhancements to the capability to prevent or mitigate seismically induced fires and floods. The SNSA's and Krško NPP's regular practice is to follow NRC's activities in area of development of new requirements, guides and standards. Thus it is not needed to explicitly transfer this recommendation to the SNSA's action plan, since the possible new NRC's regulation and guides would be considered within the PSRs and regular practice of SNSA and Krško NPP.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
421	Reevaluate the need for hardened vents for other containment designs, considering the insights from the Fukushima accident. Depending on the outcome of the reevaluation, appropriate regulatory action should be taken for any containment designs requiring hardened vents.	NRC Tier 3: Recommendation 5.2/ SECY-11-0137, SECY-11-0093	design issues	This is a recommendation to the NRC to consider possible lon-term enhancements for the hardened vents for other containment designs. The SNSA's and Krško NPP's regular practice is to follow NRC's activities in area of development of new requirements, guides and standards. Thus it is not needed to explicitly transfer this recommendation to the SNSA's action plan, since the possible new NRC's regulation and guides would be considered within the PSRs and regular practice of SNSA and Krško NPP.	
422	The Task Force recommends, as part of the longer term review, that the NRC identify insights about hydrogen control and mitigation inside containment or in other buildings as additional information is revealed through further study of the Fukushima Dai-ichi accident.	NRC Tier 3: Recommendation 6/ SECY-11-0137, SECY-11-0093	severe accident management	This is a long-term recommendation to the NRC to further study the Fukushima accident's insights regarding the hydrogen control and mitigation. The SNSA's and Krško NPP's regular practice is to follow NRC's activities in area of development of new requirements, guides and standards. Thus it is not needed to explicitly transfer this recommendation to the SNSA's action plan, since the possible new NRC's regulation and guides would be considered within the PSRs and regular practice of SNSA and Krško NPP.	
423	Recommendation 9.1: Initiate rulemaking to require EP enhancements for multiunit events in the following areas: • personnel and staffing • dose assessment capability • training and exercises • equipment and facilities Recommendation 9.2: Initiate rulemaking to require EP enhancements for prolonged SBO in the following areas: • communications capability • ERDS capability • training and exercises • equipment and facilities	NRC Tier 3: Recommendations 9.1, 9.2/ SECY-11-0137, SECY-11-0093	emergency preparedness	Recommendation 9.1 concerns multiunit sites and is thus not applicable for the Krško NPP. Recommendation 9.2 suggests that the regulation should be amended with emergency planning requirements for prolonged SBO in the areas of communications capability, ERDS capability, training and exercises, and equipment and facilities. SNSA should consider this recommendation by amending its JV5 rule.	2

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
424	Recommendation 9.3: Order licensees to maintain ERDS capability throughout the accident. This recommendation is also related to long-term evaluation Recommendation 10.3: Evaluate ERDS to do the following: • Determine an alternate method (e.g., via satellite) to transmit ERDS data that does not rely on hardwired infrastructure that could be unavailable during a severe natural disaster. • Determine whether the data set currently being received from each site is sufficient for modern assessment needs. • Determine whether ERDS should be required to transmit continuously so that no operator action is needed during an emergency.	NRC Tier 3: Recommendation 9.3/ SECY-11-0137, SECY-11-0093	emergency preparedness	The status of ERDS in the Krško NPP is the following: • there is a continuous transmition of data between the plant and the SNSA through a data modem, • the ERDS includes around 200 parameters mostly based on NUREG-1394, • the suggested transition from the modem based to VPN based transfer of ERDS data is currently stopped due to cyber security concerns. Still, this system needs revision to include all needed SA parameters, increase reliability of system,…	9

