Post-
Fukushima
accident

ENSREG 2nd National Action Plan Workshop

Summary Report

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ENSREG
European Nuclear Safety Regulators Group

SUMMARY REPORT
2ND ENSREG NATIONAL ACTION PLANS WORKSHOP

EXECUTIVE SUMMARY

ENSREG National Action Plans (NAcPs) describe the actions, identified following the Fukushima Dai-ichi accident, that were taken, planned or implemented and their schedule to improve the safety of European nuclear power plants (NPPs). In April 2013, the NAcPs were subjected to a peer review to discuss contents and status of implementation of NAcPs. The scope of this first workshop focused on the topics of the EU Stress Tests (natural external hazards, loss of safety systems/design issues, and management of severe accidents). In 2014, NAcPs were updated and were the input for a new review process.

The main objectives of the 2nd ENSREG National Action Plan (NAcPs) Workshop, held on 20-24 April 2015 in Brussels, was to peer review the contents and status of implementation of the NAcPs via a common discussion and to exchange technical information on measures and activities contained in the NAcPs.

The Stress Test peer review recognised the importance of the Periodic Safety Review process as a powerful tool to be used for continuous improvement of nuclear power plants, including the necessity to maintain the containment integrity under severe accident conditions, the assessment of natural hazards and margins and the implementation of protection and mitigation measures for severe accident conditions. The 2015 NAcP peer review process identified many findings and activities directly related to these topics.

The 2015 workshop supported the consistency of actions contained in NAcPs, as well as promoted sharing of technical information, identifying commendable practices, experiences and challenges within European countries.

The discussion took place in an open constructive and challenging atmosphere. Transparency on the implementation of lessons learned from the Fukushima Dai-ichi accident was provided. Experts (110 experts attended partially or during the full week) from 20 European Union member States, Switzerland and the Ukraine, the European Commission, as well as observers from other additional countries (Armenia, Norway, Taiwan and the United Sates) participated.

All countries reported measures adopted, or planned to be adopted in their NPPs, as well the results from studies and analyses, modifications and regulatory actions, and corresponding implementation schedules in their NAcPs. During the workshop it was recognised that some countries had previously and continuously updated their NPPs by providing new or improved equipment or features before the stress tests process commenced. This was done as a consequence mainly of the TMI and Chernobyl accidents (e.g. severe accident management systems), either within their Periodic Safety Review process, or immediately after Fukushima (e.g. mobile equipment).

The workshop identified that a considerable number of actions listed on the NAcPs has been completed under the oversight of the regulatory authorities. However, the status of implementation of actions differs between the participating countries. While some countries are almost finished with their implementations, others have clear schedules to complete their actions by 2016. Most of the countries are progressing adequately with the implementation of their NAcPs, although some

countries have rescheduled some specific actions up to 2020.

As part of the continuing improvement process many regulators are updating their regulatory requirements taking into account the lessons learned from the Fukushima Dai-ichi accident and the 2014 updated WENRA Safety Reference Levels. The implementation of new requirements may require additional measures to improve safety, with an appropriate schedule for implementation. The countries reconfirmed their commitment to implement in the national regulations these safety reference levels by 2017.

All participating countries are strongly committed to the full implementation of identified improvement actions in their respective NAcPs, under the oversight of the regulatory authorities..

The workshop concluded that a follow-up of the completion of implementation of the pending actions contained in the NAcPs is necessary. This follow-up could take advantage of the updated NAcPs to be prepared under the framework of ENSREG and the second national report on the revised Directive expected for 2020. The ENSREG Working Group Nuclear Safety (WG1) should propose the appropriate process.

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1. Introduction

1.1 Background to the EU Stress tests process

In the aftermath of the nuclear accident that occurred at the Fukushima Dai-ichi nuclear power plant in Japan on 11 March 2011, the European Council requested at its meeting of 24-25 March 2011 that European Nuclear Safety Regulators Group (ENSREG) and the European Commission should review all EU nuclear power plants (NPPs) on the basis of a comprehensive and transparent risk and safety assessment ("stress tests") in light of the Fukushima lessons learned. The Council invited ENSREG and the European Commission to develop the scope and modalities for the stress tests for NPPs with the support of the Western European Nuclear Regulators' Association (WENRA). The stress tests were conducted by the European NPP licensees and reviewed by the national regulators who prepared national reports on their assessments. The stress tests focus was on the following three topics: natural external events (including earthquake, flooding and extreme weather conditions), the loss of safety functions and severe accident management.

The national reports were completed in December 2011 and peer reviewed through a process organised and overseen by ENSREG. Country visits were undertaken as part of the peer review. The outcome of the stress tests were one main Peer Review report and 17 individual country peer review reports summarising the studies made and actions decided in different countries. The main report also included recommendations and suggestions to further improve safety of the European NPPs. ENSREG endorsed the stress tests peer review report and published a joint statement dated 26 April 2012. This statement concluded that follow-up activities would occur through an action plan developed by ENSREG on 25 July 2012 and agreed on 1 August 2012. In October 2012 ENSREG published a compilation of the recommendations and suggestions included in the stress test peer review report.

1.2 National action plans

The ENSREG Action Plan of 25 July 2012 requested that each national regulator develop and make public a NAcP. The NAcPs describe the actions, identified following the Fukushima Dai-ichi accident, that were taken, planned or implemented and their schedule to improve the safety of nuclear power plants (NPPs). ENSREG requested that a NAcP peer review workshop be held at the beginning of 2013 to discuss contents and status of implementation of the national action plans. One of the aims of the workshop was to ensure that the recommendations and suggestions from the stress test peer review were addressed by national regulators in a consistent manner.

The first NAcP workshop was held between 22-26 April 2013. In advance of the workshop, stakeholders had the opportunity to post questions and comments on the NAcPs via the ENSREG website. Based on the pre-workshop analysis of each NAcP, on the comments raised by stakeholders as well as the discussions held during the ENSREG workshop, commendable issues and challenges were identified. ENSREG considered the workshop to have been a highly successful exercise and endorsed a follow-up NAcP peer review to be completed in 2015 when the results of important studies and assessments identified in the 2012 NAcPs are available.

In December 2014, all ENSREG members, Switzerland and Ukraine updated and published their NAcP. The 2014 NAcP provides:

- An update on the implementation of actions outlined in the 2012 NAcPs;
- Main changes in the NAcPs since the 2013 workshop
- The technical basis leading to the main changes identified in the NAcPs.
- Details of relevant outcomes from studies and analyses identified in the 2012 NAcPs.
- Challenges and commendable practices identified during the implementation process.

2. 2nd NAcP Workshop Process

2.1 Preparation of the workshop and Scope

The ENSREG working group on nuclear safety (WG1) developed the Terms of Reference for the 2015 NAcP review process. This included report templates to be used by the presidency and officers of the workshop and a detailed scope for the process.

The scope of the review process and 2015 workshop included the following:

- Update on progress with implementation of actions specified in the 2012 NAcPs;
- Main changes in the NAcPs since the 2013 workshop, including:
    - additional measures
    - measures removed or modified
    - changes in the implementation schedule
- Technical basis leading to the main changes identified in the NAcPs.
- Relevant outcomes of studies and analyses identified in the NAcPs, and completed since the 2013 workshop.

