National Action Plan - Update 2014
FINLAND

ENSREG National Action Plans Follow-Up Workshop

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Outline

Structure of NAcP Update 2014 of Finland

Changes of NAcP

Background

Progress of implementation of NAcP actions since 2013

Identified good practices

Challenges

Questions addressed to Finland

Structure of NAcP Update 2014

Provides a readable overview on the progress of implementation of the actions and improvements introduced in the NAcP 2012.

Addresses all recommendations including ENSREG, Ext.CNS and national.

The structure of the update follows the structure of the original NAcP 2012 and is presented three parts according to a recommendation by ENSREG

- Part I: Topics 1, 2 and 3
- Part II: Topics 4, 5 and 6
- Part III: Summary table of all activities planned , in progress or implemented with schedule

The update is available to the public on STUK's website:
http://www.stuk.fi/ydinturvallisuus/fi_FI/fukushima-selvitykset/_files/93488389688590756/default/national-action-plan_stress-tests_Finland_dec2014.pdf

Major changes in the NAcP - Update 2014

No additional measures included, no actions removed.

Changes are related to the schedule of implementation and the refinement of measures.

Background information - good practises (1/2)

Existing requirements on Severe Accident Management systems

- Safety classified, independent, single failure tolerant
- Severe Accident management strategy and systems
- Implemented in 1980's and early 1990's

Existing requirements on full scope and living PSA levels 1 and 2 for all plant operating states

- Including seismic and external hazards PSAs (extreme weather conditions, man-made and their combinations) since -90's
- Design phase PSA required at Construction License, final at Operation License stage and living PSA during plant operation
- Several plant modifications have been done based on PSA results

Background information - good practises (2/2)

New Nordic guidelines for nuclear and radiological emergencies (The Nordic Flagbook) have been developed based on the existing Finnish guidelines in co-operation with five Nordic countries (February 2014)

- Denmark, Iceland, Norway, Finland and Sweden
- Guidelines take into account both domestic and foreign emergencies and cover both accidents and intentional acts
- Joint criteria allow consistent protective measures and advice in early and intermediate phases
- http://www.stuk.fi/ajankohtaista/tiedotteet/fi_FI/news_890/_files/91363928307537126/default/nordic_flagbook_february2014.pdf

Major actions implemented at the national level by the end of 2014

- Projects EXWE (Extreme weather and NPPs) and SESA (Seismic safety for NPPs) included in the Finnish national research programme SAFIR
  - EXWE e.g. occurrences and expected changes in the future, sea water level, abundant freezing rain, excess coastal snowfall, meteotsunamis
  - SESA e.g. analysis of data recorded in 2012 near Kouvola from an earthquake swarm, sensitivity modelling for a generic reactor building subjected to earthquake loads expected in Finland, challenges concerning equipment qualification
  - http://www.vtt.fi/inf/pdf/technology/2015/T213.pdf
- Emergency exercises including multi-unit scenarios at Loviisa NPP and intermediate phase at Olkiluoto NPP – 2014
- Ensuring sufficient amount of radiation protection equipment and monitoring devices for rescue services – 2014

Renewal of nuclear safety legislation and regulations (1/2)

Renewal of nuclear safety legislation and regulations effective in December 2013

- Lessons learned from recent events, Fukushima Dai-ichi accident and oversight projects
- IAEA Requirements, WENRA Safety Reference Levels and WENRA safety objectives for new reactors
- Requirements for on-site emergency preparedness regarding a simultaneous accident of all nuclear facilities on site, a long duration of emergency situation, emergency centres

Renewal of nuclear safety legislation and regulations (2/2)

YVL Guides are to be applied as such to new NPPs

- application to the operating plants and plants under construction is considered case by case
- Licensees' assessments whether the facility and the licensee operations are in compliance with the revised requirements under review by STUK – 2015
- in case of non-compliances the licensee is expected to propose plans and schedules for achieving compliance
- an exemption from a new requirement can be accepted if it is not technically or economically reasonable to implement respective modifications, and if, the safety justification is considered adequate.

Updating of the Regulatory Guides by the end of 2017 with consideration against the new WENRA Reference Levels 2014.

