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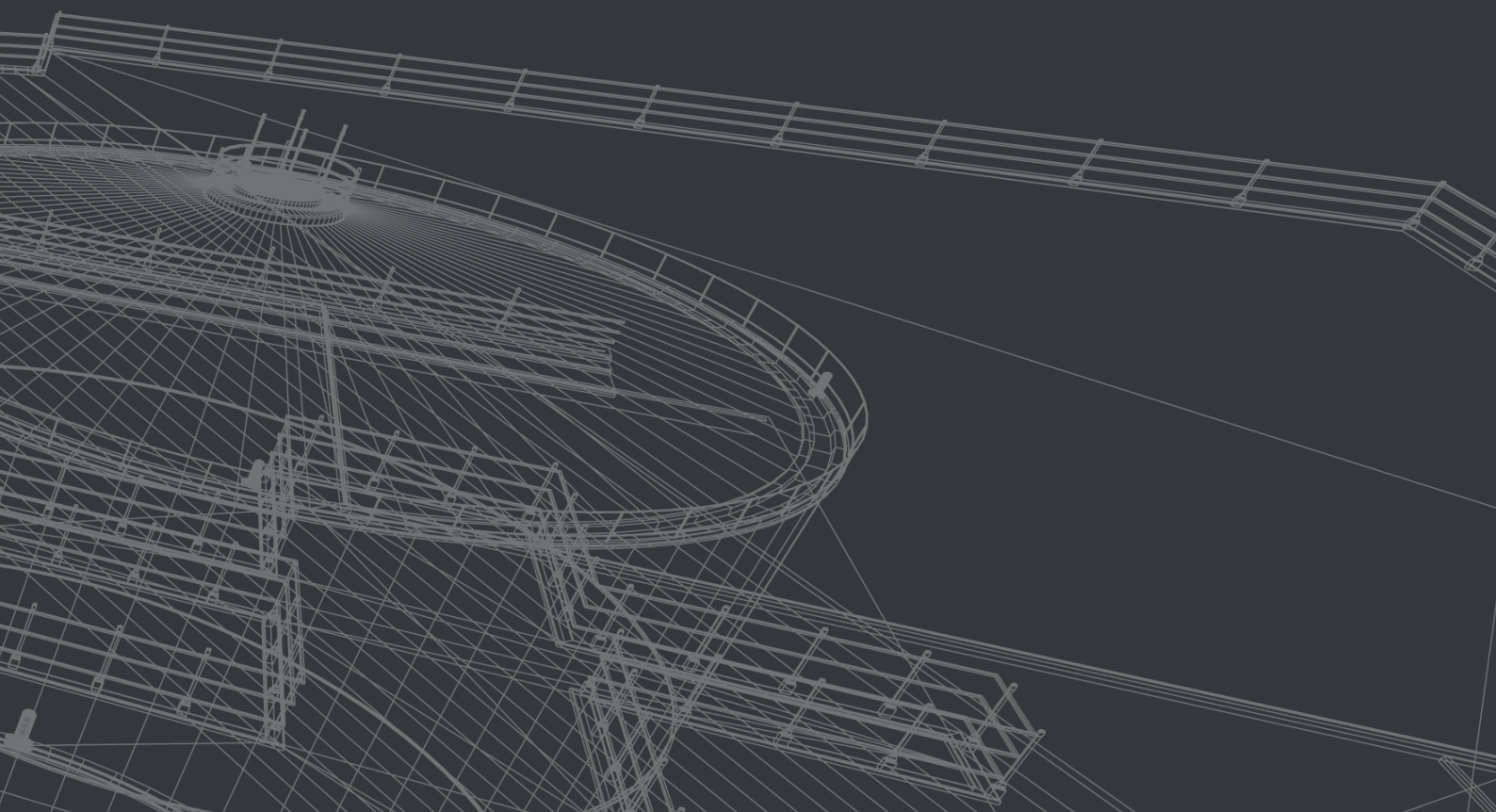
Swiss Federal Nuclear Safety Inspectorate ENSI

Implementation of post-Fukushima international recommendations

Switzerland



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1 Introduction

In the aftermath of the Fukushima Dai-ichi accident the international community has undertaken several actions to foster exchange of information, cooperation and peer review in the field of nuclear safety, thus facilitating the leverage and dissemination of the lessons learned from the accident.

In September 2011 the International Atomic Energy Agency (IAEA) issued the so-called Action Plan on Nuclear Safety /1/ addressing issues that the international community as well as the single member countries should pick up with the ultimate goal of strengthening nuclear safety worldwide. The IAEA decided also to call for a (second) extraordinary meeting of the contracting parties to the Convention on Nuclear Safety (CNS), which was held in August 2012 and resulted in a list of action-oriented objectives compiled in the annex to the Final Summary Report of the meeting /2/.

In parallel, the European Council mandated the European Nuclear Safety Regulators Group (ENSREG) to conduct a first-of-a-kind peer review exercise for nuclear power plants in Europe – the European Stress Tests – addressing the targeted re-evaluation of safety margins in relation to the most relevant Fukushima issues. The European Stress Tests were concluded in April 2012 /3/ and a follow-up was launched to monitor the advancement of post-Fukushima activities on the considered topics. In the frame of the follow-up activities ENSREG produced, among others, a compilation /4/ of recommendations and suggestions summarizing the results and best practices identified during the peer review of the 17 country reports participating in the exercise (15 countries from the European Union having nuclear power plants plus Switzerland and Ukraine).

ENSI, as regulatory authority for nuclear safety and security in Switzerland, has actively contributed to the above-mentioned international efforts in the conviction that such efforts towards more transparency and openness could benefit the internationally shared fundamental safety objective /5/ of protecting people and the environment from harmful effects of ionizing radiation. Thus ENSI submitted several reports to international scrutiny and discussion, among which the Swiss National Report for the European Stress Tests /6/ with the corresponding Peer Review report by ENSREG for Switzerland /7/, the Swiss status report for 2012 within the frame of the European Stress Tests Follow-Up /8/ with the corresponding Peer Review Summary report by ENSREG /9/. Along the lines of the IAEA Action Plan on Nuclear Safety ENSI has published the following reports: Swiss National Report to the Second CNS Extraordinary Meeting /10/ and the 6th National Report of Switzerland to the Convention on Nuclear Safety /11/. Beyond that, ENSI hosted at the end of 2011 an Integrated Regulatory Review Service (IRRS) Mission of the IAEA, a peer review mission on the activities of the regulatory body, the results of which were made publicly available /12/. At the same time, as recommended in the IAEA Action Plan, the Mühleberg NPP invited an Operational Safety Review Team (OSART) led by the IAEA to conduct a peer review mission on its operational activities and disclosed the mission's results /13/.

At the national level ENSI has conducted in 2011 an own event analysis aiming at extracting the lessons learned in view of their applicability for the situation in Switzerland and derived from those a series of so-called checkpoints which warranted further analysis /14/. Further open points were added to the issue list (see Tables 4 and 5 of the present report) on completion of the analyses for the European Stress Tests. In order to keep track of the work conducted on the identified issues, ENSI publishes regularly on a yearly basis an Action Plan Fukushima (/15/, /16/, /17/), the most recent update of which dates February 2014.

By means of critical reviews, frank discussions among experts and stakeholders, as well as open communication of evaluation results and regulatory decisions ENSI has advanced its commitment to transparency and openness in Switzerland and abroad. The present report describes the implementation status in Switzerland of the recommendations issued by ENSREG and the IAEA in the aftermath of the Fukushima Dai-ichi accident as of February 2014. Chapters 2.1 to 2.3 list one by one the ENSREG and IAEA recommendations extracted from /1/, /2/ and /4/ in their original formulation and include a concise comment about how Switzerland, and in particular ENSI, has dealt with the issue. Reference is also made to the own lessons learned, checkpoints and open points as listed in Chapters 2.4 and 2.5.