In January 2015, the NAcPs of the participating countries were published on the ENSREG website. In advance of the workshop, each NAcP was reviewed by other participating countries which raised questions and comments. These questions and comments were sent to the relevant country and rapporteurs to be taken into account in the national presentation and rapporteurs' workshop report. Questions and comments were also raised by the public to be taken into account in the same way (see paragraph 2.4 below). More than 1000 questions and comments were submitted, not only by reviewers from regulatory authorities but also by the general public and stakeholders. All participating countries were requested to address these in their respective national presentations. Additionally, although not requested to do so, the majority of countries prepared answers in written format.

2.2 Objectives

The main objective of the second NAcP workshop was to present the status of implementation of and any changes to, the 2012 NAcPs. The NAcP peer review considered the extent to which the relevant post Fukushima assessment outcomes as well as ENSREG and the Convention for Nuclear Safety recommendations and suggestions have been taken into account. The purpose of a common discussion was to support consistency and promote the identification and sharing of commendable practices and experiences and to identify challenges.

The review was not intended to provide a detailed technical assessment of the NAcPs individual measures. Nevertheless, appropriate technical aspects were considered to the extent necessary to understand the actions and improvements identified.

2.3 Conduct of the Workshop

The contents and status of implementation of the NAcPs were presented and peer reviewed via a common discussion at the second ENSREG NAcPs workshop held in Brussels on 20 – 24 April 2015. Workshop participants included: 110 experts from 20 European Union member States, Switzerland and the Ukraine, the European Commission, as well as observers from other additional countries (Armenia, Norway, Taiwan and the United States).

All fourteen EU Member States that operate nuclear power plants[1] plus Lithuania[2] as well as Switzerland and Ukraine presented their NAcP´s. The national presentations were structured according to the elements of the general scope for the workshop. The presentations also took into account questions raised before the workshop. All national report presentations and discussions at the workshop were made in plenary sessions.

[1] Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Netherlands, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom

[2] Where the Ignalina NPP is being decommissioned.

The presentations and discussions of NAcPs were followed by 12 rapporteurs, who collated the outputs and drafted country specific reports. No rapporteur was assigned to monitor his/her own country.

A special technical session of the workshop included a presentation by the USNRC on the experience and requirements of the USNRC after Fukushima. This technical session included presentations from a number of EU member States on their approaches to Periodic Safety Review (PSR). In addition, WENRA provided a presentation on the WENRA safety reference levels, that have been recently updated in the light of the lessons learned from Fukushima.

The presentation of Michael Franovich, deputy director of the NRC's Japan Lessons-Learned Division, described in an extensive way, the process in U.S.A. There was not an internationally steered process like the Stress Test, but somewhat similar processes took place in the U.S.A. led by the USNRC and the joint NRC/US industry Fukushima steering committee, resulting in, for instance, FLEX (immediate measures) and decisions and orders from NRC. After the presentation there was a long and lively exchange of view of the pro and cons of the solutions and processes used on both sides of the Atlantic Ocean and its results.

In order to discuss approaches to Periodic Safety Review (PSR) in Member states, four presentations were made by:

- Mr. Manuel Rodríguez, Deputy Director for Nuclear Installations at CSN
- Kirsi Alm-Lytz, Director of Department of Nuclear Reactor Regulation at STUK
- Fabien Féron, ASN, Deputy Director of the NPP department, with special responsibility for regulations and new builds.
- Mr. Gary Cook, ONR, who has led the latest PSR review at Sizewell B and Fukushima-related projects at the UK gas cooled nuclear power plants

Although the same standards (WENRA Safety References Levels and IAEA-standards) were used as a basis by all these member states, the resulting process was quite different. In some states the licensees had a strong obligation to proactively find ways to improve safety in their plants and apply for permission to execute these improvements, in other states the regulator had had a greater part of the responsibility to initiate improvements of the safety of nuclear installation. During the ensuing panel discussion all presenters were involved in enlightening exchanges with the audience. In the discussion it was clearly stated that these processes contribute substantially to continuous improvement in nuclear safety.

Related to WENRA safety reference levels, the presentation was given by Mr. Fabien Féron, ASN, a member of WENRA's Reactor Harmonisation Working Group (RHWG) since 2009 and now its newly designated chair. He gave an introduction to WENRA's Safety Reference Levels (SRLs), purpose and the process used when developing them, using the revisions of reactor SRLs taking into account the experiences after the Fukushima accident and associated guidance as an example.

The workshop concluded that a follow-up of the completion of implementation of the pending actions contained in the NAcPs is needed; the ENSREG Working Group Nuclear Safety (WG1) should propose the appropriate process. This follow-up could take advantage of the updated NAcPs to be prepared under the framework of ENSREG and the second national report on the revised Directive expected for 2020.

2.4 Transparency of the Stress Tests follow-up process

One of the key objectives of ENSREG is to improve the overall transparency on issues relating to the safety of nuclear installations and effective radioactive waste management. Therefore possibilities for public interaction were provided during the EU stress tests and follow-up process. National regulators published their NAcPs on their website (in most cases

in their national language). English versions of the NAcPs are also available on the ENSREG website.

The general public was informed via the ENSREG website about the peer review process. The public had the opportunity to give comments and put questions regarding the NAcPs and the peer review workshop via the ENSREG website. These comments and questions were an additional input for the workshop. The written answers to the questions provided by most countries were of considerable assistance to the rapporteurs in establishing their reports. It was agreed that the publication of these answers would be a national responsibility.

At the end of the second workshop (24 April 2015) a press statement of the workshop President was issued. The Peer Review Workshop Report will be published after the approval by ENSREG and will be presented at the ENSREG Conference on Nuclear Safety (29-30 June 2015) to the public.

3. Findings (overview)

3.1 The consistency and scope across the NAcPs

The 2012 NAcPs were produced to a format issued by ENSREG. These plans were revised by 31 December 2014 to reflect changes and developments since the first NAcP workshop in 2013. The detailed structure of the 2012 NAcPs varied between countries and therefore it was considered not appropriate to propose a new detailed format, but to only identify the principles for the 2014 revised NAcP.

In the majority of cases, the 2014 NAcPs was an update of the existing 2012 reports, rather than a new document, with the emphasis on highlighting updates and changes to the NAcP. In general the revised NAcP incorporated the topics specified in the workshop scope as well as:

- Response/clarification on any issues identified in the rapporteur's report from the 2013 workshop.
- Nationally identified commendable practices and challenges during implementation so far.

3.2 Progress on implementation and update of the NAcP

The workshop identified that a considerable number of actions listed on the NAcPs has been completed under the oversight of the regulatory authorities. However, the status of implementation of actions differs between the participating countries. While some countries are almost finished with their implementations, others have clear schedules to complete their actions by 2016. Most of the countries are progressing adequately with the implementation of their NAcPS, although some countries have rescheduled some specific actions up to 2020. The main reasons reported for these delays were:

- Number and magnitude of the modifications required
- New insight on identified issues and ongoing discussions
- Ongoing discussion between the regulatory body and the licensee on how to fulfil requirements through implementation of new systems or upgrade of existing systems.
- Dependence on legal or administrative measures.
- Financial constraints.
- Difficulties and delays related to the supply of components and the implementation of contracts.
- Completion of on-going studies and research.

