National Action Plan of Hungary

on the implementation actions decided upon the lessons learned from the Fukushima Daiichi accident

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Introduction

The accident at the TEPCO Fukushima Daiichi NPP triggered the European Council to conclude that the safety of all EU nuclear power plants should be reviewed, on the basis of comprehensive and transparent risk and safety assessment [1] - the so called stress tests. The official Hungarian denomination of this assessment was "Targeted Safety Re-assessment" (TSR). The stress tests consisted of three main steps: a self-assessment by licensees, followed by an independent review of the results and preparation of a national report by the national authorities, and by a third phase of international peer reviews. The peer review also consisted of 3 steps: an initial desktop review of the national reports, three topical reviews in parallel *(namely: external initiating events, loss of electrical supply and of ultimate heat sink, and accident management)* when the reviewers discussed the national reports with the authors of the reports; then visits were conducted by international expert groups at the national authorities and at the site of one nuclear power plant in each of the 17 participating States concerned. This last phase meant the conclusion of the country reports.
In Hungary, the Hungarian Atomic Energy Authority (hereinafter referred to as the HAEA or the authority) issued the requirements for operator's re-assessment [2] shortly after the publication of the ENSREG requirements [1]. The nuclear power plant completed the re-assessment and then the Authority prepared and submitted the national report [3] to the European Council by the deadline.

As the result of the first two steps of the international peer-review, draft country reports were drawn up on the basis of the reports of the national authorities and the consultations. These draft country reports still contained a "list of open questions" requiring further discussion, which provided basis for the third review phase to be concluded on the scene. The Hungarian party provided the review team with further information regarding the open questions even before the commencement of the third review step. During the visit phase, the review team conducted a site walk-down in addition to discussions with the experts of the authority and the operator. In the course of the site visit the international experts received clarification and explanatory information and visited the locations, reviewed equipment as well as the relevant procedures, which were referred in the National Report [3].

The international peer-review concluded that Hungary submitted a comprehensive National Report [3], which presented the appropriate analyses and their results. Hungary provided further detailed answers and explanations to the questions asked during the presentation of the report. During the national review both the authority and the operator provided appropriate explanations and justifications, as well as they allowed the international experts to observe the relevant documentation. The peer-review team was allowed to visit all relevant locations during the site walk-down.

The general statements of the country report on Hungary [5] on the basis of international peer-review were:

- The nuclear power plant is in compliance with the licensing conditions, able to withstand the loads induced by a design basis earthquake, flood or by extreme weather conditions; additionally, the facility is prepared for those design basis events, which entail the total loss of the electric power supply or the ultimate heat sink.
- The design basis established during the construction of the plant was extended through a series of safety improvement programmes (e.g. free surface acceleration, occurrence frequency of external threats) during the service life of the plant.
- Regulatory requirements were not in existence for events beyond the design basis at the time of the construction of the plant, but they are now established and the plant is in compliance with them thanks to the completed modifications.

- As a condition for the planned service life extension the authority requested the completion of all modifications in connection with the management of severe accidents. (These modifications had already been completed on Unit 1, since the service life extension licensing procedure of this unit finishes in 2012).

In addition to those mentioned above, in the course of the TSR process the operator proposed several corrective actions in order to increase the safety margins [3]. The HAEA overviewed and accepted the proposed actions and, together with a few additional actions, issued a decision [10] on their implementation and the preparation of a detailed implementation action plan.

The actions to be implemented for increasing the margins require detailed analyses and further preparation. Consequently, the authority required the preparation of the above mentioned action plan, which includes the detailed description of each action, the schedules of their planned implementation and the final deadlines thereof. This action plan [11] was submitted by the operator for regulatory review on June 27, 2012. The authority, after careful review, ordered the implementation of the actions in an authority resolution [12] on December 17th 2012. The operator's action plan [11] determined a list of elementary actions in order to complete the actions identified in the National Report [3] and in the authority decision [10], so that each elementary action can be associated with a unique modification or some other activity. Therefore, the number of elementary actions is larger than the number of actions in the authority decision [10], without identifying any new action since. In the current National Action Plan we refer to these elementary actions and also to additional actions to be completed by the authority itself.