Major actions implemented at Loviisa NPP

- Updating the fire seismic fragility analyses for fire fighting systems – March 2013
- Evaluation of demineralised water usage in an accident concerning all units and SFPs at site – May 2013
- The DC batteries of the DG automation of the auxiliary emergency feed water system have been replaced for 72 hours' operation – Loviisa 1 2013 and Loviisa 2 2012
- Replacement of batteries for secured power supply including strengthening of their racking for earthquakes – 2014
- Capability of dealing with multi-unit accidents, updating the emergency plans and organisation – June 2013
- Plans for restoring the access routes to the site – December 2013
- Evaluation of suitability of emergency preparedness personnel to their duties – March 2013
- Plans for access control and radiation monitoring of the staff and decontamination measures in extreme natural hazards – December 2013

Alternate decay heat removal system at Loviisa NPP

Two air-cooled cooling towers per unit as an alternative ultimate heat sink

- No connections to seawater systems or emergency diesel generators (powered by additional air-cooled diesel unit)
- One tower removes the decay heat from the reactor via residual heat removal system (RR)
- The other removes decay heat from the spent fuel pools via the intermediate cooling system (TF)
- Installed in 2014, commissioning 2015

Figure by Fortum

NAcP Actions on-going at Loviisa NPP

Protection against seawater flooding at Loviisa NPP (1/2)

Three alternative flood protection concepts have been assessed by the licensee

1. Flood protection wall
2. Comprehensive improvement of all buildings against flooding - waterproofing
3. Strengthening of flood protection of certain buildings important to safety – waterproofing

All solutions above have uncertainties and might even lead to worse situation

- flood wall and heavy rain might lead to flooding of some safety significant buildings, equipment instead
- a comprehensive protection of all buildings in operating plant against flooding in practical challenging and uncertain due to many doors, inlets, ducts etc.

Protection against seawater flooding at Loviisa NPP (2/2)

The licensee is now updating estimates for the extreme values of seawater level at the plant on the basis of the study on high sea water frequencies recently conducted by the Finnish Meteorological Institute.

- Very low frequencies, however, cliff edge concern

Based on these studies, the licensee of Loviisa NPP will make final decisions to improve plant flood protection concept in 2015.

Enhanced seawater flood protection during outages at Loviisa NPP

The modification consists of heightening the ‘stoplog’ gates VC10/50 of the circulating water system at the outtake channels at both units (+ 2,1 m ➔ + 3 m).

The modification is carried out in stages 2012 – 2018 (original 2016)

- The installation of the VC gates is possible to carry out during long outages
- The installation has to be adjusted with the on-going renewals in the service water piping (VF) connected to the VC channels

The modification is preliminarily estimated to decrease the total CDF approximately by 1 - 2 %. New estimates of extreme water level values will affect.

STUK has requested the licensee to assess of the risk impact of the delay.

Use of mobile equipment at Loviisa NPP

The need of mobile equipment will be considered as a part of the plant flood protection strategy.

As required in the updated STUK YVL B.1 *Safety design of a nuclear power plant*, Req. 450:

"…It shall be possible to carry out decay heat removal in rare external events without relying on power supply from transportable sources for at least eight hours without any material replenishments or recharging of the DC batteries. In addition, a sufficient inventory of water and fuel and capability to recharge the DC batteries shall exist on the site to enable decay heat removal for a period of 72 hours."

The guide was issued after the licensee had made its' study of the possibilities to use mobile equipment. Because the requirement 450 above prevents use of mobile power supply on the first eight hours of a rare external event, the licensee had to reconsider the plant flood protection strategy.

Capacity of rainwater drainage system at Loviisa NPP

The licensee has performed a study of present drainage situation.

Due to the site location as surrounded by the sea, the drainage is not considered a large problem, since heavy rains do not affect the sea level and the excess water will overflow to the sea.

However, the capacity of rainwater drainage system will be reassessed along the design of the overall plant flood protection concept.

Ensuring water injection into the spent fuel pools at Loviisa NPP

The modification consists (both units)

- Auxiliary cooling system of SFP in reactor hall
- Auxiliary cooling system of spent fuel interim storage
- Instrumentation for monitoring water level and temperature

Designed for DEC situations for one year operation.

Pool measurements will be based on robust, simple and reed relay-based technology, and are visible outside pool rooms and independent from power supply or any other systems.