3.3 Main changes in the NAcP since the 2013 workshop

All countries updated the NAcP´s and took into account the country specific recommendations and suggestions following the first NAcP workshop.

Some Countries reported in the NAcP, that significant safety improvement had already been completed at the NPPs, prior to the Fukushima Dai-ichi accident as consequence of the TMI and Chernobyl accidents (for example bunkered systems, filtered containment venting system, Passive Autocatalytic Re-combiners, or accident procedures such as primary and secondary feed and bleed), or in 2011/2012 immediately after the Fukushima accident, as for example mobile equipment.

A majority of 2014 NAcP identified changes on the implementation schedule, as consequence of the results of the analysis needs, hardware improvements, procedural modifications and regulatory actions, from the corresponding implementation schedules in their 2012 NAcPs. In several cases further national review from the regulatory authority is still pending and may lead to additional measures. On-going investigations and analyses may lead to changes and

reschedule in the achievement of NAcP actions.

As part of the continuous improvement process many regulators are updating their regulatory requirements taking into account the lessons learned from the Fukushima Dai-ichi accident. The implementation of new requirements might require additional measures to improve safety, with an appropriate schedule for implementation.

3.4 Technical basis leading to the main changes and Relevant outcomes of studies and analyses identified in the NAcPs,

A number of countries reported that the outcomes of technical studies and analyses resulted in changes to their respective NAcPs.

The reported technical analyses or feasibility studies were required to verify and assess additional prevention and mitigation measures. The results of studies have sometimes led to changes in the strategies related to containment integrity and heat removal under severe accident conditions. Some of these changes are still under consideration. During the workshop studies and analyses on the following topics were reported:

- Analyses of hydrogen distribution in containment and surrounding rooms.
- Cooling of molten corium in and ex vessel.
- Refinement of the assessment of seismic activities and extreme weather conditions.
- Containment integrity and heat removal.
- Evaluation of robustness of systems, structures and components.
- Survivability of dedicated I&C.

The technical outcomes of the reported studies and analyses leading to changes were not discussed in depth during the workshop due to the limited time available.

3.5 Commendable aspects (commendable practices, experiences, interesting approaches) and challenges

The most commendable aspects and the challenges identified during the presentations and discussions in the workshop are summarised in this chapter. In addition these commendable aspects may be used as references for safety improvements in other NPPs, reflecting the reactor technology.

3.5.1 Commendable aspects

During the review meeting a number of commendable aspects were identified. It should be noted that some of these aspects may already be implemented in some countries.

Commendable aspects identified include:

- Relying more on fixed equipment instead of mobile equipment in particular during the initial phase of the accident, in as far as they are protected against external impacts.
- Protecting additional fixed safety equipment against external hazards (bunkered systems). In some cases, safety functions were required to be available in case of external events with frequencies well below 10^{-4}/yr.
- Increase the autarchy/capacity of bunkered systems beyond the design basis.
- Building an alternative emergency management building on-site (capable of withstanding extreme events).
- On-site bunkered control facility with the capacity to control SAM equipment
- Centralized emergency support centre including the possibility for rapid intervention.
- Provisions for the management of large volume of contaminated water should the prevention and mitigation strategies fail.
- Actions (procedures, equipment, etc.) to mitigate the consequences of loss of control of

large areas of the facility caused by fires or explosions.
- Trans-boundary working groups and cooperation for off-site emergency response[3].
- For smaller reactors, implementation of measures needed for in-vessel retention for molten corium
- Emergency exercises dealing with multi-unit accident scenarios
- Use of full-scope simulators for training on severe accident.
- The general implementation and continued review of Severe Accident Management Guidelines, SAMG, including the adequacy of the training process.
- Extension of the stress test review on nuclear installations other than NPPs, to embrace e.g. research reactors and fuel fabrication facilities.

3.5.2 Challenges

The following challenges were identified for some countries during the workshop:

- Delay compared to the initial schedule for complex safety related actions (Filter Containment Venting, Passive Autocatalytic Recombiners, emergency management building, hardened safety core, etc). Detailed schedules for specific measures resulting from analyses and studies to be compiled.
- Difficulties with the implementation of actions due to financial constraints, which would require a regulatory position.
- Availability of dedicated instrumentation and control required for accident management qualified to remain operable under severe accident conditions and extreme hazards.
- Hydrogen management outside the containment.
- Integration of concurrent safety related improvements, such as the implementation of the NAcPs, updated WENRA Safety Reference Levels and the findings from the Periodic Safety Reviews.
- Containment integrity in severe accident conditions and heat removal from the containment with independent qualified systems and selection of the strategy for the molten corium retention.
- Accident conditions arising during reactor shutdown with no containment integrity.
- Assessment of the management of large volumes of contaminated water
- Periodic review of natural hazards (including seismic, flooding and extreme weather conditions) and the relevant plant provisions during Periodic Safety Review according to ENSREG recommendation.

3.6 Transparency of the NAcP and of the process of the implementation of the tasks identified within it

All participating countries are strongly committed to the issue of transparency of their work. All regulators posted the 2012 and revised NAcPs (2014) in English and some also in their own national language. In addition the NAcPs are available in English via the ENSREG homepage.

Many Countries provide information on the status of implementation of their NAcP on a regular basis; at least annually. Such information is published via the national regulator's website.

All countries are committed to follow-up the implementation of their NAcP until all measures have been finalised.

[3] although not a specific core issue arising from stress test exercise

4. Country-By-Country Main Findings Resulting From The Workshop

The conclusions for all 17 countries that presented their NAcPs at the 2nd workshop are reported below:

4.1 Belgium

Belgium gave comprehensive and understandable information in its National Action Plan (NAcP) prepared for the 2013 ENSREG review workshop. The NAcP is in compliance with the national stress tests, the results of the country visit within the ENSREG Peer Review, the recommendations and suggestions of ENSREG and to those of the extraordinary meeting of CNS. The NAcP doesn't closely follow the structure proposed by ENSREG, though it covers all the required sources and the issues identified.

Although the action plan of Belgium is being carried out without legally binding ordnances from the national regulator, at the time of the 2013 review workshop the actions were being completed mainly as scheduled.

The majority of planned actions were originally to be implemented by the end of 2013, only 3 of them were planned to 2017 and the deadlines of a handful of actions were not fixed yet. After the 2013 ENSREG workshop some substantial and unexpected political and technical complications emerged in unrelated fields, causing significant delays relative to the original plans. Still the progress with the completion of the action plan was substantial during the past two years. The main priority was given to the protection against external natural hazards, causing some delays in the completion of Complete Station Black-Out related actions.

In spite of the political uncertainties with regard to the future of Doel 1&2, the regulator made clear that it is a precondition of an Long Term Operation approval that all the related NAcP actions are to be reinitiated.