After the implementation of all corrective actions, the authority shares the opinion of the operator on the judgment of the safety improvement of the nuclear power plant, as follows:

- The occurrence probability of severe accidents due to the permanent loss of electric power supply and ultimate heat sink is decreased.
- Severe accidents of reactors and spent fuel pools can be prevented or mitigated by the provision of an alternative water supply and electric supply routes.
- Extreme external events may cause damages to the site, but the risk of damage occurrence and the consequences of such events are reduced.
- The capability to prevent and/or mitigate accidents simultaneously affecting more units is enhanced.
- The solutions that can be utilized for emergency response are extended, including accident situations simultaneously affecting more than one unit.

The European Union has not closed the European level review triggered by the accident of Units 1-4 of the TEPCO Fukushima Daiichi Nuclear Power Plant; instead it declared its intention to track the implementation of the actions decided on the results of the "stress tests" in the Member States. Accordingly, the ENSREG (European Nuclear Safety Regulators Group) as the advisory body of the European Council made a decision at its meeting held on September 4-5, 2012 that the EU Member States operating nuclear power plants should elaborate a National Action Plan (hereinafter referred to as NAcP) and then submit it to the European Council by December 31, 2012. The NAcP should include the corrective actions identified during the stress tests and the subsequent international review, together with the deadlines for their implementation. Additionally, the NAcP should include the actions determined in the scope of those issues, which were identified in the 2nd Extraordinary Review Meeting of the Convention on Nuclear Safety (CNS) held in August, 2012.

The ENSREG provided guidance for the format and content of the NAcP (i.e., "Compilation of recommendations and suggestions, Peer review of stress tests performed on European nuclear power plants" [9] and "National Action Plan (NAcP) Guidance as directed within the ENSREG Stress test Action Plan" [8]). The current Hungarian NAcP has been prepared in accordance with these recommendations in the following structure and with the following content:

The introduction describes in general the preliminaries, the structure of the NAcP and the authority tasks in connection with the implementation of the corrective actions.

Part I, in line with the ENSREG recommendations [9] in its Topics 1-3, discusses the actions determined in relation to:

- natural hazards,
- loss of safety systems,
- severe accident management.

The document includes a short description of the actions, but their detailed justification is excluded, since such information can be found in the publicly available TSR National Report [3].

Part II includes those statements and potentially required actions, which came to the floor only at the Extraordinary Review Meeting of the Convention on Nuclear Safety held in Vienna, on August 27-31, 2012. Hungary, pursuant to the expectations, submitted an Extraordinary National Report [6] to the Convention by the requested deadline. The main areas discussed during the extraordinary review meeting, in addition to the scope defined by ENSREG, were:

- National organizations,
- Off-site Emergency Preparedness and Response,
- International Cooperation.

Part III would list those actions, which were not discussed above and did not belong to any areas listed above. Such actions were not identified based on the review; so Part III remained blank.

Part IV presents the actions discussed in Parts I-III in a table format, together with the deadlines for their implementation. In order to facilitate the identification of the listed actions, the table, if appropriate, provides references to the identifiers used in the ENSREG recommendations [8, 9], to the related chapters in the TSR National Report [3], as well as in the authority resolution [12] ordering their implementation. These references are meant to facilitate the work of those reviewing the NAcP, since the corrective actions can be clearly associated with the previously identified lessons and issue areas to be assessed.

This Hungarian NAcP was thus prepared based on the authority resolution [12] issued on the action plan proposed by the licensee of the nuclear power plant [11] (in relation to the scope and deadlines of tasks to be performed by the licensee) that was complemented by the actions to be performed by the authority.

Authority tasks

The authority, during the implementation of actions decided based on the lessons learned from the Fukushima accident, performed and performs the following tasks:

a) Review of the TSR action plan prepared by the licensee [11], its extension and harmonization, as well as ordering its execution.
b) Authority supervision of the execution of the ordered action plan; oversight of the fulfilment of the action plan.
c) Revision of the nuclear safety legal requirements, with the consideration of the compulsory requirements of the EU directive and of the reviewed WENRA reference levels and also of the reviewed IAEA safety standards, as well as the results of the national review process of the legal background.
d) Participation in the international processing and utilization of operational experience feed-back (IAEA and ENSREG Action Plan, OECD NEA).
e) Public information.

a) Review of the road map of the licensee

The authority evaluated the action plan submitted by the licensee [11]. A working group was established to carry out the evaluation, which prepared a work plan including the major milestones and viewpoints of the review. The review was carried out by at least two experts in each professional area and task, based on whether:

- the harmony with the TSR [3] report is adequate,
- all findings identified in the TSR report are managed,
- the actions are adequate and effective to eliminate the findings,
- the actions established are clear and can be performed,
- the schedule of actions is justified, and the safety risk of the period until the implementation is acceptable,
- the tasks have any relationship to Service Life Extension or Periodic Safety Review results (in order to establish agreement among action plans).