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
425	10.1 Analyze current protective equipment requirements for emergency responders and guidance based upon insights from the accident at Fukushima. 10.2 Evaluate the command and control structure and the qualifications of decisionmakers to ensure that the proper level of authority and oversight exists in the correct facility for a long-term SBO or multiunit accident or both. • Concepts such as whether decisionmaking authority is in the correct location (i.e., at the facility), whether currently licensed operators need to be integral to the ERO outside of the control room (i.e., in the TSC), and whether licensee emergency directors should have a formal "license" qualification for severe accident management. 10.3 Evaluate ERDS (already covered within the recommendation 9.3 above).	NRC Tier 3: Recommendation 10/ SECY-11-0137, SECY-11-0093	emergency preparedness	These are long-term recommendations to the NRC to further analyze current protective equipment requirements for emergency responders and guidance, as well as to evaluate the command and control structure and the qualifications of decisionmakers. The SNSA's and Krško NPP's regular practice is to follow NRC's activities in area of development of new requirements, guides and standards. Thus it is not needed to explicitly transfer this recommendation to the SNSA's action plan, since the possible new NRC's regulation and guides would be considered within the PSRs and regular practice of SNSA and Krško NPP.	
426	The Task Force recommends, as part of the longer term review, that the NRC should pursue EP topics related to decisionmaking, radiation monitoring, and public education. 11.1 Study whether enhanced onsite emergency response resources are necessary to support the effective implementation of the licensees' emergency plans, including the ability to deliver the equipment to the site under conditions involving significant natural events where degradation of offsite infrastructure or competing priorities for response resources could delay or prevent the arrival of offsite aid. 11.2 Work with FEMA, States, and other external stakeholders to evaluate insights from the implementation of EP at Fukushima to identify potential enhancements to the U.S. decisionmaking framework, including the concepts of recovery and reentry. 11.3 Study the efficacy of real-time radiation monitoring onsite and within the EPZs (including consideration of AC independence and real-time availability on the Internet). 11.4 Conduct training, in coordination with the appropriate Federal partners, on radiation, radiation safety, and the appropriate use of KI in the local community around each nuclear power plant.	NRC Tier 3: Recommendation 11/ SECY-11-0137, SECY-11-0093	emergency preparedness	These are long-term recommendations for the NRC to further pursue EP topics related to decisionmaking, radiation monitoring, and public education. The SNSA's and Krško NPP's regular practice is to follow NRC's activities in area of development of new requirements, guides and standards. Thus it is not needed to explicitly transfer this recommendation to the SNSA's action plan, since the possible new NRC's regulation and guides would be considered within the PSRs and regular practice of SNSA and Krško NPP.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
427	12.1 Expand the scope of the annual ROP self assessment and biennial ROP realignment to more fully include defense-in-depth considerations.	NRC Tier 3: Recommendation 12.1/ SECY-11-0137, SECY-11-0093	general	This recommendation concerns the NRC's formal process integrating the NRC's inspection, assessment, and enforcement programs (the ROP). The Task Force evaluates that ROP's reliance on risk undervalues the safety benefit of defense-in-depth and consequently reduces the level of NRC resources focused on inspecting defense-in-depth characteristics that contribute to safety. Thus this recommendation is not directly applicable to SNSA, since the SNSA does not use such program. Still maybe this recommendation would need additional consideration whether the SNSA capability for evaluating defense-in-depth could be further enhanced.	7
428	Enhance NRC staff training on severe accidents, including training resident inspectors on SAMGs.	NRC Tier 3: Recommendation 12.2/ SECY-11-0137, SECY-11-0093	severe accident management	The SNSA staff have had limited training on SA and SAMGs in the past, so this is also applicable recommendation for the SNSA.	7

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
429	Undertake assessment of the safety vulnerabilities of nuclear power plants in the light of lessons learned to date from the [Fukushima] accident	IAEA Action plan/ 2	general	This action was already performed in Slovenia within the ENSREG Stress test and Peer review process	
430	Strengthen IAEA peer reviews in order to maximize the benefits to Member States • Member States to be strongly encouraged to voluntarily host IAEA peer reviews, including follow-up reviews, on a regular basis; the IAEA Secretariat to respond in a timely manner to requests for such reviews.	IAEA Action plan/ 3	international cooperation	Slovenia already had several IAEA peer reviews (OSART, RAMP, IRRS). Still it is recommended to regularly host IAEA missions, so it is recommended to consider possible new missions in future.	8
431	Strengthen emergency preparedness and response • Member States to conduct a prompt national review and thereafter regular reviews of their emergency preparedness and response arrangements and capabilities, with the IAEA Secretariat providing support and assistance through Emergency Preparedness Review (EPREV) missions, as requested. • The IAEA Secretariat, Member States and relevant international organizations to review and strengthen the international emergency preparedness and response framework, taking into account recommendations given in the final report of the International Action Plan for Strengthening the International Preparedness and Response System for Nuclear and Radiological Emergencies, and encouraging greater involvement of the relevant international organizations in the Joint Radiation Emergency Management Plan of the International Organizations. • The IAEA Secretariat, Member States and relevant international organizations to strengthen the assistance mechanisms to ensure that necessary assistance is made available promptly. Consideration to be given to enhancing and fully utilizing the IAEA Response and Assistance Network (RANET), including expanding its rapid response capabilities. • Member States to consider, on a voluntary basis, establishing national rapid response teams that could also be made available internationally through RANET. • The IAEA Secretariat, in case of a nuclear emergency and with the consent of the State concerned, to conduct timely fact-finding missions and to make the results publicly available.	IAEA Action plan/ 3	international cooperation	The national emergency response plan is already being reviewed against the Fukushima lessons learned (ordered by SNSA). It could be useful to invite the IAEA's EPREV (Emergency Preparedness Review) mission. Regarding the estabilishing national rapid seponse team and making it available through IAEA's RANET, it is belived that Slovenia with such a small NPP program does not need a rapid response team.	8