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2 Implementation status in Switzerland of International Recommendations

2.1 Table 1: ENSREG recommendations

Reference	Description	Status	Related Checkpoint or Open Point
European Level Recommendations			
ENSREG2.1.	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.	In compliance with the Swiss DETEC Ordinance on the Hazard Assumptions and the Assessment of the Protection against Accidents in Nuclear Installations, hazard assumptions are updated to take into consideration findings from experience, research and methodical developments. In particular with the PEGASOS Project and the PEGASOS Refinement Project, Switzerland has performed a first-of-a-kind study in Europe for the probabilistic assessment of seismic hazards on the sites of the Swiss NPPs. As regards most recent regulatory developments, ENSI is an active contributor in the WENRA working group on natural hazards assumptions. The updated WENRA safety reference levels will be implemented by ENSI as soon as they are officially adopted by WENRA (public consultation on the updates ended in February 2014).	PP1, OP4-1
ENSREG2.2.	The peer review Board recommends that ENSREG underline the importance of periodic safety review. In particular, ENSREG should highlight the necessity to reevaluate natural hazards and relevant plant provisions as often as appropriate but at least every 10 years.	In Switzerland, Periodic Safety Reviews (PSRs) are mandatory. As stated in the Article 34 of the Swiss Nuclear Energy Ordinance, the following elements are part of a PSR: •safety concept •operational management and performance •deterministic safety analysis •probabilistic safety analysis •overall safety assessment •organisation and personnel The deterministic and probabilistic analyses must be based on up-to-date hazard assumptions. The current seismic hazards are based on the PEGASOS Refinement Project results. The flooding hazards for the Swiss NPPs have been recently updated. Further refinements of the analysis methods for flooding are possible but should be supported by research results. In this respect, ENSI is participating with several federal agencies in a research project on flooding hazard calculation for the Aare river basin. As regards extreme weather conditions the operators have submitted their updated hazards at the beginning of 2014, with the corresponding safety cases expected by the end of 2014. ENSI will subsequently review the safety cases in order to check the adequacy of the protection against extreme weather conditions.	-

ENSREG2.3.	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.	In Switzerland, the recommendation ENSREG2.3. has already been analysed and technical measures have been implemented to protect the third barrier. Regarding hydrogen hazard, extensive studies were performed which served as basis for the probabilistic safety analysis. ENSI ordered nevertheless a new re-assessment of this topic also taking into account the state-of-the-art in backfitting technology. As listed in the Action Plan Fukushima 2013 (http://www.ensi.ch/en/2013/05/21/action-plan-fukushima-2013/), the following plant-specific points need to be addressed: • review of robustness and scope of the measurement equipment in connection with the assessment of the hydrogen hazard; • update of the hydrogen hazard analyses as well as investigation of hydrogen dispersion from the containment to other buildings; • review of existing provisions and procedures for protection against the hydrogen hazard; • review of the containment venting path with regard to the hydrogen hazard. The restoration of the containment integrity in case of a total SBO during shutdown (see OP6-2) has also been identified as an open point by ENSI at the end of the EU stress tests. This issue will be addressed in the course of 2014 (see ENSI Fukushima Action Plan 2014).	PP5, PP7, PP8, OP6-2
ENSREG2.4.	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.	The results of ENSI's reviews performed after Fukushima confirmed that the Swiss nuclear power plants display high levels of protection against the impacts of earthquakes, flooding and combinations thereof, and that appropriate precautions have been put in place to cope with a loss of power supply and of the ultimate heat sink. For such events, the legal requirements are met, taking into account the latest hazard assumptions and the NPPs are therefore in compliance with the safety objectives. Beyond that, with regard to reactivity control, fuel cooling and confinement of radioactive substances, safety margins are available. During the evaluation of the safety margins, the importance of the bunkered special emergency safety systems in place in the Swiss NPPs was confirmed. As described in ENSI Fukushima Action Plan 2013 (http://www.ensi.ch/en/2013/05/21/action-plan-fukushima-2013/), a project was started in 2013 with the aim of increasing the safety margins. Based on the results of the deterministic and probabilistic analyses, areas for possible significant risk reduction were identified. For these areas (namely earthquakes and external flooding) the operators will submit to ENSI's review their relevant studies in 2014.	All PPs OPs and PRTs
Topic I: Natural Hazards			
ENSREG3.1.1.	To consider the use of a return frequency of 1E-4 per annum (0.1g minimum peak ground acceleration for earthquakes) for plant reviews/back-fitting with respect to external hazards safety cases.	2011: ENSI ordered the seismic safety of the Swiss NPPs to be reassessed. In the analysis, the operators had to consider the intermediate results of the PEGASOS Refinement Project (PRP) for the site-specific seismic hazard. 2012: The analyses showed that margins exist and that only moderate, non-relevant building damage is to be expected. The Swiss NPPs are designed to withstand natural hazards with a return period of 1E-4 years, and have further margins beyond this. 2013: The PRP results are submitted to ENSI for final review according to the SSHAC Level 4 procedure followed for the evaluation of the seismic hazard. 2014: ENSI is reviewing the submitted documents and will subsequently set the updated site-specific seismic hazard curves.	PP1
ENSREG3.1.2.	To consider the possible secondary effects of seismic events, such as flood or fire arising as a result of the event, in future assessments.	In the Swiss legislative framework, the DETEC ordinance on the Hazard Assumptions and the Assessment of the Protection against Accidents in Nuclear Installations requires that secondary effects of earthquakes be considered in the seismic safety cases. 2011: ENSI ordered the seismic safety of the Swiss NPPs to be reassessed. 2012: ENSI confirmed that the seismic safety cases of the Swiss NPPs are compliant with the relevant requirements. 2013: The Mühleberg NPP started a project for reinforcing the Lake Wohlen dam (some 2 Km upstream from the Mühleberg NPP) against sliding, in order to further decrease the hazard of seismically-induced flooding. Licensing authority for the project is	PP1

Reference	Description	Status	Related Checkpoint or Open Point
		the Federal Office of Energy (supervision of dams).	
ENSREG3.1.3.	To consider the use of a protected volume approach to demonstrate flood protection for identified rooms or spaces.	The reactor buildings and the buildings with the bunkered safety systems of all Swiss NPPs are protected against flooding. 2011-2012: The flood protection of other safety-relevant buildings was enhanced with mobile flood barriers.	PP4
ENSREG3.1.4.	To consider 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.	Warning systems are already in place for dams and similar facilities with the potential to cause flooding at NPP sites in case of large releases of water. Corresponding procedures exist on the NPP operator's side. 2012: ENSI requested the safety cases for extreme weather conditions to be updated by the operators. 2014: The updated hazards were submitted at the beginning of the year and safety cases will be submitted to ENSI by the end of the year. Change in the procedures, if necessary, will be part of the evaluation.	PP1, OP4-1
ENSREG3.1.5.	To consider the installation of seismic monitoring systems with related procedures and training.	At all four Swiss NPP sites, seismic monitoring systems were installed many years before the Fukushima accident. Operating procedures include rules for the operators on how to respond after certain pre-defined seismic thresholds are reached (e.g., OBE, SSE). 2014: ENSI is analysing the advantages and disadvantages of an automatic shutdown of the plants triggered by the seismic instrumentation.	PP1, PP5, OP2-1
ENSREG3.1.6.	To consider 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).	Guideline ENSI-A05 requires systematic and comprehensive walkdowns in the context of the development and update of a PSA based on recognised standards, e.g. for seismic walkdowns EPRI-NP-6041-SL. All the NPPs have developed seismic housekeeping concepts which are regularly inspected by ENSI.	PP4
ENSREG3.1.7.	To consider 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.	2011: The external flooding analyses were redone for flood levels with an exceedance frequency of 1E-4 per annum. It could be shown that all Swiss NPPs fulfil the regulatory requirements. 2012: A research project was initiated in Switzerland to develop the scientific data necessary to further refine the flood hazard assessment. 2013: ENSI started a project with the aim of increasing the safety margins in case of accidents beyond the design basis (including seismic and flooding events). 2014: The operators' reports on increasing the safety margins will be submitted to ENSI.	PP1, PP4
ENSREG3.1.8.	To consider, 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.		PP1, OP2-2, PRT-1
Topic II: Loss of safety systems			
ENSREG3.2.1.	To consider 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.	All Swiss NPPs with the exception of Mühleberg NPP have redundant, diverse ultimate heat sinks. 2011: At ENSI's request the Mühleberg NPP started a project to backfit an additional, diverse ultimate heat sink. 2012: ENSI approved the Mühleberg NPP's submittal issuing the so-called permit of concept. 2013: The Mühleberg NPP decided to permanently shutdown the plant in 2019 and informed ENSI about its intention of deviating from the permit of concept. 2014: The Mühleberg NPP will submit a request for alternative measures for a diverse ultimate heat sink taking into account the limited additional operating lifetime.	PP3, PP12, PP13, PP14
ENSREG3.2.2.	To consider 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	The design of power supply of the Swiss NPPs is based on multiple layers of defence. The first layer consists of the external main grid; the second layer consists of the island mode of the plant after load rejection (failure of the main grid). The external reserve grid acts as third layer. The emergency electrical power supply (either from an emergency DG or a direct feed from a hydroelectric power plant) is the 4th layer. In the fifth layer the special emergency electrical power supply from bunkered emergency DGs is activated upon loss of external feed. A sixth layer consists of accident management equipment.	PP2, PP13