Belgium has extended the stress test exercise to other nuclear installations than nuclear power plants which is considered as a good practice. 2015 update: A Stress Test covering man made events has also been performed in Belgium, another good practice.

By the 2015 review workshop the detailed design for the filtered containment venting is completed, making the completion of the installation by the planned schedule (2017) realistically achievable.

Belgium has elaborated a very detailed action plan in order to further improve the safety of its nuclear power plants. The implementation of this plan is closely monitored by the regulatory body; the analysis results are reviewed and the modifications are approved as applicable and the progress of the programme is inspected regularly.

4.2 Bulgaria

Bulgaria gives comprehensive and understandable information on the improvement of safety of its NPPS in the light of the Fukushima Daiichi accident, in accordance to the national stress tests, to the recommendations and suggestions of ENSREG and to those of the Extraordinary Convention of Nuclear Safety, EO CNS. In addition to the operating two NPP units, the spent fuel storage facilities are also covered by the action plan.

The NAcP closely follows the structure proposed by ENSREG with some specific interpretation of "Additional actions". Some of the actions referred in the NAcP are quite complex, actually covering several elementary actions.

The implementation of all actions is planned before the end of 2017 and this is still valid in the up-dated NAcP of 2015. Several actions were already completed by the time of the 2013 review work-shop, while the majority of actions were "in progress", and some were not started yet, but their completion dates were scheduled. Internal milestones were not referred to in the document. The up-dated report of 2015 presents that 2/3 of the total number of actions are already completed and all the remaining actions are in progress, including 12 of the 14 new actions defined in the meantime, while 2 of those are already completed. A small fraction of the actions have been re-scheduled.

Several commendable practices and experiences were identified in the 2013 report and, in addition to those additional actions are spotted in the 2015 review. The most important are: the establishment of flexible connectivity of 0.4 kV and 6 kV mobile diesel generators, making their application interchangeable, including their applicability to re-charging the batteries; the use of a "plugging ball" in the ionisation chamber channels to prevent early containment by-pass in case of an ex-vessel molten core scenario; flexible and universal connectivity to external water sources applicable for re-filling the reactor, the SG, the containment or the spent fuel pool.

The optimum strategy for molten core handling for the VVER-1000 reactors has not been decided yet in the framework of an international research programme, however, several measures have already been completed in order to mitigate the consequences of or prevent an ex-vessel scenario. The management of large volumes of radioactive water after a severe accident is still under investigation. The SAMG is complemented by special instruction to evacuate the operating staff from the Main Control Room, if – during a severe accident – the dose rate exceeds a 1 mSv/h limit. At the same time an action is in progress to develop means to avoid this situation.

The Bulgarian action plan systematically covers all the items expected by ENSREG, outlining the situation in relation to every item and assigning action, whenever it is applicable. The progress demonstrated during the 2015 review meeting is substantial and shows that the action plan is basically progressing according to schedule.

4.3 Czech Republic

The NAcP (2012) of the Czech Republic informed comprehensively and in an understandable manner how each NPP is improved in the aftermath of Fukushima according to national assessments, the recommendations and findings of the European Stress Tests and the conclusions of the CNS process.

The implementation of improvement measures is clearly scheduled.

A number of ENSREG recommendations were in 2013 already in an advanced stage of implementation. Some measures scheduled for long term were in 2013 identified during the workshop as crucial ones, like analyses for maintaining the integrity of the containment and cooling of the molten core.

The updated NAcP follows the structure proposed by ENSREG and covers all aspects specified in the ENSREG Action Plan.

The updated NAcP comprehensively and in a well understandable manner informs on how each and every NPP in the Czech Republic are progressing in safety improvements. Review of legislation in the field of nuclear energy to reflect the 2014 WENRA Reference levels is in progress.

Additional measures (Actions 77-84) which emerged from a detailed analysis of ENSREG documents made in the period from May to September 2013, have been added to the NAcP.

Action No.:50, implementation of measures for maintaining long-term containment integrity for

Temelín NPP, has been specified and a deadline has been set. A highlight of analyses performed in relation to containment integrity is that the proposed strategy of ex-vessel cooling (ExVC) is effective and the necessity of installing a filtered venting to ensure long-term integrity of the containment has not been confirmed. The strategy ExVC will be implemented within action No.:50 with a deadline in 2022.

4.4 Finland

The Finnish NAcP gives comprehensive and understandable information on the safety improvements of the Finnish nuclear power plants after the Fukushima accident, taking into account the national stress tests, the recommendations and suggestions of ENSREG and the CNS summary report.

Finland followed the structure proposed in the ENSREG National plan. Most planned actions and recommendations have already been implemented before 2014. There are still a few actions, some coming from finalised studies that will be implemented by the end of 2018. However some particular actions have no specific deadline due to the specific stakeholders involved on national level.

Finland has adopted an approach of continuous improvement, utilizing the feedback of full scope Probabilistic Safety Assessments, including extreme weather conditions. Severe accident managements systems are required to be safety classified, qualified, independent and single failure tolerant.

Seismic safety assessments indicate that the retrofitting of all components and structures in existing plants to new seismic criteria is not necessary, but these criteria are taken into account for major modifications at the existing units and for new units. Also some modifications related to seismic resistance have been carried out based on the PSA results.

Finland is implementing several measures to improve core cooling. At Loviisa nuclear power plant, air cooled cooling units powered by an air-cooled diesel generator have been installed and long term decay heat removal in case of loss of sea water can be ensured. At Olkiluoto an independent way of pumping water based on the firefighting water system with additional booster pumps will be set up. Also steam driven pumps will be implemented for the early phases of the accident. Finland thus puts emphasis on backfitting of fixed installed systems, since requirements demand 8 hours of accident management without mobile equipment.

Finland also tries to handle the currently identified issues with updated and evolving regulations, together with an appropriate national research program. Furthermore in the context of emergency preparedness, Finland cooperates internationally and recently organized a multi-unit accident exercise.

Finland remarked that the lessons from Fukushima are not the only safety concern and that the prioritization of possible safety improvements is important in the sense of the desirable continuous improvement process.

4.5 France

The structure of the French National Action Plan complies with the ENSREG Action Plan. The information supplied is adequate in general. Where additional information was of interest, the countries and the public presented specific questions before the workshop.

The actions that France has defined address all recommendations, i.e. the general recommendations from the Peer Review, those specifically addressed to France, and the CNS recommendations. The measures defined are the basis for significant improvements of overall nuclear safety of French NPPs.

The NAcP and the process of implementation of the actions are transparent. The state of progress of each action is presented in the report. The report is available on the regulator's website. The regulator will inform every year on the progress of implementation. Within the stress tests, representatives of the French High Committee for Transparency and Information on Nuclear Security, the local information committees and several foreign safety regulatory bodies were invited to attend the technical meetings as observers and to take part in the targeted inspections.
The implementation of the NAcP has been rescheduled. Actions have been assigned to 3 phases, (phases 1 and 2 include the main safety improvements following Fukushima): phase 1 from 2012 to 2015, phase 2 from 2015 to 2020, and phase 3 from 2019 onwards in the context of the next periodic safety review of each plant. Most of the actions based on temporary or mobile means or related to the Nuclear Rapid Response Force have been completed according to the original schedule.