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
432	Strengthen the effectiveness of national regulatory bodies • Member States to conduct a prompt national review and thereafter regular reviews of their regulatory bodies, including an assessment of their effective independence, adequacy of human and financial resources and the need for appropriate technical and scientific support, to fulfil their responsibilities. • The IAEA Secretariat to enhance the Integrated Regulatory Review Service (IRRS) for peer review of regulatory effectiveness through a more comprehensive assessment of national regulations against IAEA Safety Standards. • Each Member State with nuclear power plants to voluntarily host, on a regular basis, an IAEA IRRS mission to assess its national regulatory framework. In addition, a follow-up mission to be conducted within three years of the main IRRS mission.	IAEA Action plan/ 3	international cooperation	The SNSA hosted the IRRS mission in 2011. The follow-up mission is planned for 2014.	8

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
433	Strengthen the effectiveness of operating organizations with respect to nuclear safety • Member States to ensure improvement, as necessary, of management systems, safety culture, human resources management, and scientific and technical capacity in operating organizations; the IAEA Secretariat to provide assistance to Member States upon request. • Each Member State with nuclear power plants to voluntarily host at least one IAEA Operational Safety Review Team (OSART) mission during the coming three years, with the initial focus on older nuclear power plants. Thereafter, OSART missions to be voluntarily hosted on a regular basis. • The IAEA Secretariat to strengthen cooperation with WANO by amending their Memorandum of Understanding to enhance information exchange on operating experience and on other relevant safety and engineering areas and, in consultation with other relevant stakeholders, to explore mechanisms to enhance communication and interaction among operating organizations.	IAEA Action plan/ 4	international cooperation	The operator shall consider hosting an OSART mission in next three years.	8
434	Review and strengthen IAEA Safety Standards and improve their implementation • The Commission on Safety Standards and the IAEA Secretariat to review, and revise as necessary using the existing process in a more efficient manner, the relevant IAEA Safety Standards in a prioritised sequence. • Member States to utilize as broadly and effectively as possible the IAEA Safety Standards in an open, timely and transparent manner. The IAEA Secretariat to continue providing support and assistance in the implementation of IAEA Safety Standards.	IAEA Action plan/ 4	general	In Slovenia the IAEA safety standards are utilized through WENRA RL harmonization. The new post-Fukushima changes of IAEA standards will be incorporated in Slovenian legislation with amendment of rules in accordance with updated WENRA RL.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
435	Improve the effectiveness of the international legal framework • States parties to explore mechanisms to enhance the effective implementation of the Convention on Nuclear Safety, the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the Convention on the Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and to consider proposals made to amend the Convention on Nuclear Safety and the Convention on the Early Notification of a Nuclear Accident. • Member States to be encouraged to join and effectively implement these Conventions. • Member States to work towards establishing a global nuclear liability regime that addresses the concerns of all States that might be affected by a nuclear accident with a view to providing appropriate compensation for nuclear damage. The IAEA International Expert Group on Nuclear Liability (INLEX) to recommend actions to facilitate achievement of such a global regime. Member States to give due consideration to the possibili	IAEA Action plan/ 4	international cooperation	Slovenia ratified all these conventions.	
436	Facilitate the development of the infrastructure necessary for Member States embarking on a nuclear power programme	IAEA Action plan/ 5	general	N/A	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
437	Strengthen and maintain capacity building • Member States with nuclear power programmes and those planning to embark on such a programme to strengthen, develop, maintain and implement their capacity building programs, including education, training and exercises at the national, regional and international levels; to continuously ensure sufficient and competent human resources necessary to assume their responsibility for safe, responsible and sustainable use of nuclear technologies; the IAEA Secretariat to assist as requested. Such programmes to cover all the nuclear safety related areas, including safe operation, emergency preparedness and response and regulatory effectiveness and to build upon existing capacity building infrastructures. • Member States with nuclear power programmes and those planning to embark on such a programme, to incorporate lessons learned from the accident into their nuclear power programme infrastructure; the IAEA Secretariat to assist as requested.	IAEA Action plan/ 5	general	Nuclear safety infrastructure in Sovenia needs more political support. Only in such environment the human resource capacity and competence across all organizations in the field of nuclear safety can be further develop. The Resolution on nuclear safety as a top level political document is expected to be passed through the Parliament in 2013. SNSA shall organize a meeting in which this topic shall be brainstormed by all involved parties (the utility, the RB, TSOs…). Special action plan shall be prepared and executed to enhance political support to nuclear safety infrastructure.	6
438	Ensure the on-going protection of people and the environment from ionizing radiation following a nuclear emergency • Member States, the IAEA Secretariat and other relevant stakeholders to facilitate the use of available information, expertise and techniques for monitoring, decontamination and remediation both on and off nuclear sites and the IAEA Secretariat to consider strategies and programmes to improve knowledge and strengthen capabilities in these areas. • Member States, the IAEA Secretariat and other relevant stakeholders to facilitate the use of available information, expertise and techniques regarding the removal of damaged nuclear fuel and the management and disposal of radioactive waste resulting from a nuclear emergency. • Member States, the IAEA Secretariat and other relevant stakeholders to share information regarding the assessment of radiation doses and any associated impacts on people and the environment.	IAEA Action plan/ 5	emergency preparedness	Slovenia does this already.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
439	Enhance transparency and effectiveness of communication and improve dissemination of information • Member States, with the assistance of the IAEA Secretariat, to strengthen the emergency notification system, and reporting and information sharing arrangements and capabilities. • Member States, with the assistance of the IAEA Secretariat, to enhance the transparency and effectiveness of communication among operators, regulators and various international organizations, and strengthen the IAEA's coordinating role in this regard, underlining that the freest possible flow and wide dissemination of safety related technical and technological information enhances nuclear safety. • The IAEA Secretariat to provide Member States, international organizations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences, including analysis of available information and prognosis of possible scenarios based on evidence, scientific knowledge and the capabilities of Member States. • The IAEA Secretariat to organize international experts meetings to analyse all relevant technical aspects and learn the lessons from the Fukushima Daiichi nuclear power station accident. • The IAEA Secretariat to facilitate and to continue sharing with Member States a fully transparent assessment of the accident at TEPCO's Fukushima Daiichi Nuclear Power Station, in cooperation with Japan. • The IAEA Secretariat and Member States, in consultation with the OECD/NEA and the IAEA International Nuclear and Radiological Event Scale (INES) Advisory Committee to review the application of the INES scale as a communication tool.	IAEA Action plan/ 6	emergency preparedness	Not really useful recommendation for SNSA.	
440	Effectively utilize research and development • Relevant stakeholders, with assistance provided by the IAEA Secretariat as appropriate, to conduct necessary research and development in nuclear safety, technology and engineering, including that related to existing and new design-specific aspects. • Relevant stakeholders and the IAEA Secretariat to utilize the results of research and development and to share them, as appropriate, to the benefit of all Member States.	IAEA Action plan/ 6	general	Not really useful recommendation for SNSA. On National level the nulcear regulator and other stakeholders are very well aware of the importance of sustainable research in nuclear safety field. In 2013 the adoption of the Rasolution on nuclear safety is foreseen, which will include also provisions for appropriate research and development.	