Reference	Description	Status	Related Checkpoint or Open Point
	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 utilization of generator load shedding and house load operation for increased robustness, however, before introducing such arrangements the risks need to be properly understood.	Since the Fukushima event, the sixth layer has been reinforced and a seventh layer with off-site accident management equipment has been newly added (see ENSREG3.3.14).	
ENSREG3.2.3.	To consider 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 load shedding/ 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).	All battery groups for safety-important electrical loads in an emergency have been analysed with respect to the battery discharge time and their locations in the buildings. The result showed that, for safety equipment, battery life – before accident management power supply for recharging the batteries is available – is sufficient in all cases, and for safety-important equipment in most cases. 2014: The operator will submit their reports within the project ENSI has started in 2013 on increasing the safety margins, which in turn can lead to additional improvements in the DC power supply (see ENSREG 3.1.7).	PP2, OP5-1
ENSREG3.2.4.	To consider the 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.	2011: creation of an external storage facility at Reitnau, containing various accident management resources for emergencies including DG fuel and other consumables. Enhancement of the equipment on site was also conducted by the operators. 2012: ENSI reviewed the operational concept of the Reitnau external storage facility and inspected it. 2013: The procedures of the activation of the Reitnau external storage facility and the provision of SAM equipment and its transportation from the external storage facility to the plants have been tested. These tests have been carried out as part of an unannounced alarm exercise in one NPP and a national emergency drill.	PP2, PP12, PP13
ENSREG3.2.5.	To consider 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.	Guideline ENSI-B12 on emergency preparedness sets the requirements for accident instrumentation and monitoring. 2011-2014: Upon ENSI's request the NPPs backfitted new temperature and level measurements for the SFPs. The older NPPs also started major backfitting projects for an additional flooding and seismically robust SFP cooling system. 2014: new analysis on hydrogen management will be submitted by the operators and reviewed by ENSI. Within the project related to increasing the safety margins, a review of requirements for SAM instrumentation will be performed. Additional actions are described under ENSREG3.1.5..	PP5
ENSREG3.2.6.	To consider 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 hydroaccumulators), requiring the availability of SGs during shutdown operations and the availability of feedwater in all modes.	The Swiss NPPs have sufficient procedures on the required availability of core cooling capacity in shutdown states and mid-loop operation.	-
ENSREG3.2.7.	To consider the use of temperature-resistant (leak-proof) primary pump seals.	Gösgen NPP, Leibstadt NPP and Mühleberg NPP all have primary pumps that are inherently leak-proof after shutdown. 2014: Beznau NPP will install an additional robust seal water system as part of the bunkered emergency system.	PP3
ENSREG3.2.8.	To consider the enhancement of ventilation capacity during SBO to ensure equipment operability.	Effects of the loss of ventilation at the special emergency control rooms were tested. These tests showed that the operability of the equipment located in rooms of the special emergency bunkered systems, including control panels, is assured for at least several days.	PP2

Reference	Description	Status	Related Checkpoint or Open Point
		During an extended SBO the necessary safety functions will be carried out by means of accident management measures (AMM), e.g. the use of fire water pumps or trucks, mobile diesel generators, and other means that have a relatively small waste heat production compared to the regular safety systems. According to ENSI's experience, conduction of AMM is possible without extra ventilation of such equipment.	
ENSREG3.2.9.	To consider 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).	Since 1996 improvements of the ventilation of the main control room (MCR) were implemented in order to ensure the habitability of the MCR in case of accidents with release of radioactive material. The special emergency control room displays were extended by adding neutron flux, important containment data, and stack release parameters to the existing displays. Further enhancements were carried out regarding operational safety and availability. 2012: The review of the emergency infrastructure at the nuclear power plant site was initiated. The inspections that took place focused on short term operability of the ECCs and their substitute rooms: topics addressed encompass the operation strategy of the ECCs and their substitute rooms as well as single aspects of their habitability under severe accident conditions. The operators have also been required to submit reports on the long term operability of these rooms. 2013: Follow-up inspections were carried out, focusing on the radiation protection material to be used in case of an emergency. 2014: ENSI will review the submitted reports on the long term operability of the ECCs and their substitute rooms.	PP10, PP11
ENSREG3.2.10.	To consider 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.	2011: the protection of the Swiss NPPs and their spent fuel pools (SFP) against external events has been reassessed by the operators and reviewed by ENSI. ENSI ordered all licence holders to immediately implement two physically separated lines/connections for feeding the SFPs from outside the buildings as an accident management measure, and to backfit seismically robust SFP cooling systems in the older NPPs. Correspondingly, backfitting projects are ongoing at the Beznau and Mühleberg NPPs. The Beznau NPP is furthermore required to improve the earthquake resistance of the SFP storage building, and has to implement a venting duct to remove heat and pressure generated by boiling SFP water in order to protect the building structure in case of beyond design basis accidents. A backfitting project was launched in this respect and is foreseen to complete by 2014.	PP6, PP14
ENSREG3.2.11.	To consider 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.	In the Swiss legal framework the Nuclear Energy Ordinance requires physical separation and independence of safety systems. The newer Swiss NPPs are designed from the beginning with the special emergency safety systems functionally separated and independent from the classical safety systems. In the older Swiss NPPs the special emergency safety systems were backfitted in the 90s. During the periodic safety reviews which are performed every ten years compliance of the NPPs with the regulatory requirements is extensively checked. Appropriate improvements may result from the PSR reviews. Additional analyses have been initiated especially within the frame of the EU stress tests. A redundant, diverse ultimate heat sink needs to be implemented in the Mühleberg NPP (see ENSREG3.2.1).	PP3
ENSREG3.2.12.	To consider the verification of assured flow paths and access under SBO	2012: ENSI inspection on the status of the provisions for coping with a long lasting SBO.	PP2, PP11, PP16, OP5-1

Reference	Description	Status	Related Checkpoint or Open Point
	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.	A verification of the robustness of the containment and primary circuit isolation was submitted by the operators. 2013: ENSI reviewed the submitted document on containment and primary circuit isolation and concluded that the equipment employed is seismically robust enough to withstand loads according to the newest seismic hazard assumptions available (PRP intermediate hazards). As a improvement measure, the Gösgen NPP will increase the seismic resistance of the conventional emergency diesel generatos which are needed for containment isolation. 2014: The operators will submit their analyses on provisions to restore containment integrity during outages in case of a total SBO.	
ENSREG3.2.13.	To consider 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).	2011: Creation of an external storage facility at Reitnau, containing various operational resources that can readily be called up in case of an emergency. 2013: Test of the severe accident equipment stored in Reitnau during an emergency exercise (see ENSREG3.2.4).	PP12, PP13, PP15, PP16, OP5-1
ENSREG3.2.14.	To consider 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).	Recommendation already implemented. The Swiss NPPs already have bunkered systems containing the special emergency safety systems specially designed against external hazards (including man-made threats).	PP18, PP19, PP12
ENSREG3.2.15.	To consider 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).	Only Beznau NPP has two units. In the year 2013, the organizational aspect of this issue has been addressed in the course of the revision of the Emergency Regulation (Notfall-Reglement). Resource aspects (equipment, personnel) are treated within the work on post-Fukushima checkpoint PP16. Furthermore, this point has been addressed in the new draft of the regulatory guideline ENSI-A03 "Periodic Safety Review of NPPs".	PP16, PP18, PP12, PP19
ENSREG3.2.16.	To consider the establishment of regular programmes 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.	2011: On the basis of the submitted documentation and inspection results, ENSI concluded that the Reitnau external storage facility is a viable facility for the purposes of storing equipment and auxiliary supplies in order to extend the emergency preparedness of the Swiss NPPs in case of severe accidents. 2013: Equipment, procedures and organization of the Reitnau external storage facility were tested during an alarm exercise and the general emergency drill.	PP16, PP18, PP12, PP19
ENSREG3.2.17.	To consider the performance of further studies in areas where 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,	After Fukushima, the issues related to SFP have been re-assessed by the Swiss operators and reviewed by ENSI. Backfitting were also implemented (e.g. external hook-up points for water make-up into the SFP; backfitting of level and temperature instrumentation for the SFP). Further studies regarding hydrogen dispersion are currently on-going (see ENSREG 3.3.10.). For SBO please refer to the recommendations above. Extensive infrastructure damage is the subject of studies performed in the frame of the activities of the IDA-NOMEX	PP1, PP6, PP14 PP2 PP15, PP16