France had extended the stress test to all of its 150 nuclear installations (58 NPPs, NPPs under construction, fuel cycle facilities, research reactors, etc.). France also addressed social, organisational and human factors, which are key elements in safety. The regulator focuses on the renewal of the licensees' workforce and skills as well as the organisation of subcontracting, particularly the role of subcontractors in crisis management.

The actions that France has defined allow significant improvements of overall nuclear safety of the French NPPs and they are mainly focused on preventive and mitigative accident management in case of extreme natural hazards. They have been or will be designed with references that are well beyond current design basis.

There are two commendable aspects which deserve to be highlighted, i.e. the approach of the hardened safety core and the deployment of a Nuclear Rapid Response Force (FARN).

The approach of the hardened safety core is focused on beyond design basis events. Its objectives are prevention of an accident with fuel melt or limiting its progression, limiting large-scale radioactive releases and enabling the licensee to fulfill its emergency management duties. The safety core will include an additional ultimate electricity generating set for each reactor, a diverse emergency cool-down water supply for each reactor, new crisis management premises for each site, mobile devices and means of communication essential to emergency management, as well as technical and environmental instrumentation. The hardened safety core is designed to withstand a probabilistically defined increased seismic hazard (return period of 20,000 years), an updated flooding reference level where needed, and additional external hazards. The implementation of the hardened safety core approach proves to be challenging. Already the concept and design phases require a process lasting several years.

The Nuclear Rapid Response Force consists of specialized crews equipped with mobile equipment which can intervene within 24 hours simultaneously on all units of an affected site. It is already capable to intervene on a 4 plant-unit site. By the end of 2015 it will have a 6 plant-unit intervention capability.

4.6 Germany

Previous Germany's NAcP provided comprehensive information on how the robustness of NPPs was being reinforced in the aftermath of Fukushima and according to the recommendations and suggestions of the European Stress Tests and the conclusions of the CNS process. The Plan had identified that further work was still ongoing in some relevant technical areas. These have been generated by the BMUB and the Länder authorities and still under consultations of the Reactor Safety Commission (RSK). No schedule was identified.

After the revision of the NAcP, the following remarks may be added:

- Germany's revised NAcP provides comprehensive information on how the robustness of NPPs is being reinforced in the aftermath of Fukushima accident, according to the recommendations and suggestions of the European Stress Tests and the conclusions of

the CNS process. Nevertheless some of the activities included in the tables are not easy to fully understand.

- Related to the transparency of the process, the German report is accessible on the internet both English in and in German.
- Many measures had already been completed at the NPPs, either after the Chernobyl accident (for example filtered containment venting, Passive Autocatalytic Recombiners, nitrogen containment inertization for BWRs or accident procedures such as primary and secondary feed and bleed), or in 2011/2012 immediately after the Fukushima accident, as for example mobile diesel generator equipment.
- Some of the remaining identified activities and studies have been already completed, with some left to be finished in 2015.
- On behalf of the BMUB the RSK has issued two new recommendations dealing with extreme external events. Additionally two evaluating activities are currently on-going at RSK and one at SSK, with no identified schedule.

4.7 Hungary

The Hungarian NAcP from 2013 provided clear and comprehensive information on how the safety of their NPPs will be improved following the recommendations and suggestions of the European Stress Tests and the recommendations from the CNS. The structure of the Hungarian NAcP was compliant with the provided ENSREG guidance. The same applied for the content of the report which follows the ENSREG guidance very closely. The information provided in the NAcP was adequate and covers all aspects specified in the ENSREG Action Plan. The implementation of improvement measures was clearly scheduled with the specified timeframe to implement all the measures until the end of 2018.

In the updated NAcP from 2014, substantial progress has been made for actions identified in the NAcP from 2013. No actions have been removed or added to the plan. Many actions have been completed before the deadline. However, there are some actions which are delayed and some actions which have been modified mainly due to change of technical content.

The challenge for the actions which are still not completed is connected to management of delays, public procurement and the Hungarian authority to keep track of actions. As commendable practices identified during the implementation process, one can mention the development of a severe accident simulator for Technical Support Centre staff and the new backup command centre which is located outside the nuclear power plant and constructed with high security requirements.

4.8 Lithuania

The Lithuanian NAcP informs comprehensively and well understandably on how the safety of the Ignalina NPP, which is shut down, and the spent fuel storage facilities, including all spent nuclear fuel handling processes, in the country is going to be improved in the aftermath of Fukushima according to the national assessments, the recommendations and suggestions of the European Stress Tests and the conclusions of the CNS process.

The NAcP is transparent and accessible on the regulator's website.

The NAcP follows the structure of the ENSREG guidance. The items, that are relevant for Lithuania, which does not have operating nuclear power plants, are grouped in several subjects. Therefore it is not always clear how specific ENSREG recommendations and suggestions have been addressed.

The NAcP does not directly reply to comments related with the possible practical improvements of the spent fuel pools safety formulated by the Peer Review team in the Peer Review country report. During the 1st NAcP workshop Lithuania provided explanations on this issue, as well as how other ENSREG recommendations and suggestions have been addressed.

In 2013 almost all actions were planned to be implemented by the end of 2013 or were already implemented. Most actions demand additional studies and assessments, several imply procedural revisions and review of regulations, while some demand hardware modifications, such as new measurement equipments for the spent fuel pools.

In 2013-2014 some delays have appeared in the measures´ implementation. On the 14 initially planned measures, 6 measures are still ongoing and should be completed in 2015-2017. In particular two measures have been postponed by 4 years, to 2017, in relation with the updated planning of the construction of a new dry spent fuel storage facility.

The construction of a new nuclear power plant on the site of Visaginas is considered as a challenge for Lithuania. Lessons from Fukushima will be taken into account for this new unit.

4.9 Netherlands

The second edition of the Netherland's NAcP is maintaining its structure according to the ENSREG recommendation. The content of the Plan has been preserved and satisfactorily corresponds to the recommendations of the ENSREG Action Plan. The update has been made in a clear manner. Tables listing all measures were extended by a new column containing description of the current status of implementation of planned measures. The description is brief but provides information on whether the measure has been implemented or it is still in progress.

The revised NAcP informs that the majority of measures to improve nuclear safety planned by the end of 2014 have been done, remaining measures are in progress. There is certain delay for some measures due to objective reasons described in the NAcP (e.g. a decision to build a new ECR). During the workshop the Netherlands has informed that the new schedule proposed by the operator has been accepted by the Regulatory Body.

The revised NAcP contains a new section "Quick scan of compliance with recently updated WENRA SRLs" with a first verification of the status of implementation in Dutch regulations and at the NPP Borssele of the recently published WENRA RLs for existing reactors (Fukushima related changes). The preliminary conclusion is that after publication of the new guidance (Dutch Safety Requirements) and the implementation of the CSA and PSR measures The Netherlands will largely comply with the new SRLs. The Plan also contains a new Appendix A "Implementation of IAEA Action Plan as of October 2014".