In the course of the review described above, the HAEA requested the licensee to supplement the action plan in order to comprehensively evaluate the safety risks of the periods remaining until the execution of each action. After the review of the additional information provided by the licensee, a unified and synthetic plan was concluded, the implementation of which was ordered by the authority to be carried out by the operator [12].

b) Supervision of the implementation of the licensee's action plan

The execution of tasks listed in the action plan, even if the shortest possible deadlines are considered, is a long-lasting process, which needs several years. Consequently, the authority should be prepared for a long-term supervisory activity, which may include difficulties that are usual in the case of actions requiring such prolonged implementation periods (e.g. replacement of persons, difficulties in traceability).

The supervision over the execution of actions can be divided to two basic groups:

A.) The supervisory activities for (nuclear safety related) modifications requiring authority apporval are to be performed in line with Govt. decree 118/2011. (VII.11) Korm.; i.e. licensing procedure, inspection and evaluation in connection with the given modification, and if appropriate, enforcement. The modifications not requiring authority approval are also inspected and evaluated by the authority. The oversight can be performed by a site inspection during the construction phase or via evaluation of the relevant documentation.

B.) Supervisory activities of actions not related to any modification (e.g. study, analysis, assessment, concept planning) are performed through evaluation of the individual documents in order to ensure that the necessary interventions will be accomplished in compliance with the nuclear safety requirements. If additional actions are to be established based on the regulatory evaluation (e.g. further modifications are needed), then the supervisory activities are realized as in Para A.

The progress of the implementation of the licensee's action plan is supervised by the authority in the frame of comprehensive and targeted inspections. These inspections are integrated to the yearly inspection plan of the authority.

In order to facilitate the tracking process of the implementation of the action plan, the authority obliged [12] the licensee to prepare periodic (due every six months) reports. This regulatory tool was applied by the authority also for tracking the action plan that was established as a result of the latest Periodic Safety Review. The TSR action progress report should present the progress in the implementation of each action individually, including the difficulties, decision points, any change in the schedule, as well as any such issue that may have effect on implementation. The report should also identify the reference documents prepared for each action.

c) Review of nuclear safety laws

The nuclear safety requirements for nuclear facilities should be reviewed based on the lessons learned from the Fukushima accident, as discussed in detail in Topic 4 of Part II.

d) Participation in the international experience feedback

Several international organizations are committed to process the experience gained from the Fukushima accident. HAEA has an active role in the work of these organizations, what gives opportunity to exchange and utilize the lessons learned (see Topic 6 of Part II).

In summary, the most important task in the field of international cooperation is the preparation and execution of the National Action Plan (NAcP).

e) Public information

It is important to inform the public about the results and consequences of the Hungarian and European stress tests. The HAEA puts special emphasis on providing appropriate and correct information to the public, as further discussed in Part II.

Part I: Review areas derived from the Post-Fukushima Stress Tests of the European Union

Part I contains the Action Plan concluded in the three main topics (1: Natural Hazards, 2: Loss of Safety Systems, 3: Severe Accident Management) of the Targeted Safety Re-assessment (the Hungarian stress test), which has been structured according to the expectations of the four following documents:

1. ENSREG "Compilation of Recommendations and Suggestions" [9],
2. Stress Test Peer Review, Country Report about Hungary [5],
3. Recommendations of the 2nd Extraordinary Meeting of the Contracting Parties to the Convention of Nuclear Safety held in 2012 august [7], and
4. additional tasks revealed during the Hungarian Stress Test [3].

According to the three main topics Part I is divided into three chapters, in which four sub-chapters appear.