Reference	Description	Status	Related Checkpoint or Open Point
	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.).	working group (see IAEA-AP3.1, ENSREG 3.3.4. and 3.3.9.). ENSI supports and coordinates safety research within its regulatory powers. The results of that research directly influence its Guidelines, regulatory decisions and resources. Research projects serve training purposes and thereby maintain competence within ENSI and among its experts. ENSI's research programme contributes to international projects which Switzerland would be unable to conduct on its own. International exchange of expertise is thereby encouraged.	
Topic III: Severe accident management			
ENSREG3.3.1.	To consider 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.	ENSI has committed to incorporate all WENRA reference levels in its guidelines. The process is completed to a high percentage (more than 80%). After Fukushima, WENRA created additional topical working groups dedicated to tackle the issues of: Mutual assistance, Natural Hazards, containment in severe accidents, Accident management and Periodic safety reviews. ENSI participates actively in all the topical working groups and will implement the updated safety reference levels as soon as they are officially issued (public consultation on the updated WENRA reference levels was concluded in February 2014).	PP28
ENSREG3.3.2.	To consider 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.	AM provisions are available on the Swiss NPPs sites and offsite. After Fukushima these provisions were checked and improvements implemented (e.g. additional onsite AM-DGs). Beyond that, the Reitnau external storage facility was established in June 2011 (see ENSREG3.3.14).	PP1, PP15, PP16, OP5-1
ENSREG3.3.3.	To consider the systematic review of SAM provisions focusing on the availability and appropriate operation of plant equipment in the relevant circumstances, taking account of	AM provisions are available on the Swiss NPPs sites and offsite. After Fukushima these provisions were checked and improvements implemented (e.g. additional onsite AM-DGs). Beyond that the Reitnau external storage facility was established in June 2011 (see ENSREG3.3.14).	PP15, PP16, OP5-1

Reference	Description	Status	Related Checkpoint or Open Point
	accident initiating events, in particular extreme external hazards and the potential harsh working environment.		
ENSREG3.3.4.	To consider, in conjunction with the recommendation 2.4 *(among the European level recommendations)* , 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.	SAMGs of the Swiss NPPs are generally symptom-based and thus not only focused on specific scenarios. Recently the use of mobile accident management equipment in case of a SBO received special attention, including focused inspections by ENSI. At the Swiss national level (e.g. in case of accidents not involving only the nuclear facilities) the IDA-NOMEX group has been tasked by the Swiss government to review emergency preparedness measures in case of extreme events in Switzerland (see IAEA-AP3.1). A concept paper has identified 56 measures to be analysed and checked in detail. Work on the 56 measures is in progress.	PP15, PP16, OP5-1
ENSREG3.3.5.	To consider the validation of the enhanced SAMGs.	In Switzerland, the adequacy of SAMGs is continuously reviewed in PSR and emergency exercises.	PP15, PP16 OP5-1
ENSREG3.3.6.	To consider exercises aimed at checking the adequacy of SAM procedures and organizational measures, including extended aspects such as the need for corporate and nation level coordinated arrangements and long-duration events.	2011: Start of the revision of Guideline ENSI-B11 (Emergency exercises). The revised version includes regular emergency exercises with the involvement of fire brigades and security forces. Beyond that, the revised ENSI-B11 foresees the possibility of long-lasting exercises. The communication among different organisations and transboundary partners will be regularly checked during the general emergency drills.	PP15, PP16 OP5-1
ENSREG3.3.7.	To consider 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.	The ENSI Guideline ENSI-B11 describes the requirements for emergency exercises (see ENSREG 3.3.6). 2013: During the national emergency drill AM equipment was tested (also from the Reitnau external storage facility) as well as procedures and organisational processes.	PP15, PP16, OP5-1
ENSREG3.3.8.	To consider the extension of existing SAMGs to all plant states (full and low-power, shutdown), including accidents initiated in SFPs.	SAMGs of the Swiss NPPs cover all plant states and include the SFPs.	PP15, PP16 OP5-1
ENSREG3.3.9.	To consider 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.	Effects of damage to infrastructure and communication systems are addressed by IDA-NOMEX (see IAEA-AP3.1). The work on the measures suggested by IDA-NOMEX is in progress. 2013: ENSI and the NPPs have introduced the so-called POLYCOM (radio-based communication network also used by the rescue teams in Switzerland) as an alternative communication system. 2014: Currently the possibility of satellite-based communication is under investigation.	PP9, PP15, PP17, PP20, PP22, PP23
ENSREG3.3.10.	To consider 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.	2012: The licensees have submitted their investigations regarding protection against hydrogen hazards in the area of the spent fuel pools. Based on its review of the submitted documentation, ENSI has imposed specific additional requests for each plant to ensure monitoring of the spent fuel pools, upgrading of the SFP cooling systems and extension of the relevant on-site emergency preparedness measures. These measures additionally reduce the risk of a severe accident in the area of the SFP. 2014: The licensees will submit their updated studies on hydrogen management including migration to other building outside the containment. Based on the review of the submitted documentation ENSI will decide on the necessity of additional hardware provisions (e.g. PARs).	PP7, OP6-1, PRT-2
ENSREG3.3.11.	To consider the conceptual preparations of solutions for post-accident contamination and the treatment of potentially large volumes of contaminated water.	2013: ENSI issued a report on the situation in Switzerland in case of a discharge of large quantities of radioactivity into the rivers Aare and Rhine. It concluded that the measures to protect the population are in principle adequate. Some improvements e.g. in the alarming process and continuous radioactivity surveillance have been identified and will be followed-up in 2014. ENSI has required the licensees to examine those cases in which large quantities of radioactively contaminated water can be expected in their plant, the routes by which these quantities of	PP34, PP35

Reference	Description	Status	Related Checkpoint or Open Point
		water can reach the surrounding area, and the methods that can be used to retain and/or minimise them. Work on this topic is in progress.	
ENSREG3.3.12.	To consider the provision for radiation protection of operators and all other staff involved in the SAM and emergency arrangements.	Within its regulatory oversight, ENSI routinely checks radiation protection measures for severe accident situations in all Swiss NPPs, including rescue teams. Additional radiation protection equipment in case of an emergency is available at the Reitnau external storage facility.	PP18, PP31
ENSREG3.3.13.	To consider the provision of an on-site emergency centre protected against severe natural hazards and radioactive releases, allowing operators to stay onsite to manage a severe accident.	2012: ENSI requested the plants to submit a report on the long-term operability of the emergency control centre (ECC) and substituted ECC after a core damage accident with large releases. ENSI carried out inspections in the ECC and substituted ECC at NPP sites. 2013: The plants submitted these reports. 2014: The reports are currently under review.	PP10, PP11
ENSREG3.3.14.	To consider 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.	2011: Creation of an external storage facility at Reitnau, containing various operational resources for emergencies that can readily be called up.Transport by road or air transportation by helicopter are planned options. Beyond off-site equipment, it's worth mentioning that mobile accident management equipment stored on-site has been significantly upgraded. 2013: Test of the procedures of the activation of the Reitnau external storage facility and the provision of SAM equipment and its transportation from the external storage facility to the plant. These tests have been carried out as part of an unannounced alarm exercise and an emergency exercise in one plant.	PP18, PP19, PP31
ENSREG3.3.15.	To consider 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 prioritizing 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.	Guideline ENSI-A05 (Probabilistic safety analysis: quality and scope) already requires all Swiss NPPs to develop and maintain level 2 PSAs covering all relevant accidents due to internal or external events in all plant states. The Swiss NPPs have developed their level 2 PSAs accordingly. SAMGs of the Swiss NPPs are generally symptom based and thus not only focused on specific scenarios. PSA is not used to reduce the scope of SAMG but applied to check the completeness of considered measures in the SAMGs and to support the technical basis.	-
ENSREG3.3.16.	To consider 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	SAMGs of the Swiss NPPs are generally symptom-based and thus suitable to cover a comprehensive set of scenarios. Recently the use of mobile or accident management equipment to cope with an SBO received special attention, including focused inspections by ENSI. SAMGs of the Swiss NPPs cover all plant states and include the SFPs. Studies with relevance to the SAMGs are continuously being performed. ENSI and the operators independently cooperate with domestic and foreign research institutions to increase knowledge on severe accident behaviour.	PP16

Reference	Description	Status	Related Checkpoint or Open Point
	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.		