The decision of the Dutch Government to create one single independent administrative regulatory authority for nuclear safety and radiation protection has been appreciated. The new organization (Autoriteit Nucleaire Veiligheid en Stralingsbescherming - or ANVS) started operation on January 1st 2015 and will be formally installed as an independent administrative body at the beginning of 2016. The new RB better complies with international requirements for RB (e.g. the IAEA safety guides).

Among commendable practices a long term practice of Periodic Safety Reviews and a comprehensive practical use of Probabilistic Safety Assessments (since 80-ties) are in place.

In addition following commendable practices have been identified since 2013:

- the alignment of implementation of post-Fukushima measures with activities in the framework of PSR
- the planned implementation of measures needed for in vessel retention for molten corium and following actions (first KWU-plant)
- building an alternative emergency management building on-site (capable to withstand extreme events).

The definition of a Reference Level Earthquake for the low-seismicity region of the Borssele plant is a challenge. The ongoing discussion causes delay in the implementation of some seismic

measures, in particular the construction of a new ERC building, protected against all extreme events. The regulator has stated during the meeting that a deadline has been set at June 2015 for the License Holder to deliver a justified proposal for an RLE. If the deadline is not met, the RLE value will be decided by the RB.

4.10 Romania

2013 Workshop summary: The NAcP informs comprehensively and clearly how the NPP will be improved in the aftermath of Fukushima according to the National assessments, the recommendations and suggestions of the ENSREG Peer Reviews carried out after the Stress Tests, the conclusions of the CNS process and other sources.

The NAcP follows the structure proposed by ENSREG and covers all aspects specified in the ENSREG Action Plan, with some exceptions that were clarified during the workshop. The NAcP – along with all EU stress test documents – is accessible on the regulator's website in English language.

The implementation of improvement measures is clearly scheduled, and the end date of the process (2015) is considered ambitious and commendable. At the time of 2015, only two of the planned improvements have slipped beyond the original target date of 2015, see details below.

Romania considered initially the qualification of instrumentation and monitoring under severe accident conditions (especially in the long term) as a challenge (ENSREG Recommendation 3.2.5). At the time of the 2015 workshop this has now been solved by the supply chain and installation of severe accident qualified equipment is underway with completion scheduled for 2016.

During the workshop several other commendable practices have been identified in the NAcP. These are e.g. the construction of a new on-site emergency centre, which is seismically robust and protected against external hazards as well as the development of a new off-site emergency control centre located away from the site or the prompt implementation of relevant containment protection measures as well as passive autocatalytic re-combiners and seismically qualified filtered venting. The second delayed activity is completion of the hazard qualified on site emergency control centre, the reasons for the delay were explained in the Questions and Answers and at the Workshop, and the compensatory mitigations temporarily in place were also described.

4.11 Slovakia

The 2014 NAcP provides the overall impression that the activities are well under way, and all issues identified post-Fukushima are pursued. This is well presented in the updated NAcP. The structure of the report is clear; up-to-date information is easy to find.

The original (2012) NAcP followed the structure proposed in the ENSREG Action Plan. It contained comprehensive information on the actions planned post-Fukushima, as well as on earlier safety improvements and measures.

The actions listed covered the ENSREG recommendations and the Country Peer Review recommendations. In the 2014 NAcP, a considerable part of the measures listed was either in an advanced stage of implementation or concerned analyses, studies and the planning of further measures. There was a clear schedule for these measures. Depending on the outcome of analyses which were to be performed until 2015, the implementation of the technical and administrative findings was mostly expected to take place after 2015. Commendable practices could be identified in the NAcP, in particular in respect to the systematic use of Periodic Safety Reviews to identify improvement measures, the implementation of in-vessel retention which is already completed, and the application of a return frequency of 10-4/year for extreme weather events, as basis for the evaluation of safety important components and systems.

It is commendable that, as the updated NAcP shows, most activities have been completed according to the planned schedule, or are proceeding according to plan. Some activities have been completed before the planned deadline. One important task which was to be completed by the end of 2014 according to the original NAcP is still ongoing - the work on multi-unit accidents which has consequences for a number of activities (concerning SAM for SFP and for external events, SAMG verification, SAMG training). The report explains that the main part (the analyses) has been completed. The results of the analyses are still being evaluated by the licensee, and the plan of implementation of additional measures, which is part of this task, is still under preparation since it is dependent on the evaluation of these results; the regulator required that the licensee provide a revised deadline.

Furthermore, the updated NAcP lists several additional measures which have resulted from analyses defined by originally planned medium-term measures. Brief explanations have been provided to clarify whether these measures have not in fact already been part of the action as originally planned. In some cases, the updated NAcP mentions studies and analyses, without providing results; also, measures which are to be performed as a consequence of studies and analyses are not specified.
In a number of cases, no schedule is provided for additional measures whereas in some cases, additional measures are already in the process of implementation.

In-vessel retention, IVR, is already implemented in both Slovakian NPPs. Analysis of consequences of IVR, failure and the preservation of containment integrity in case of a severe accident are on-going and were emphasized to be important in the discussion at the 2013 Workshop. Analyses (or any other activities) related to the consequences of the failure of in-vessel retention are not addressed in the updated 2014 NAcP. However, updated information has been provided during the 2015 Workshop. There have been further measures , leading to the result that failure of IVR is extremely unlikely. Therefore no further analyses or investigations are planned in this respect.

The task of integrating pre-Fukushima programs, which were modified after the Fukushima accident, and post-Fukushima improvement programs may constitute a challenge to some extent, since work on multi-unit accident management which was to be completed in 2014 is still ongoing.

4.12 Slovenia

Slovenia has taken into account all the necessary issues, identified according to the National assessments, the recommendations and suggestions of the European stress tests and the conclusions of the CNS process, in its NAcP and updated this plan. The progress on the identified actions was good; however, an important part of the hardware measures still has to be implemented.

Slovenia has made very good progress with the implementation of measures after the Fukushima Daiichi accident. Immediately after the accident the implementation of measures, which were already planned before (installation of mobile equipment in the framework of NRC's B.5.b requirements) were accelerated. The measures were an important upgrade to the safety of the Krško NPP. The Krško NPP reviewed and updated the SAMGs in relation to this new equipment and in relation to the accident in Fukushima Daiichi.

Additional substantial improvements are included in the Krško Safety Upgrade Program (SUP). The Phase one of the SUP (Filtered containment venting system and Passive autocatalytic re-combiners) was finished in 2013. The second phase of the SUP (e.g., Additional flood protection of the nuclear island, Establishment of new technical support centre, Installation of pressurizer PORV bypass, Installation of spent fuel pool alternative cooling, Installation of emergency control room) is delayed and will be implemented from 2015 till 2018. In 2014 the licensee notified the SNSA that a part of the SUP project (phase 3) will not be realised by the end of 2018.

A financial viability study had to be done first. The SNSA is now awaiting the NPP's application for the SUP 3rd phase final deadline, which will most probably be in 2021. The change in this schedule is mainly due to non-technical reasons. The benefit of this delay is that the owner of the Krško NPP can take advantage of experiences and technical developments in other nuclear countries and implement the best technical solutions.