Topic 1: Natural hazards

The accident of Fukushima Daiichi NPP has made it obvious that it is essential to consider the *appropriate* level of natural hazard factors in the design basis of nuclear power plants and that in addition to direct impacts the indirect consequences should also be taken into account.

1.1 Tasks derived based on the ENSREG "Compilation of Recommendations and Suggestions" document [9]

Document [9] highlights eight topics in relation to external natural hazards in Sections 3.1.1. through 3.1.8., which should be covered in the National Action Plans (NAcPs). Those issue groups regarding these topics together with the respective tasks are described below in which corrective actions were decided to improve the situation:

1.1.1 Recurrence frequency taken into account in the design basis

According to the recommendation: *in the safety reviews and back-fitting of nuclear power plants a return frequency of 10^{-4} per annum (0.1g minimum peak ground acceleration for earthquakes) with respect to external hazards should be considered*. The Hungarian regulation requires to consider natural hazards of 10 thousand year recurring frequency. As described in Section 2.1.1. of the Hungarian Stress Test Report [3] this requirement had been satisfied for earthquakes before the Periodic Safety Review terminated in 2008, due to the completion of the seismic safety reinforcements. The respective analyses demonstrated (See [3] 3.1) that the requirement for flooding, or for low water level, of the Danube is also met. ([3] 4.1.). Systematic assessment of these impacts had not yet been accomplished at the time of the Periodic Safety Review, but later, by 2011 December the analyses were successfully completed. [<1>][1]. So no open task exists in this relation.

1.1.2 Secondary effects of earthquakes

The assessments described in Section 2.3.3. and 3.1.1 of [3] showed that flooding occurring as a consequence of an earthquake on the site, or far from it (dam break in upstream direction or narrowing of runway of the Danube), cannot endanger the site. Possible secondary effects of design basis earthquakes are discussed in Section 2.1.2. of [3]. However, occurrence of a fire on the site cannot be excluded, which may necessitate the deployment of the plant fire brigade. Some intervention is necessary therefore to protect the personnel and equipment in

[1] The form [<x>] will be used hereinafter to make reference to individual serial number of tasks listed in Part IV.

the fire brigade headquarters, which are made of reinforced concrete, but are not yet seismically qualified. [<2>].

The demineralised water tanks at Installation II (Units 2 and 3) – that play an important role in ensuring demineralised water stocks – are located in the direct vicinity of the service building. The walls of the building shall be seismically qualified and, if necessary, reinforced or provide appropriate protection of the tanks by other means. [<3>].

According to the current conservative analyses, soil liquefaction might occur in the acceleration ranges slightly exceeding the design basis, which may cause uneven settlement of the buildings (discussed in Section 2.2.1.1. of [3]). As a consequence, the underground lines and connections (pipelines, cables) at risk due to potential settlement of the main building shall be re-qualified and, if necessary, modified to allow for a relative displacement [<4>]. In addition, a state-of-the-art analysis shall be performed for the proper assessment of the existing margins of earthquake-initiated building settlement and soil liquefaction phenomenon [<5>].

1.1.3 Protected volume approach

There are certain wall penetrations in the machine room of the essential service water pumps above the level Bf 95.12 m (Section 3.1.2. of [3]). The penetrations are not provided with water sealing, so flooding of the machine room may occur if a flood exceeding this level takes place. The water penetrating through the walls would accumulate in a sump and a permanently installed sump pump can remove it. Modification of the wall penetrations to a sealed design shall be carried out [<6>].

According to Section 2.1.2. of the report [3], automatic shutdown of the main condenser coolant pumps shall be provided when the condenser pipeline is damaged due to earthquake or other reason. It shall be ensured that the pipeline trenches are applicable to receive and drain the discharged water. If necessary, the dike shall be elevated or additional dam shall be constructed to avoid the flooding of the turbine hall or the cable tunnels [<7>].

1.1.4 Early warning notifications for extraordinary natural impacts

Besides the fact that Paks NPP operates its own meteorological station, it is in daily touch with the Hungarian Meteorological Services. A similar relationship is maintained with the water authorities. Taking into account the relatively small size and geographical situation of Hungary, the current practice is satisfactory from every aspect and no task has been identified.