2.2 Table 2: CNS 2nd Extraordinary Meeting recommendations

Reference	Description	Status	Related Checkpoint or Open Point
CNS-EOM1	Take the IAEA Safety Standards into account in enhancing nuclear safety.	ENSI was peer-reviewed by an IRRS mission in 2011 which also checked for compliance with the IAEA safety standards (see IAEA AP4.1) The explanatory reports (mandatory reports accompanying ENSI guidelines) contain an updated list of all relevant IAEA requirements and guides and WENRA reference levels which are covered by each guideline.	PP29
CNS-EOM2	Include information in its report under the Convention on Nuclear Safety (National Report) about how it has taken or intends to take the IAEA Safety Standards (including, in particular, the Safety Fundamentals and Requirements) into account in implementing its obligations under the Convention on Nuclear Safety.	ENSI was peer-reviewed by an IRRS mission in 2011 which also checked for compliance with the IAEA safety standards (see IAEA AP4.1). In its 6th national CNS report Switzerland promotes the idea that the use of IAEA Safety Standards should be strengthened in regular peer review missions on the assessment of the regulatory framework and activities, on NPP design and on NPP operation. In fact Switzerland proposed an amendment to the Convention aiming at setting safety goals for new plants as well as existing reactors.	PP29
CNS-EOM3	Ensure that its regulatory body is effectively independent in making regulatory judgments based on scientific and technological grounds and taking enforcement actions and that it has functional separation from entities having responsibilities or interests, such as the promotion or utilisation of nuclear energy (including electricity production), that could conflict with safety or other important regulatory objectives or otherwise unduly influence the decision making of the regulatory body.	The Nuclear Energy Act requires the supervisory authorities to be independent of technical directives and formally independent of the licensing authorities. It also clarifies and expands the position, duties and responsibilities of ENSI as the supervisory authority for nuclear safety in terms of the development of safety criteria and the maintenance of nuclear safety. Since the beginning of 2009, ENSI is an independent body constituted under public law. It reports direct to the Government but is completely separate from the Swiss Federal Office of Energy. In other words, the regulatory body is now legally, institutionally, politically and financially independent.	PP30
CNS-EOM4	Ensure the effectiveness of its regulatory body by providing for adequate legal authority, sufficient human and financial resources, staff competence, access to necessary external expertise for its decision-making based on adequate scientific and technical knowledge, access to international cooperation, and other matters needed for fulfilling its responsibilities for the safety of nuclear installations.	Costs incurred by the safety authorities (with the exception of the regulatory framework and informations to the public), totalling some 60 million Swiss francs per year, are mainly covered by fees from licensees. Knowledge management and training measures are an integral part of ENSI's Management System. The process includes an annually updated systematic compilation of the skill and knowledge requirements for each organisational unit. Staff training is based on this compilation (see also the 6th National Report of Switzerland to the Convention on Nuclear Safety).	PP29, PP30
CNS-EOM5	Ensure that its regulatory body requires a licensee for a nuclear installation to have adequate expertise and resources to fulfill its responsibility for the safe operation of the nuclear installation, including effective response to any accident and mitigation of its consequences.	Swiss nuclear legislation stipulates that nuclear installations must be kept in good condition and that the licensee must provide persons responsible for the safe operation of a nuclear installation with the necessary resources. Under the Swiss Nuclear Energy Act, there must be a sufficient number of qualified staff with the expertise required to manage and control a nuclear installation during all phases of its life cycle. A minimum level of staffing with qualified personnel is stipulated for the plants on a 24-hour basis. This ensures that adequate staff is present in the plant at all times under normal conditions, to initiate alarms and to undertake the first measures required in case of an emergency. Moreover, all employees of Swiss NPPs are members of the respective Emergency Response Organisation (ERO), so the plants can always draw on a sufficient large pool of specialists for their ERO.	PP29, PP31, PP36, PP37
CNS-EOM6	Ensure that its regulatory body operates in a transparent and open manner, taking into account legitimate concerns over security and other sensitive interests that might be adversely affected by the public disclosure of particular information.	Under the Nuclear Energy Act (Article 74), ENSI "shall regularly inform the general public about the condition of nuclear installations and any matters pertaining to nuclear goods and radioactive waste" and "shall inform the general public of any special occurrences". In addition to that, ENSI is obliged to respond to questions from the parliament on nuclear safety and the work of the regulatory body. As a federal authority, ENSI is subject to the	PP29, PP30

Reference	Description	Status	Related Checkpoint or Open Point
		Federal Act on Freedom of Information in the Swiss administration. According to this law, all ENSI documents are public with a few exceptions, such as security-related information, personal data or trade secrets. The communication services of ENSI comply well with these legal requirements. They regularly provide direct information to the public. ENSI's website www.ensi.ch is an important information tool covering all aspects of nuclear safety in Switzerland in the national languages of German and French as well as some aspects in Italian and English. It is accompanied by activities on social media – e.g. Twitter, Facebook, YouTube, etc.	
CNS-EOM7	Include information in its National Report on its efforts to ensure the independence, effectiveness and transparency of its regulatory body.	All this information is listed in chapter 8 "regulatory body" of the 6th National Report of Switzerland for the CNS (see also CNS-EOM3). From the very beginning Switzerland, and in particular its nuclear regulatory body ENSI, committed to international peer review missions. Switzerland had already hosted an IRRT mission in 1998 and a follow-up in 2003 and has provided experts to participate in various IRRT and IRRS missions in the past. According to the law (ENSI ordinance) ENSI has to periodically host IRRS missions. The last IRRS mission took place in 2011 and a follow-up is scheduled for 2015 (see IAEA AP2.1).	PP29
CNS-EOM8	Host, as appropriate, an international peer review mission of its regulatory framework governing the safety of nuclear installations, if the Contracting Party has an operating nuclear installation.		PP29
CNS-EOM9	Host regularly, as appropriate for the size and number of the nuclear installations within that Contracting Party, international peer review missions of the operational safety of its nuclear installations, if the Contracting Party has an operating nuclear installation.	All Swiss plants regularly undergo WANO missions. From 1994 to 2000 the plants hosted OSART missions as well. In order to comply with IAEA AP5.2 recommendation ENSI plans to have all the NPPs carry out new OSART missions. This new series started with an OSART mission in Mühleberg NPP in 2012. The follow-up will take place in 2014.	PP29
CNS-EOM10	Host international peer review missions on integrated nuclear infrastructure and other relevant matters, including site and design safety reviews prior to commissioning its first nuclear installation,	Recommendation not applicable. Switzerland started its nuclear programme more than 50 years ago.	-
CNS-EOM11	Include information in its National Report on any international peer review missions under paragraph 1, 2 or 3 of this section that the Contracting Party has hosted in the period between two review meetings of the Contracting Parties including a summary of the findings, recommendations and other results of the missions, actions taken to address these results, and plans for follow-up missions.	Switzerland's 6th National Report to the CNS presents the results of both the IRRS Mission from 2011 and the OSART Mission to Mühleberg NPP from 2012 (see 6th National Report of Switzerland for the CNS pages 61 and 146).	PP29
CNS-EOM12	Make its National Report and any written questions and responses relating to that report publicly available, with the exception of any particular item of information that would adversely affect security or other sensitive interests if publicly disclosed and request the IAEA to maintain this information, other than any information covered by the above exception, on a website open to the public.	Switzerland's 6th National Report to the CNS is available on ENSI website on the following webpage (see CNS-EOM15) http://www.ensi.ch/en/2013/08/16/6th-national-report-of-switzerland-to-the-convention-on-nuclear-safety/	PP29
CNS-EOM13	Make any international peer review mission reports, any follow-up reports or any national responses to such reports publicly available, with the exception of any particular items of information that would adversely affect security or other sensitive interests if publicly disclosed and request the IAEA to maintain this information, other than any information covered by the above exception, on a	All related documents to the IRRS mission from 2011 (the latest to take place in Switzerland) are available on ENSI website http://www.ensi.ch/en/dossiers-3/irrs-mission-2011/ . The final report of the IAEA to the OSART mission in Mühleberg is available under http://static.ensi.ch/1359642780/osart-report-muhleberg_8-january-2013.pdf . Switzerland's 6th National Report to the CNS presents the results of both IRRS Mission from 2011 and the OSART Mission to Mühleberg NPP from 2012.	PP29

Reference	Description	Status	Related Checkpoint or Open Point
	website open to the public.		
CNS-EOM14	Include information in its National Report on its efforts to enhance openness and transparency in the implementation of its obligations under the Convention on Nuclear Safety.	In 2009, in connection with the search for sites for deep geological repositories, the Swiss Federal Office of Energy set up the Technical Forum on Safety, which is led by ENSI. The Technical Forum on Safety discusses and answers technical and scientific questions asked by the public, communities, siting regions, organisations, cantons and authorities in neighbouring states. The forum comprises experts from the body leading the process (Swiss Federal Office of Energy), from other bodies with supervisory or supportive roles (ENSI, Swiss Federal Office of Topography [swisstopo]), from commissions (Federal Nuclear Safety Commission [NSC], from the National Cooperative for the Disposal of Radioactive Waste [Nagra], from the cantons), and includes one representative from each of the siting regions. A similar panel (Technical Forum on NPPs) was created by ENSI in 2012 for topics related to the safety of NPPs. All results of the work conducted in the Technical Fora are publicly available (in German) on the ENSI website (http://www.ensi.ch/de/2012/09/03/ensi-forum-fragen-und-antworten-zur-sicherheit-von-kernkraftwerken/ and http://www.ensi.ch/de/2013/09/25/technischen-forum-kernkraftwerke-eingereichte-fragen/).	PP29
CNS-EOM15	Enhance the robustness of the peer review of national reports submitted under the CNS through the preparation and submission of thorough reports that present successes and challenges and the frank discussion of these reports.	ENSI actively participated in the IAEA working group on effectiveness and transparency to improve the CNS and its review conferences. Switzerland's 6th National Report to the CNS is available on ENSI website on the following webpage http://www.ensi.ch/en/2013/08/16/6th-national-report-of-switzerland-to-the-convention-on-nuclear-safety//	PP29