Most of the other actions from the NAcP are well in progress. However, there is no real progress in the improvement of the nuclear safety infrastructure in the present economic crisis situation.

The NAcP from Slovenia is mainly focussed on hardware measures and improvements in regulations, emergency preparedness and processes within the SNSA, and to a lesser extent on studies.

The use of a full scope simulator for severe accidents for the validation and training of SAMGs is a commendable practice in Slovenia.

It is also commendable that Slovenia has implemented the updated (2014) WENRA Reference Levels in a draft of new regulations. The updated regulations should be adopted by the end of 2015.

Furthermore Slovenia has put a lot of effort in the improvement of the emergency preparedness arrangements and the cooperation with Croatia on this issue is a commendable practice.

Slovenia still has the following challenges:

- Implementation of phase 2 and phase 3 of the SUP until 2018 and 2021 respectively
- Improving the nuclear safety infrastructure in the present economic crisis situation.

4.13 Spain

The NAcP informs comprehensively and in a well understandable way how the NPPs in Spain shall be improved in response to the lessons of the Fukushima accident, according to the National assessments, the recommendations and suggestions of the European Stress Tests and the conclusions of the CNS process and other sources.

The NAcP follows the structure proposed by ENSREG and covers all aspects specified in the ENSREG Action Plan. An important additional topic: potential loss of large areas at a NPP – which is at the interface between safety and security – also was addressed.

The NAcP – along with all EU stress test documents – is accessible on the regulator's website.

At each site with nuclear power plants a "Local Information Committee" is established to inform at least annually the local authorities, NGOs, and the general public about relevant aspects concerning the operation and any other topic which could be considered of interest in respect to the nuclear installations.

The implementation of improvement measures is clearly scheduled in three steps: short (until end of 2012), medium (until end of 2014) and long (until end of 2016). Some of the actual modifications to be implemented were at the review workshop of 2013 still depending on the results of on-going analyses. By the end of 2014 practically all the planned analyses have been completed by the licensees, but in many cases the review by CSN in not completed yet. In these cases where the analysis results are still being reviewed by the regulator, the related modifications are being implemented – or even finished – by the licensees.

The timeframe to implement all the improvement measures by the end of 2016 is ambitious and commendable. Nevertheless some measures scheduled for long term are crucial ones, like filtered venting and installation of PARs. The installation of filtered venting at one plant, where it was not previously requested, is scheduled to the 2017 refuelling outage.

Several commendable aspects could be identified in the NAcP of Spain, such as the issuance of specific Complementary Technical Instructions (ITCs) by the regulator, the maintenance of close co-operation between the regulator and the licensees to supervise the implementation of the action plan, the seismic margin analysis for 0.3 g, remote access to radiation data (including personnel dosimetry data) by bodies of emergency response organization, and the construction of alternate on-site emergency centres and a nationwide emergency support centre. By the 2015 review meeting this support centre is fully set up and operational.

The significance of the periodic safety review (PSR) process – which is also a tool for periodic license renewal in Spain – is further enhanced with the inclusion of severe accident management in the review.

A new ITC was issued by CSN requiring the full completion of the applicable NAcP items by the Garoña NPP as a pre-requisite for the restart of the plant.

A challenge for Spain is the appropriate and timely implementation, in its regulation and practices, of the outcomes of the WENRA review of the reference levels in the field of external hazards.

Spain has prepared a convincing and effectively controlled action plan to establish a higher level of safety for its nuclear power plants in the light of the Fukushima lessons. During the 2015 review workshop smooth progress of the completion of the action plan was demonstrated.

The demonstrated recent progresses establish a good basis for the full completion of the action plan according to schedule; however two major issues, namely the installation of hydrogen management components and filtered venting of the containments are still on-going.

4.14 Sweden

The activities in the NAcP have been completed according to the planned schedule, or are proceeding according to plan. All issues which were identified post-Fukushima are being pursued. Relevant information is mostly well presented in the updated NAcP. A number of important tasks still have to be pursued; a large part of the activities so far concerned analyses and studies, on the basis of which measures will be planned, to be implemented until 2020 at the latest.

The original NAcP followed the structure proposed in the ENSREG Action Plan. It contained comprehensive information on the actions planned in the aftermath of Fukushima, as well as background information on the European context of the activities and on the Swedish nuclear power plants.

The 2012 NAcP mainly presented investigations for which the aim is to determine and consider which measures shall be implemented, and the time for their implementation. The final deadline provided for all related activities (2020) was later than most other countries; however, during the 2015 workshop some countries presented delays which result in a comparable (or later) final deadline. It was also noted during the 2013 workshop that the implementation of the majority of the measures is expected before this year. It is notable that the central spent fuel storage facility CLAB has been included in the stress test.

Specific safety goals in terms of timespans for keeping a safe plant state (e.g. in case of total loss of AC power) have been set in Sweden, which can be regarded as a good practice. It is also commendable that the implementation of severe accident management measures has begun in the 1980s and that Sweden applies continues improvements and is implementing extensive modernization programs.

The implementation of an additional Independent Core Cooling function was already planned in

the 2012 NAcP. At the Workshop 2013, it was found that it should be considered with high priority and can be regarded as a challenge.

Accordingly, the introduction of the Independent Core Cooling function has high priority today and is progressing according to schedule. Originally, it was planned to introduce this measure in just one step, implementing the full solution by 2020. A transitional solution, which does not have fully to meet the expectations for the Independent Core Cooling function, is to be introduced by the end of 2017.

An implementation plan for the transitional solution is to be submitted by mid-2015 and for the full solution by end of 2015. For reactors to be shut down soon after 2020, licensees may apply for a change of conditions.

For the implementation of the Independent Core Cooling function, the licensees will have to demonstrate that the requirement for the function to be available at hazard frequencies of 10-6/yr is fulfilled. It is commendable that Sweden has decided to issue a requirement for this low frequency although it will be a challenge to demonstrate the fulfilment of this requirement.

In many cases, the updated Swedish NAcP mentions results of studies and analyses which have already been completed, and measures which are to be performed as a consequence, without providing information on the results and measures. However, explanations were given before and at the Workshop.

The general final deadline of 2020 for all measures resulting from studies and investigations will soon be supplemented by a more detailed schedule: It was stated at the Workshop that the authority is planning to issue a new decision, requiring all licensees to present, in spring 2016 after all investigations have been completed, detailed and plant specific plans for the implementation of measures identified through the investigations, applying a risk-informed approach. Additionally it was clarified during the workshop that the licensees have already implemented some measures and planning is ongoing for the remaining measures. This has been discussed with the authority but not yet presented in detail.

Thus, it appears that establishing appropriate, comprehensive and consistent schedules remains a challenge. SSM is well aware of this challenge.

4.15 Switzerland

The Swiss regulator ENSI has provided clear and transparent updates to its National Action Plan every year. The plan shows that the early phases of work to improve accident management equipment, its storage and distribution, maintenance and application were all completed in the early years post-Fukushima. Early years work also included enhancements to cooling water supplies and power supplies as well as control and instrumentation upgrades. The second phase of work was more reflective and considered further studies on flooding, seismic hazard re-evaluation, severe accident management measures, etc. This phase in now also complete and ENSI has finished its review. Corresponding backfit measures have been implemented (e.g. backfit of special emergency water intake against sediment clogging at one plant, backfit of the seismic isolation of the special emergency diesel generators at one plant). For the final set of topics, the licensees have submitted their analyses and ENSI is undertaking its review and plans to finish its assessment and issue subsequent regulatory orders (if needed) by the end of 2015. Final upgrade programmes to close out Fukushima findings will then be implemented.