Schedule:

- Updated conceptual plans has been submitted to STUK by the end of 2014
- Detailed design of spent fuel interim storage auxiliary cooling system by the end of 2015/beginning of 2016, equipment acquisition 2017
- Detailed design of SFP auxiliary cooling system in reactor hall and equipment acquisition 2016 - 2017
- Implementation planned to be ready 2018 (original plan 2017)

Major actions implemented at Olkiluoto 1 & 2 NPP

- Updating the seismic fragility analyses for fire fighting systems and SFPs – February 2013;
  - reinforcements of the old fire fighting systems done 2013 – 2014, new pumping station 2014 - 2015
  - resistance of SFP 0,3 g PGA (TVO and MMI)

- Improvement against exceptional high seawater level on the cooling systems of spent fuel interim storage – 2013

- Four mobile diesel aggregates of larger capacity purchased and delivered at site 2014.

- Capability of dealing with multi-unit accidents, updating the emergency plans and organisation – October 2013

Major actions implemented at Olkiluoto 1 & 2 NPP

- Plans for restoring the access routes to the site – December 2013
- Evaluation of suitability of emergency preparedness personnel to their duties – March 2013
- Plans for access control and radiation monitoring of the staff and decontamination measure in extreme natural hazards – December 2013
- Enhancement of adequacy of maintenance personnel in case of emergency – March 2013
- Enhancement of the emergency plan on radiation measurement patrols – March 2013

Independent reactor cooling and residual heat removal system at Olkiluoto 1 and 2

Consists of two systems operating at different reactor pressure.

Alternate Coolant Injection System (ACIS)

- Automatically actuated (low reactor water level or low voltage) steam turbine pump circulates water from the demineralised water tank at reactor pressure range 70 – 10 bar

Low pressure Coolant Injection System

- Through the fire fighting water system
- Fixed piping between fire fighting system and reactor
- Additional manually activated and removable booster pump with a dedicated power supply (diesel aggregate)
- Operates when reactor pressure is below 15 bar

Scheduled 2015 – 2017.