2.3 Table 3: IAEA Action Plan recommendations for Members States

Reference	Description	Status	Related Checkpoint or Open Point
1. Safety assessment in the light of the accident at TEPCO's Fukushima Daiichi Nuclear Power Stations			
IAEA-AP1.1	Member States to promptly undertake a national assessment of the design of nuclear power plants against site specific extreme natural hazards and to implement the necessary corrective actions in a timely manner.	In the scope of the EU stress test and as required by ENSI's formal orders issued shortly after Fukushima, the operators of the Swiss nuclear power plants submitted their updated safety cases for natural hazards (updated extreme weather hazards were submitted but safety cases are still pending). The safety cases are based on site-specific hazards which refer to a 1E-4 occurrence frequency per year. The results of ENSI's review confirm that the Swiss NPPs display a high level of protection against the impacts of earthquakes, flooding and other natural hazards, as well as loss of electrical power and ultimate heat sink. For the performed analyses, the most updated site-specific hazard assumptions, e.g. PRP Intermediate Hazard for earthquakes, have been taken into account. The safety margins, which have been determined in the updated analyses, are attributable to the robust design of the special emergency systems at all Swiss NPPs (bunkered systems). The systems have a special protection against external events, including an independent power supply and a separate supply of cooling water. Beyond that, improvements have been identified and corrective actions have already been implemented except for major backfitting projects which are still on going. In particular for the Mühleberg NPP a redundant, diverse UHS has been requested (for implementation status and more details see ENSREG3.2.1). Provisions for handing accidents involving disrupted infrastructure have also been taken off-site with the installation of an external emergency storage facility for all Swiss NPPs in Reitnau (see ENSREG3.3.14).	PP1, OP4-1, PRT-1
2. IAEA Peer reviews			
IAEA-AP2.1	The IAEA Secretariat to strengthen existing IAEA peer reviews by incorporating lessons learned and by ensuring that these reviews appropriately address regulatory effectiveness, operational safety, design safety, and emergency preparedness and response; Member States to provide experts for peer review missions.	Switzerland was the first Western country to request a mission by an IAEA International Regulatory Review Team (IRRT). The mission took place in 1998, the follow-up mission in 2003. Swiss legislation requires ENSI to regularly host IRRS missions. The last IRRS mission to Switzerland took place in November 2011, including issues dedicated to the lessons learned from the Fukushima event. The IRRS Follow-Up mission to Switzerland is scheduled for 2015. Furthermore, ENSI experts so far have participated in sixteen IRRT and IRRS missions to other countries and chaired two of these missions. At the international level, ENSI encourages the conduct of international peer reviews having committed itself to transparency of the regulatory performance (see CNS-EOM8 and CNS-EOM13).	PP29
IAEA-AP2.2	The IAEA Secretariat, in order to enhance transparency, to provide summary information on where and when IAEA peer reviews have taken place, and to make publicly available in a timely manner the results of such reviews with the consent of the State concerned.		-
IAEA-AP2.3	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.		PP29
3. Emergency preparedness and response			
IAEA-AP3.1	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.	In May 2011, the Swiss Federal Council decided to appoint an interdepartmental working group to review emergency protection measures in case of extreme events in Switzerland (IDA-NOMEX). The remit of this working group, in which ENSI was also represented, was to examine in the light of the Fukushima accident whether further action is required regarding emergency protection in case of extreme events in Switzerland, and whether any new statutory and organisational emergency protection measures need to be taken. In July 2012, the Federal Council acknowledged the report of the working group IDA-NOMEX and issued tasks for the elaboration of organisational measures in the field of personnel and material for	PP15, PP22, PP29

Reference	Description	Status	Related Checkpoint or Open Point
		emergency management, improvement of the coordination and cooperation at national level and the clarification of responsibilities. ENSI will mainly work on the reference scenarios and the emergency planning zone concept, but will also be involved in several other measures. The emergency preparedness of Switzerland and its response at the international level is regularly verified by its participation in international exercises conducted by the IAEA or ECURIE. The OECD/NEA INEX exercises are another opportunity to verify certain aspects of emergency management. Switzerland usually participates in these exercises. In November 2011, the IRRS mission reviewed, amongst other things, the Swiss concept for emergency preparedness and response. Switzerland also participates in working groups of HERCA and WENRA on emergency preparedness. Finally, in order to improve the emergency response system at the national and international level, members of ENSI and the National Emergency Operations Centre actively support the activities of the OECD/NEA working party on Nuclear Emergency Matters.	
IAEA-AP3.2	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.	As a consequence of the nuclear accident in Fukushima, considerable effort has been deployed in Switzerland to strengthen emergency preparedness and response at the national level with the work of the IDA-NOMEX group, see IAEA-AP3.1). Numerous tasks in this respect are ongoing. Switzerland is committed to review and implement IAEA's recommendation to strengthen emergency preparedness and response capabilities, in particular those identified during an IRRS-mission in Switzerland in 2011. Switzerland is further involved in international working groups aiming at the harmonization of emergency preparedness and response in case of an emergency. Within the framework of RANET, Switzerland will make available to other countries measurements capacities and offer advisory services if needed. Switzerland is member of the REMPAN network since 2013.	PP15, PP22, PP29
IAEA-AP3.3.	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.	In 2013 Switzerland joined the RANET and will make available to other countries measurements capacities and offer advisory services.	PP22
IAEA-AP3.4	Member States to consider, on a voluntary basis, establishing national rapid response teams that could also be made available internationally through RANET.		PP22
4. National regulatory body			
IAEA-AP4.1	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.	A two-week IRRS mission took place in November 2011, ahead of which a self-assessment was conducted by ENSI over a period of almost 2 years. The final report by the review mission contains 19 Good Practices, 12 Recommendations and 18 Suggestions. By the end of 2012, ENSI drafted an action plan on the measures needed to cope with the mission findings in view of the IRRS follow-up mission which is scheduled for 2015. Regarding the regulatory body, the IRRS team noted that "ENSI is institutionally, financially and politically independent". A Good Practice was given to the fact that the ENSI ordinance requires ENSI to undergo an IRRS mission periodically. As a consequence of one suggestion related to staffing, ENSI established a section for decommissioning in August 2012 which will be further developed in accordance with the advancement in the NPP decommissioning projects (the Mühleberg NPP is due to permanently cease operation in 2019). In addition, a Human Capital Management concept was developed in 2012 by ENSI which will be implemented step by step	PP29, PP30
IAEA-AP4.2	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.		PP29, PP30

Reference	Description	Status	Related Checkpoint or Open Point
		over the next three years.	
5. Operator's organisations			
IAEA-AP5.1	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.	ENSI has started tackling the issue of management of safety by the operators in the late 90s. In 2013, ENSI published a report on its integrated oversight approach. After the accident in Fukushima, safety culture was once more identified as a key aspect. In this regard, safety culture was one of the topics of the ENSI Fukushima action plan. As a result, a position paper on safety culture was published in March 2014.	PP30, PP37
IAEA-AP5.2	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.	In the period from 1994 to 2000 all Swiss NPPs underwent OSART missions, including follow-up missions, and all of them have implemented the recommendations listed in the OSART reports. Following the recommendation from the IAEA Action Plan on Nuclear Safety, Switzerland requested a new OSART mission for the Mühleberg NPP which reached 40 years of commercial operation in 2012. The OSART mission took place in October 2012 and the follow-up mission is scheduled in 2014. ENSI asked the NPPs to plan for regular OSART missions, possibly to be alternated with the WANO missions. All Swiss OSART reports are derestricted and available to the public, e.g. http://static.ensi.ch/1359642780/osart-report-muhleberg_8-january-2013.pdf .	PP29
6. IAEA safety standards			
IAEA-AP6.1	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.	The Swiss legal framework governing the safe use of nuclear energy is extensively based on the IAEA Safety Standards. When drafting guidelines, the IAEA safety standards are systematically taken into account. ENSI will continue its efforts to complete its regulatory framework considering the current IAEA Safety Standards. ENSI is actively involved in the IAEA's committees for the drafting of the IAEA Safety Standards and thereby contributes to their strengthening. ENSI is represented in the Nuclear Safety Standards Committee (NUSSC), in the Radiation Safety Standards Committee (RASSC), in the Transport Safety Standards Committee (TRANSSC) and in the Waste Safety Standards Committee (WASSC).	PP28
7. International legal framework			
IAEA-AP7.1	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.	Switzerland is signatory party to the listed conventions. Switzerland supports efforts to strengthen the global system for nuclear safety. Switzerland aims for more transparency in the reporting on the CNS meetings and the peer review missions by calling for mandatory publication of the review results. The IAEA Action Plan on Nuclear Safety includes these elements on a non-mandatory basis and is considered to be a necessary step towards the effective strengthening of the global nuclear safety regime. At the Second Extraordinary Meeting of the Convention on Nuclear Safety held in August 2012, Switzerland proposed various amendments to the Convention. To accommodate those, a working group entrusted with the task of strengthening the Convention was established. Switzerland is actively participating in this working group. Switzerland also contributes in the Working Group on Practices in the Management of the Review Process under the Convention on Nuclear Safety and the Joint Convention. ENSI reaffirmed this position during the Fukushima Ministerial Conference on Nuclear Safety in December 2012.	PP28
IAEA-AP7.2	Member States to be encouraged to join and effectively implement these Conventions.		PP28
IAEA-AP7.3	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.	Nuclear liability is governed by the Act on Nuclear Third Party Liability of 18 March 1983. This act reflects internationally accepted principles such as strict liability and channelling of liability to the operator of a nuclear facility. The act does not foresee any limitation of third party liability and provides for a minimum amount of coverage (1 million Swiss francs). On 13 June 2008, Switzerland approved the revised Nuclear Third Party Liability Act and also ratified the international Paris and Brussels Conventions. The total revision of the Nuclear Third Party Liability Act increases the level of compulsory insurance coverage for nuclear accidents. It also greatly	-