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
441	(The report was in German, while this recommendation was from the abstract, which was translated into English) Retrofits are recommended by the EU Commission and planned by the operator - the required extent however, remains uncertain, as potential hazard is not being adequately studied (the latter is not addressed in the European Commission report).	University of Natural Resources and Life Sciences' (Vienna) "The Krško NPP in light of the nuclear disaster in Fukushima"	natural hazards	The NPP Krško site has undergone several seizmical studies since it was put into operation. The last comprehensive study was done in the scope of the first PSR in 2003. From all these studies it is clear that the site is seismicaly active and that due precautions should be taken into account to compensate for this fact. Therefore both the operator and the SNSA are looking for the ways how to improve robustness of the plant against the most severe earthquakes foreseeable on the site. Most of modifications under the SUP will contribute to further reduction of CDF caused by earthquakes. The Stress Tests campaign has shown the cliff edge effect for the core melt lies somwhere around 0.8 g, which is almost three times more than original SSE ground acceleration. As we understand the most severe earthquake to be expected at the site or even in Slovenia (the strongest one was in the area of Idrija about five centuries ago) would have smaller acceleration. It is general opinion of the regulator that it is much more usefull to invest resources into the equipment upgrades for increasing robustness than into additional seizmical studies. SNSA will, however, follow the development of the relevant science and if clear evidences of new methods apear, it will reconsider decision and request additional studies.	
442		3rd SNSA decision	emergency preparedness	In January 2012 SNSA issued the 3rd decision regarding the Fukushima event, with which it requires from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan. This work is to be finished until the end of 2012. The results of the review, possible proposals for improvements of the Radiological Emergency Response Plan, shall be implemented as apropriate.	3

No.	Recommendation	Source/ Chapter/ Page	Topic	Comment	Action
443		2nd SNSA decision	severe accident management	Within the reassessment of its severe accident management strategy, existing design measures and procedures, the operator has also reassessed its possibilities for alternative spent fuel strategy. The results showed that best strategy would be storing the spent fuel in dry cask storage with a possibility to combine it with later reprocessing. This modification / improvement shall be imeplemented until the end of 2018. In accordance with the latest study further actions shall be implemented on national level to change the national strategy and to enable licensing of the modification.	12