1.1.5 Seismic monitoring system

The Paks NPP control rooms are equipped with seismic monitoring systems, which provide an alarm signal if a pre-defined acceleration level is exceeded. However, currently no such system exists which would initiate an automatic shutdown of the reactors for a given acceleration level ([3] 2.1.2). In the frame of the reconstruction project of the seismic instrumentation, which is in preparatory phase, the question of automatic shutdown shall be revisited [<9>].

1.1.6 On-site inspections, qualified walkdowns

The licensee performed a large number of walkdowns during the TSR process, and deployed external experts when and where it was necessary. Records were taken about the walkdowns. The authority supervised the stress test assessments of the licensee in an inspection process. During the course of implementation of safety improvement measures, with special regard to those where the implementation of which was ordered by it, the authority shall apply

regulatory inspections. If specific international standards, requirements become available for such inspections and qualified walkdowns, both the authority and the licensee shall adopt and apply them. Currently it was not justified to set up any additional task in this field.

1.1.7 Flooding margin assessments

Section 3.2. of [3] determined that the site of Paks NPP is not prone to flooding, since the formation level of the embankment both on the opposite side of the Danube and upstream on the right bank is lower than the level of the site. Consequently, should an extreme high water level occur, the opposite bank and areas far from of the plant site will be flooded. No open task exists.

1.1.8 Assessment of external hazard margins

Section 1.1.2. discussed task [<5>] in relation to earthquakes. Apart from that, the seismic resistance margins of buildings and equipment have been recently reviewed using the most advanced techniques and appropriate margins have been observed (see: [3] 2.2.). Section 4.2.2. of the report [3] describes that one of the statements of the latest Periodic Safety Review dated to 2008, that evaluation of loads caused by weather impacts is not in compliance with modern expectations. Accordingly, the assessment scheduled a new, supplementary analysis. The deadline for that is the end of 2012. Following the submittal of the results of those, the authority will review these assessments.

1.2 Tasks from the stress test peer review report of Hungary [5]

The report [5] contains recommendations for the authority in relation to earthquakes, to closely supervise and inspect the implementation of those actions, which the licensee plans to implement to make certain structures (underground lines and connections) of the plant more resistive against the effects of a potential uneven building settlement occurring due to the effect of a possible soil liquefaction. Similarly, it recommends revision of the database containing the seismic classification of certain systems, structures and components. This revised database was completed by April 30, 2012 and its regulatory supervision was also performed. Also the ENSREG peer review [5] recommended the oversight of modification of the wall penetrations of the essential service water system to a sealed design and of the activities for necessary reinforcements against extreme weather conditions. It is true for all these activities that the authority oversees and reviews the process and results of the tasks accomplished by the licenses according to the normal regulatory procedures. The recommendations of document [5] therefore did not necessitate identification of additional tasks.

1.3 Tasks from the recommendations of the 2nd Extraordinary Review Meeting of the CNS

In Topic 1 of the 2nd Extraordinary Review Meeting of the CNS held in August, 2012, which addressed external natural hazards, five thematic recommendations were formulated. It is expected from the member states of the Convention to report during the next, 2014 ordinary review meeting about:

1) Results of reassessments of external hazards with emphasis on changes to licensing basis.
2) Peer reviews of assessments and their results.
3) Additional improvements taken, or planned, based on the reassessments.

4) Activities taken, or planned, to improve safety culture based on lessons learned from the Fukushima accident.
5) Regulatory changes concerning external events that are already expected to be reported.

These five themes are discussed below:

1.3.1 Reassessments of external hazards

This action was accomplished by Paks NPP during the last Periodic Safety Review completed in 2008. The results were reassessed in the frame of the EU Stress Test [3] and presented in Sections 1.1 and 1.2.

1.3.2 Peer review of reassessment

The reassessment took place during the peer review phase of the EU Stress Test, the results of which were discussed in section 1.2.

1.3.3 Additional improvements taken or planned based on the reassessments.

Details were discussed in Section 1.1.

1.3.4 Safety culture

Within the topic of external natural hazards, during the course of the stress test, it was revealed corresponding to safety culture (Sections 2.1.2. and 2.2.4. of [3]) that seismic-proof fixing of temporary, non-process equipment in the outage periods and recovery of fixings dismantled for maintenance purposes are not duly regulated. Paks NPP defined a corrective action in relation to that: "Extraordinary attention shall be paid to seismic-safety related housekeeping and full recovery of fixings after main outages. Fixing of the non-process equipment and maintenance tools that could adversely impact process equipment during outages shall be provided." [<8>]. The authority inspects the implementation of the action during post-outage start-up process of the reactors.