Reference	Description	Status	Related Checkpoint or Open Point
	Member States to give due consideration to the possibility of joining the international nuclear liability instruments as a step toward achieving such a global regime.	simplifies the claims procedure and so better protects victims' interests. The revised Liability Act can only enter into force when the revision protocol to the Paris Convention is ratified by at least two-thirds of the 16 signatory states.	
8. Capacity building			
IAEA-AP8.1	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.	Switzerland has a well-defined legislative and regulatory framework for the peaceful use of nuclear energy and the protection against ionizing radiation. The policy and strategy are codified in major statutes which establish the regulatory framework for the safety of facilities and sources, radiation protection, safe transport of radioactive material, safe management of waste, decommissioning and emergency planning. Regarding capacity building programs, ENSI concluded in the 6th CNS national report that the existing nuclear installations have adequate financial resources to support the safety of each nuclear installation. They also have sufficient qualified staff with appropriate education and training for all safety-related activities together with adequate retraining opportunities. On the regulatory side, knowledge management and training measures are an integral part of ENSI's Management System (see CNS-EOM4).	PP29, PP30
IAEA-AP8.2	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.	After the accident in Japan's Fukushima Dai-ichi NPP on 11 March 2011, an interdisciplinary team of experts from ENSI reconstructed the events of the accident and subjected them to in-depth analysis. The results were presented to the public in two reports at the end of August 2011. The third report on the Fukushima accident (Lessons learned) outlines how Switzerland can continue to optimise the safety of its NPPs on the basis of experience gained in Japan. Based on the lessons learned (together with input from several international sources) ENSI issued an "Action Plan Fukushima". The "Action Plan Fukushima" is effective from 2012 onwards and updated annually with reports on the current status of on-going analyses and safety upgrades. It is expected that the issues listed in the "Action Plan Fukushima" will be closed by 2015 with major backfittings possibly taking two additional years to complete.	All PPs OPs and PRTs
9. Protection of the people and the environment from ionizing radiation			
IAEA-AP9.1	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.	Switzerland has at its disposal a comprehensive sampling and measurement organization, which is continuously reviewed and enhanced. It comprises automatic, stationary and mobile means of measurement and accredited laboratories. Within the framework of RANET, Switzerland will make available to other countries measurement capacities and offer advisory services.	PP9, PP32
IAEA-AP9.2	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.	After the accident on the prototype nuclear power plant Lucens (Switzerland) in 1969, the plant was permanently shut down. During the decommissioning the molten core was removed and there is currently no more fuel on site.	PP34, PP35
IAEA-AP9.3	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.	An automatic and continuous dose rate monitoring and emergency response data system (MADUK/ANPA) has been installed in the vicinity of all NPPs in Switzerland. The data is transmitted to ENSI, to the National Emergency Operations Centre, to the Baden-Württemberg (Germany) and to the European Platform EURDEP. ENSI has set up an automated system for radiological dose forecast. The results of these calculations are also made available to the	PP9, PP17, PP20, PP22, PP30

Reference	Description	Status	Related Checkpoint or Open Point
		National Emergency Operations Centre and the responsible authorities in Germany. In 2011 a new project was launched, aiming to implement a new and modernised system for dispersion calculations. NPPs are responsible for detecting and assessing an accident, for implementing on-site countermeasures and for disseminating information immediately and continuously to the relevant off-site authorities. According to the Emergency Preparedness Ordinance and Guideline ENSI-A08, the NPPs are further responsible for the timely determination of the source term and its transmission to ENSI.	
10. Communication and information dissemination			
IAEA-AP10.1	Member States, with the assistance of the IAEA Secretariat, to strengthen the emergency notification system, and reporting and information sharing arrangements and capabilities.	As a result of the IRRS mission in Switzerland in 2011, an emergency classification system compatible with IAEA requirements will be implemented. The use of IAEA reporting forms (GENF and SRF) is being trained in general emergency exercises. Reporting and sharing of information in case of an emergency and ways of improvement are also being addressed in international working groups set up by HERCA.	PP28, PP29
IAEA-AP10.2	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.	As a federal authority, ENSI is subject to the Federal Act on Freedom of Information in the Administration. According to this law, all ENSI documents are public with defined exceptions, for instance security-related information, personal data, or trade secrets. ENSI regularly informs the public about its activities (see CNS-EOM14). In these technical fora meetings, all aspects of safety, including emergency preparedness and response are addressed. Within the WG on effectiveness and transparency ENSI supported IAEA's coordinating role and peer review instruments (see CNS-EOM15).	PP22, PP27, PP29
IAEA-AP10.3	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.	ENSI is an active member of the INES community and supports the relevant efforts for strengthening and improving the INES scale as a communication tool.	PP22, PP27
11. Research and development			
IAEA-AP11.1	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.	ENSI supports and coordinates safety research within its regulatory powers. The results of that research directly influence its Guidelines, regulatory decisions and resources. Research projects serve training purposes and thereby maintain competence within ENSI and its experts. ENSI's research programme contributes to international projects which Switzerland would be unable to conduct on its own. International exchange of expertise is thereby encouraged.	-
IAEA-AP11.2	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.		-

2.4 Table 4: List of checkpoints from the Swiss "Lessons Learned" report

No	Point designation	Description
1	PP1	The hazard assumptions for earthquake and external flooding, and also for extreme weather conditions, must be re-evaluated to take account of the latest knowledge.
2	PP2	The control strategies for a long-lasting total power failure must be re-evaluated on the basis of knowledge gained from Fukushima.
3	PP3	A review must be carried out to determine whether the coolant supply for the safety systems and the associated auxiliary systems is guaranteed from a diverse source which is safe against earthquakes, flooding and contamination.
4	PP4	A review must be carried out to determine whether the requisite tightness of buildings containing important safety equipment is guaranteed in case of flooding of the site.
5	PP5	On the basis of experience gained from the Fukushima accident, another review must be undertaken to determine whether the availability of the instrumentation required to assess the condition of the plants is guaranteed adequately even in extreme situations.
6	PP6	A review must be carried out to determine whether control of leaks and long-term cooling of the spent fuel pools are guaranteed in case of severe accidents.
7	PP7	A review must be carried out to determine whether tests and inspections regarding the prevention of hydrogen explosions should be extended to additional areas of the plants beyond the primary containment.
8	PP8	The design and operation of the systems for filtered venting of the containment must be reviewed again.
9	PP9	It is necessary to carry out a new review of the earthquake and flood design of the monitoring network for automatic dose rate measurement in the vicinity of nuclear power plants (MADUK), in relation to experience gained from the Fukushima accident.
10	PP10	A review must be carried out to determine whether the emergency rooms (ER) and the substitute emergency rooms (SER) at the Swiss nuclear power plants still meet the requirements, based on the experience gained from the Fukushima accident.
11	PP11	The access control system for nuclear power plants and the associated arrangements must be reviewed to determine the accessibility of rooms where intervention is required in case of severe accidents, while maintaining appropriate plant safety and security. Monitoring of radiation protection must continue to be guaranteed in this context.
12	PP12	The emergency measures for heat dissipation in case of a complete failure of the cooling water supply must be reviewed and verified under conditions resulting from the disruption of the infrastructure and the power supply.
13	PP13	It is necessary to review how the alternative supply of water and power for emergencies is ensured.
14	PP14	It is necessary to examine the water resources that can be made available to supply the reactor pressure vessel, the spent fuel pools and the containment.
15	PP15	Emergency management must be reviewed to determine further potential for improvement.