Enhancement plan for Olkiluoto 1&2

ACIS – conceptual plan

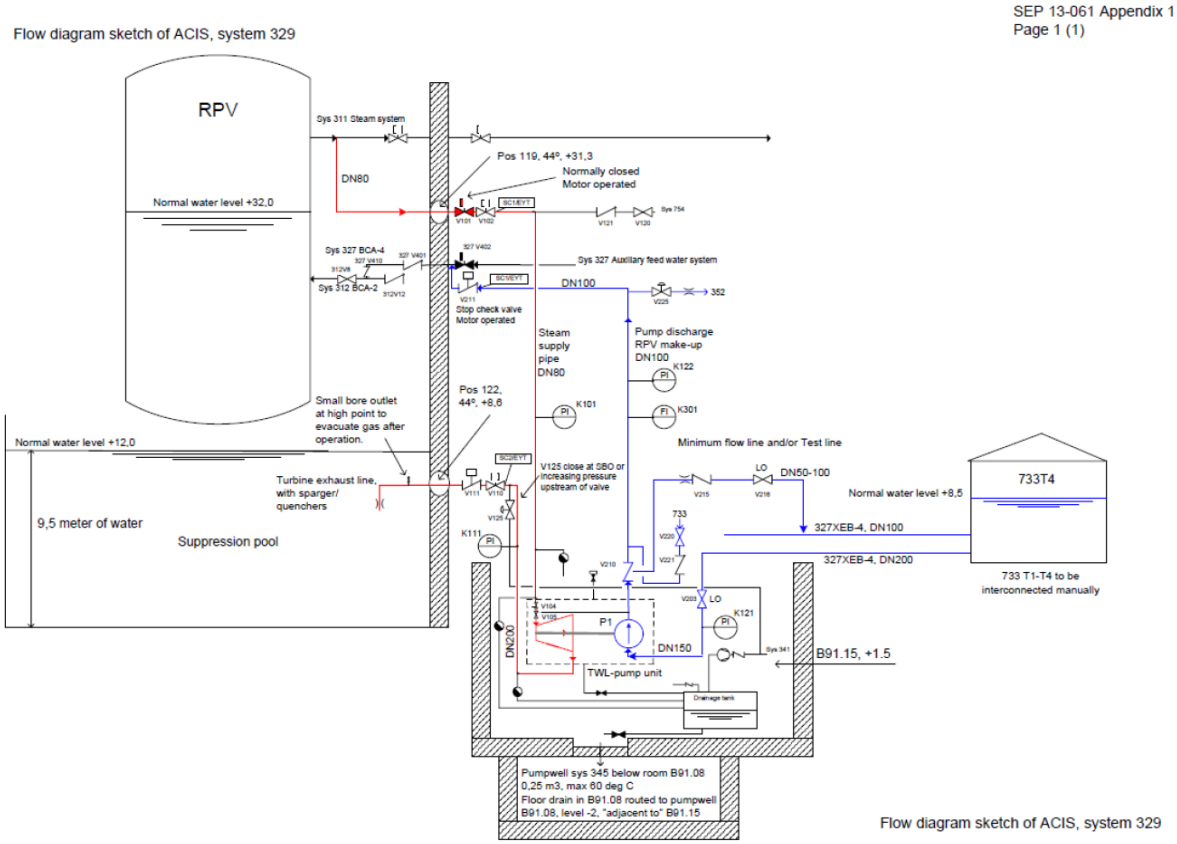

Figure by TVO

Ensuring auxiliary feed water system function (327) in LUHS at Olkiluoto 1 & 2 NPP

Modification consists of new recirculation piping arrangements in 327 system.

Conceptual and detailed presented to STUK in 2013.

Installations of subsystems at unit 1 – 2014, and unit 2 during - 2015.

Ensuring water injection into the spent fuel pools in reactor building and interim storage at Olkiluoto 1 & 2

External water injection junctions to the spent fuel pool water systems through fire-fighting mobile pumps in 2014 at unit 1 and 2015 at unit 2 reactor buildings and spent fuel interim storage 2015.

Improved measurements for monitoring the water level and temperature are based on robust , simple and reed relay-based technology and visible outside SFP room and independent from power supply or other systems 2014 – 2015.

Mobile equipment at Olkiluoto 1 & 2 NPP

Two new mobile fire fighting pumps for cooling water injection into containment in SA and cooling water injection into SFPs in reactor halls (both units) and spent fuel interim storage pools – 2014 - 2015.

One small aggregate for supplying automation will be later – 2015?

Modifications related to electric system connections regarding mobile equipment are planned to be implemented in 2015.

NAcP implementation at Olkiluoto 3

Two open items in NAcP

- Evaluating modifications for independent decay heat removal system
- Ensuring the water injection into the spent fuel pools with mobile pumps
- Will be introduced with the operating licence application

Identified good practises

Modern nuclear safety legislation and regulations

Continuous improvement, feed back from full-scope, living PSA

The Nordic Flagbook - Co-operation across borders resulting in the guidelines for nuclear and radiological emergencies

The Finnish National Safety Research Programme SAFIR gives a framework for actual safety issues of interest (e.g. Research area were re-evaluated after Fukushima ➔ EXWE, SESA)

Challenges

Ageing management of operating plants

- Major modifications on-going (e.g. modernisation of refuelling machine, reactor hall cranes, digitalisation of I & C)

Prioritisation of the safety improvements

- On-going and planned improvement projects other than those originating from the Fukushima Dai-ichi accident
- Focused evaluations (such as ”Stress Tests”) may concentrate on modifications that are not necessarily effective in improving the overall safety

Rapporteur's report - 2013

Peer-review conclusions

- NAcP followed structure proposed in the ENSREG national plan
- Transparency – NAcP published on the STUK website
- Most actions implemented in 2014, the rest by 2018
- Continuous improvement, feed back of PSA
- New seismic requirements applied with modifications of operating units
- Improvement of core cooling
- No extended use of mobile equipment; supplementary independent, diversified and protected fixed equipment instead

National Action Plan Update 2014– FINLAND

Additional questions

With answers published on STUK's website:
www.stuk.fi/ydinturvallisuus/fi_FI/fukushima-selvitykset L

Summary table of questions, comments

Related topic	Number of questions
TOPIC 1	
- Seismic	5
- Plant flooding protection	3
TOPIC 2	
- Mobile equipment	3
- Alternate heat removal, DC batteries	
TOPIC 3	
- Severe Accidient, contaminated water, EP	
TOTAL	44

Conclusions

Implementation of actions specified in NAcP are mainly followed as planned, and despite of the delays presented all Fukushima originated measures are expected to be carried out during 2018.