1.3.5 Review of regulatory requirements

The full revision of the regulatory requirements started in 2009 and terminated at the beginning of 2012. A further revision has been taking place with the involvement of external experts. The result of this revision will be the identification of the necessary amendments of the system of requirements [<50>]. Additional amendments of the requirements will be planned and scheduled when such modified international standards are issued (e.g. NAÜ, WENRA, NEA), which go beyond the current domestic norms (see also Part II Section 5!).

1.4 Tasks additional to the above expectations

Primary circuit damage for the effect of design basis earthquakes was excluded by the seismic-reinforcement projects implemented earlier. However, due to implications from the Fukushima Daiichi accident, such improbable, complex cases shall also be taken into account as extension of the design bases (See: Section 2.1.2. of [3]). Accordingly, the existing symptom-based emergency operating procedures shall be reassessed as to whether they support an optimal recovery in such a combined situation [<10>].

Section 2.2.1.2 of [3] concludes that the 400 kV and 120 kV substations are not safety systems and therefore they are not seismically reinforced. These substations however, might provide many alternative electric supply opportunities, if they are not damaged. The

earthquake protection of the substations and the gears for automatic switching the plant to isolated operation shall be re-evaluated and reinforced if necessary [<11>].

According to Section 5.2.2. of [3] maintenance and inspection procedures to be applied in the situation of the extreme low level of Danube were not satisfactory. Therefore, the periodic inspection, maintenance and operational testing regarding the equipment to be applied in case of low water level shall be supplemented. The inspection, testing and maintenance instructions, which are still missing, shall be developed [<12>].

During the stress test the authority required [10] that a "list of such system components important to safety, which are endangered by electromagnetic effects (including the effects induced by lightning) and thereby need to be classified accordingly, shall be compiled to display whether or not a given component is adequately qualified" [<13>]. Based on the list the authority and the licensee can specify reinforcements and corrective actions.

Also the authority resolution terminating the stress test assessments [10] ordered that "it shall be analyzed if the lack of seismic qualification of the machine racks and travelling water band screens of the essential service water system jeopardizes the ultimate heat sink function and, if necessary, the adequate exclusion measures shall be implemented" [<14>].

Topic 2: Loss of safety systems

2.1 Tasks derived based on the ENSREG "Compilation of Recommendations and Suggestions" document [9]

2.1.1 Application of means providing alternate cooling and heat sink

Corrective actions planned in Section 5.2.5. of report [3]: the operator shall maximize the available inventory of the stored demineralised water in all operation states [<15>]. The access to the connection point of the auxiliary emergency feedwater system in accident conditions shall be improved. Connection points shall be established on the demineralised water tanks to allow the water supply, through the auxiliary emergency feedwater system, by mobile equipment. Arrangements shall be laid down in instructions for additional external supply opportunities from the Danube and the fishing lakes. [<16>]. The potential setting of the boron concentration of water inventories from external sources, and its storage, shall be solved and supply mode of borated water inventories to the containment shall be regulated in an operating instruction [<17>]. By provision of an appropriate electrical power supply it shall be established that the bank filtered well plant, which can be used irrespective of the water level of the river, be able to supply water to the essential service water system via the existing connections in accident situations [<18>]. The accessibility of the water reserve available in the closed segment of the discharge water canal for the earthquake resistant fire water pump station of Installation II that is equipped with an individual diesel power supply shall be solved [<19>]. Similar to the connection existing on Installation I, the water supply shall also be solved for Installation II from the fire water system to the essential service water system through the technology cooling water system [<20>]. The equipment necessary for the cooling water supply to at least one diesel generator of each unit from the fire water system shall be provided and the operating instruction shall be completed with the measures to be implemented [<21>]. Topic 3 deals with the equipment to be deployed from external organizations that should be applied in case of severe accidents. See actions [<32>, <33>].