No	Point designation	Description
16	PP16	ENSI has identified the following issues as checkpoints for improving emergency planning and emergency exercises: a The decision-making aids for emergency management in case of severe accidents (SAMG) at nuclear power plants, including the newly planned checkpoints to deal with severe accidents, must be reviewed on the basis of knowledge gained from the Fukushima accident. In this regard, it is particularly necessary to check: - whether adequate consideration is given to a Station Blackout (SBO) of long duration and the simultaneous occurrence of events in multiple-unit plants - whether there is any need for measures, auxiliary resources and equipment that must be available to ensure that critical levels are not attained over the long term in case of severe accidents. b Consideration given to incidents involving an SBO of long duration in the planning of emergency exercises. c Examination of whether the procedures are trained often enough during emergency exercises. Particular attention should be focused here on a functioning inter-organisation chain of communication across the various organisations.
17	PP17	A review must determine whether and to what extent the communication facilities are designed with adequate redundancy and diversity.
18	PP18	It must be ensured that adequate staff is available at all times to accomplish all necessary emergency management activities.
19	PP19	Measures that increase the organisation's ability to react to unexpected events must be reviewed again on the basis of experience gained from Fukushima.
20	PP20	Transmission of plant parameter data must be re-evaluated with respect to an alternative, independent means of data transmission.
21	PP21	The evacuation concepts must be reviewed, taking account of knowledge gained from the Fukushima accident.
22	PP22	Coordination with other international partners is required to determine whether and how an international network for central international emergency support can be set up.
23	PP23	A review must be carried out to determine whether the necessary information regarding forecasts of releases and radiation exposure is provided in a timely and continuous manner in case of damage.

No	Point designation	Description
24	PP24	The following improvement measures were identified regarding information provided to the general public: a It must be ensured not only that the requisite infrastructure and the necessary individuals and/or organisations and equipment are available for crisis communication, but also that the necessary means of communication are in place. The relevant precautions must be taken. Regular training must be provided on the associated procedures. This point also includes a functioning network of experts who are available to the media to supply neutral and objective information. b Review to determine whether the organisational responsibilities for informing the public as well as the local authorities and support staff are clearly stipulated, and are uniformly understood by all involved parties. c A review should be carried out to determine whether the timely communication of radiological effects, including calculated forecasts, is also ensured beyond Switzerland's borders.
25	PP25	It is necessary to examine the extent to which the release of non-nuclear hazardous substances in case of events beyond the design basis could exert an additional influence on the events related to an accident, and which counter-measures are required.
26	PP26	The process of evaluating and examining the applicability of national and international operating experience must be optimised on the basis of knowledge gained from the Fukushima accident.
27	PP27	It must be guaranteed that the knowledge gained from national and international operating experience (the procedure for processing events) in the licensees' organisations reaches all the relevant individuals and units (including those at group level).
28	PP28	It must be ensured that internationally harmonised assessment scales for nuclear safety are established at the highest level of safety.
29	PP29	Greater importance should also be accorded in the international sphere to the recommendations resulting from international reviews (IRRS, OSART (Operational Safety Review Team)) and from the regular Periodic Safety Reviews (PSR). The transparency of ENSI's supervision and of the operators' safety-related activities must be increased.
30	PP30	ENSI is reviewing the significance of the lessons learned from the Fukushima accident for its supervisory activities.
31	PP31	Additional operational resources must be kept in readiness for radiation protection in case of severe accidents.
32	PP32	It is necessary to examine whether the emission and immission measurements in place on the power plant sites in order to determine the activity releases are guaranteed in case of loss of offsite power (LOOP) or in case of an emergency.
33	PP33	It is necessary to examine the extent to which the availability of the meteorological data required for dispersion calculations is guaranteed in case of extreme natural events.
34	PP34	It is necessary to stipulate arrangements for dealing with contamination in the area surrounding nuclear plants following severe accidents.
35	PP35	It is necessary to examine how to deal with large volumes of contaminated water, radioactive waste or environmentally hazardous substances in case of severe

No	Point designation	Description
		accidents.
36	PP36	As part of the emergency planning for severe accidents, it must be ensured that sufficient radiation protection staff is available on site.
37	PP37	The knowledge gained from the Fukushima accident must be taken into account in the programmes to foster and develop the safety culture in Swiss nuclear power plants.

2.5 Table 5: List of open points for Switzerland from the EU Stress Tests

No	Point designation	Description
38	OP2-1	ENSI will follow up the question as to whether automatic scrams in the Swiss NPPs should be triggered upstream by the seismic instrumentation.
39	OP2-2	With respect to the seismic proof that has still to be supplied, ENSI will follow up, for all Swiss nuclear NPPs, with a more detailed examination of the seismic robustness of the isolation of the containment and the primary circuit.
40	OP2-3	For Gösgen and Leibstadt NPPs, ENSI will continue to follow up measures to improve the seismic resistance of systems for containment venting in case of events beyond the design basis.
41	OP3-1	ENSI will follow up on the impacts of a total debris blockage of hydraulic engineering installations at Gösgen and Mühleberg NPPs.
42	OP4-1	ENSI will follow up on more detailed proof of protection against extreme weather conditions, including combinations thereof.
43	OP5-1	ENSI will follow up on the development of a comprehensive strategy for the targeted deployment of the mobile accident management emergency diesels in order to secure selected direct current or alternating current consumers in the long term under total SBO (or SBO) conditions.
44	OP6-1	For the purpose of risk minimisation, ENSI will follow up on the extent to which the current deployment strategies for the containment venting systems in severe accidents should be retained.
45	OP6-2	ENSI will follow up on whether restoring containment integrity during shutdown in the case of a total SBO represents a time-critical measure.
46	PRT-1	The peer review team recommends considering the assessment of margins with respect to extreme weather conditions exceeding the design bases, e.g. by extending the scope of future PSRs.
47	PRT-2	It is recommended that the regulator assesses the opportunity of requiring more reliance on passive systems for hydrogen management for severe accident conditions. It is also recommended that the regulator considers further studies on hydrogen management for the venting systems.

3 List of abbreviations

AM	Accident Management
BDB	Beyond Design Basis
CNS	Convention on Nuclear Safety
DC	Direct Current
DG	Diesel Generator
DETEC	Department of Environment, Transport, Energy and Communication
ECC	Emergency Control Center
ECR	Emergency Control Room
ECURIE	European Community Urgent Radiological Information Exchange
ENSI	Swiss Federal Nuclear Safety Inspectorate
ENSREG	European Nuclear Safety Regulators Group
EPRI	Electric Power Research Institute
ER	Emergency Room
ERO	Emergency Response Organisation
EU	European Union
HERCA	Heads of European Radiological protection Competent Authorities
IAEA	International Atomic Energy Agency
IDA-NOMEX	Interdepartmental working group to review emergency protection measures in case of extreme events in Switzerland
IRRS	Integrated Regulatory Review Service
IRRT	International Regulatory Review Team
LOOP	Loss Of Offsite Power
MADUK	Monitoring network for automatic dose rate measurement in the vicinity of nuclear power plants
MCR	Main Control Room
NEA	Nuclear Energy Agency of the OECD
NPP	Nuclear Power Plant
NSC	Nuclear Safety Commission
NUSSC	Nuclear Safety Standards Committee
OBE	Operating Basis Earthquake
OECD	Organisation for Economic Cooperation and Development
OP	Open Point
OSART	Operational Safety Review Team
PAR	Passive Autocatalytic Recombiner
PP	Checkpoint
PRP	PEGASOS Refinement Project
PSA	Probabilistic Safety Analysis
PSR	Periodic Safety Reviews
RANET	OAEA Response and Assistance Network
RASSC	Radiation Safety Standards Committee
REMPAN	WHO Radiation Emergency Medical Preparedness and Assistance Network
RPV	Reactor Pressure Vessel
SAM	Severe Accident Management

SAMG	Severe Accident Management Guidelines
SBO	Station Black-Out
SER	Substitute Emergency Room
SFP	Spent Fuel Pool
SG	Steam Generator
SSE	Safe Shutdown Earthquake
SSHAC	Senior Seismic Hazard Analysis Committee
TRANSSC	Transport Safety Standards Committee
UHS	Ultimate Heat Sink
WANO	World Association of Nuclear Operators
WASSC	Waste Safety Standards Committee
WENRA	Western European Nuclear Regulators' Association
WHO	World Health Organisation

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ENSI-AN-8801
Published 19.05.2014