Although almost all work at the sites has proceeded to plan, some delays or changes were noted by ENSI and challenged by the peers at the workshop. In particular, delays in long term improvements at spent fuel pools were described and the reasons explained, along with a clear explanation of compensatory measures required by ENSI. Some actions are closed as Fukushima action items, but have been transferred by ENSI into normal supervisory activities until the final installation of equipment – such as PARs – is completed. ENSI provided a clear list of

outstanding installations and improvements (with most now completed, some in the next year, and the very last complete in 2020). ENSI was also clear in its explanation that the regulatory assessment of submitted studies could yet require further improvements, this will be clarified by the end of 2015 and, should the need arise, a final programme of work developed subsequently.

In 2013, several commendable practices were identified, including the development of the national accident management equipment store at Reitnau, the multi-agency review organization (IDA NOMEX), all NPPs having 7 layers of AC power generation, and the implementation of the complex seismic hazard re-evaluation project PEGASOS. After the 2015 workshop, the no notice test of the Reitnau facility, the regulators' self-assessment of safety culture and the work to reinforce the upstream dam at one NPP were also considered to be commendable practices.

Overall, the Swiss approach to continuous improvement was clearly described. Many significant improvements have already been completed. The final package of studies requested by ENSI have been completed by the licensees and are under assessment by ENSI which is planned to be complete in 2015, further work could result, and will be subject to regulatory decisions and reported by ENSI.

4.16 Ukraine

The original NAcP follows the structure proposed by ENSREG and covers all aspects specified in the ENSREG Action Plan. Additional topics related to the specific recommendations of the Peer Review of Stress Tests for Ukrainian NPPs and Safety Improvement Measures at Chernobyl NPP were reported.

The NAcP has been discussed and agreed at the open Board meeting of the national regulator, stakeholders including non-government organizations and media have been involved. The compliance with the schedule is a licensing condition and regularly monitored by the regulator. The Periodic Safety Review is used to verify the compliance with the licensing conditions and to identify additional measures if necessary.

It should be noted that the measure on containment filtered venting at VVER-1000 units was requested by the regulator prior to the stress tests based on the first analysis of the accident.
An interesting aspect is that a measure is first implemented in a pilot power plant unit with reactors of each design and afterwards in other units taking into account the experience gained from the pilot NPP.

The updated Ukrainian NAcP provides information on the status of safety measures related to e.g. the unified state automated radiation monitoring system or the implementation of the RODOS system. The report also contains information on the harmonisation of Ukrainian nuclear and radiation safety regulations with WENRA reference levels as suggested by the previous workshop in 2013.

A number of safety improving measures were defined before the Fukushima event and are subject to the on-going Comprehensive (Integrated) Safety Improvement Program (for operating plants) and under the "Safety Improvement Plan for Chernobyl NPP Nuclear Installations. In this regard a challenge remains in technical solutions for e.g. bunkered backup systems , alternate ultimate heatsink or bunkered safety systems. During the discussion it was explained that the technical specification for those equipment and systems takes into account possible external events and severe accident conditions.

A number of technical analyses have been performed or are planned to be performed for example analyses of severe accident phenomena based on available experimental data and improvement of computer models, the possibility of IVR strategy at WWER 440 reactors or the spread of melted core and its interaction with the structures at WWER 1000 units. The purpose of these studies is to identify further administrative and technical measures.

Despite the efforts of the regulatory body and of the operator the situation since 2013 changed. Almost all deadlines for the implementation of safety measures has been rescheduled (postponed) in comparison with the original NAcP as of 2013. This relates to the so-called pilot power units (except for SUNPP unit 1 (WWER-1000/V-302)) and to all operating units accordingly. The main reasons for rescheduling are technical complexity of their development, implementation and required scope of funding taking into account the situation on the territory of Ukraine over the last year. In this regard, for those units that are under lifetime extension process, the operating organization made a decision to implement the remaining measures during a long outage period before obtaining a license for long-term operation. For other units, all measures are implemented stepwise according to the annual schedule.

4.17 United Kingdom

The UK NAcP gives comprehensive and understandable information on the safety improvements of the UK nuclear power plants after Fukushima, taking into account the national stress tests, the recommendations and suggestions of ENSREG and the CNS summary report.

The NAcP closely follows the structure proposed by ENSREG. The following additional topics are addressed: planning controls, safety assessment approach, research, spent fuel strategies and human capabilities and capacities.

The UK's national action plan is published on the ONR website, along with an implementation report and other relevant documents. Additionally, the UK has included recommendations to improve openness and transparency.

In 2013, all actions were planned to be implemented by the end of 2014, with a majority planned for 2013, which is a very tight schedule. In 2015 some actions have been shifted to end 2015, probably due to the initial tight schedule.

Most actions are studies, assessments or reviews, further modifications may result from these. No major design modifications currently arise from the studies, asides from the filtered containment venting, which is currently under consideration. Soon after the Fukushima accident, additional backup equipment was purchased and passive autocatalytic re-combiners were installed at Sizewell B. The feasibility study for filtered containment venting was completed in 2014. A decision on installation of the filtered containment venting at Sizewell B is being made in 2015 and this is a challenge for UK.

For the Wylfa Magnox reactor actions were taken to realise safety benefits with short implementation times, noting that extended actions would surpass the remaining life time.

The UK has defined several actions regarding emergency preparedness, including a future exercise program to test on-site, off-site and central government responses for prolonged periods. A large scale multi-unit exercise was performed in May 2014. UK plans to carry out periodically such exercises in the future and plans to provide feedback on the lessons learned from the exercises that will be available for the European community.

In 2013, methodologies for the re-evaluation of hazards margins to confirm the absence of cliff edges were a topic of discussion.

In 2015, most studies have been performed. Technical reviews are undergoing for flooding and extreme weather. The completion date is the second quarter of 2015. At the moment, no cliff edge effects have been identified.

Another addition to the emergency preparedness is the availability of multi-use modular accommodation and command units and other emergency back-up equipment in dedicated strategic depots, with the associated 20-year specialist maintenance contracts that assure operability in emergency situations, which is considered a commendable practice.

In 2015, the measures proposed for emergency preparedness i.e. multi-use modular accommodation, command units and other back-up equipment are available in three strategic depots spread over the national territory. One depot is dedicated to two units and, in case of additional needs, the two other depots can be used to provide the required additional equipment on site.

Two new commendable aspects linked to emergency exercises have been identified in 2015. To deal with large volume contaminated water, UK has available large capacity water bags from stocks of military equipment that are stored at back up equipment depots.

The second aspect relates to the management of traumatic and psychological stress, developed by EDF energy. The actions include a trauma management pilot scheme and a range of related policies, procedures and training courses.

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