2.1.2 Enhancement opportunities of on-site and off-site AC power supply

The following corrective actions were decided based upon Sections 5.1.1.3., 5.1.5., 5.2.5. and 5.3.1. of report [3]: utilizing the fuel storage capacity of the tanks of the safety diesel generators, the amount of stored diesel fuel shall be increased, and this shall be incorporated in the procedures [<22>]. Protection of the 400 kV and 120 kV substations, which are not of safety category and therefore are not seismically reinforced and the automatic switching of the plant to isolated operation against earthquakes shall be evaluated and reinforced if necessary [<11>]. Power supply from the safety trains of - filters of the essential service water system shall be established [<23>]. Appropriately protected independent severe accident diesel generator(s) shall be installed after assessment of the necessary capacity and determination of the design requirements including beyond design basis hazards [<24>]. Out of the two power plants being able to supply external electric power via dedicated lines, the black-start capability (start-up from own diesel generator) shall be established for the Litér gas turbine plant [<25>]. Actions discussed in the previous section can also be mentioned here: actions [<18>] and [<21>]. Procedures shall be developed for the use of the possible, but currently not applied, cross-links of the safety power trains across the units. The procedures shall cover the normal operational trains, as well as the backup and safety buses. [<26>]. Possible cross-links shall be studied and the concluding modifications shall be carried out for providing safety electrical power supply from any operable emergency diesel generator in any unit to the safety consumers of any other unit [<27>]. Topic 3 addresses the provision of electric power supply equipment of external organizations to be applied in severe accidents in the plant, see action [<33>].

2.1.3 Enhancement opportunities of DC power supply

Paks NPP assessed the battery stations during the stress test. The conclusion was that if the reliability and amount of AC power supply is available then there cannot be a problem with the DC power supply, since the battery stations can be charged from any of the AC power supplies. After considering the corrective actions related to AC power supply described above, no additional corrective actions were identified for DC power supply, see sections 5.1.1.2. and 5.1.2.1. of report [3].

2.1.4 Operational and preparatory actions

Actions [<8>], [<10>] and [<6>] in Topic 1, and actions [<22>, <15>, <16>, <17>,<21> and <26>] described above, along with actions [<33>, <34>, <35>, <37>, <38>, <42>, <43>, <41>] described below in this topic and in Topic 3, address the development and enhancement of operational and other application procedures. Action [<12>] of Topic 1 should also be mentioned here, which foresees the practical training of the personnel.

2.1.5 Instrumentation and monitoring

Although the task according to corrective action [<9>] of Topic 1 itself is not related to instrumentation, but builds on the results of seismic instrumentation reconstruction decided prior to the stress test. Beyond that, action [<36>] of Topic 3 address the instrumentation of the Protected Command Centre, while action [<46>] required by the authority schedules the

revision of the adequacy of the emergency related on-site and off-site radiation monitoring devices for earthquakes and loss of power supply.

2.1.6 Shutdown improvements

Corrective actions are only indirectly assigned to shutdown state, in relation to two analyses actions. Section 2.1.17. will describe them. Based on section 2.2.1., 5.2.4. and 5.2.5. of the stress test report [3] action [<28>] will clarify the necessity of a time limit for the state of shutdown but not for a cold reactor, while action [<41>] connected to Topic 3 includes 3-dimensional hydrogen distribution calculations for the simultaneous accident state of one open reactor in refuelling state, one operating reactor and two spent fuel pools (considering that two units have a common atmosphere reactor hall).

2.1.7 Reactor coolant pumps seals

Seals of the main coolant pumps of Paks NPP do not degrade during shutdown; therefore the issue in Hungary is not relevant, which has been satisfactorily clarified during the course of the peer review (last Para. of Section 3.2.2.2 of [5]).

2.1.8 Improvement of ventilation capacity in total loss of power supply

Section 2.1.2. of [3] dealt with the provision of AC power supply. If this is available, then ventilation connected to safety supply, required for the operation of the process equipment and compartments for personnel to stay is ensured. No separate action was necessary except for the Protected Command Centre. Action (PCC) [<48>] of Topic 3 plans the re-assessment of air conditioning for the PCC and installation of operable equipment that can be operated from an adequate power diesel generator.

2.1.9 Improvement of main and backup control rooms for long term habitability after a total loss of power

Taking into account Section 4.2.1. of [3], after the improvement of safety supply according to Section 2.1.2. the habitability of the unit control room will be appropriate (also taking into account the DC power supply according to Section 2.1.3). The situation is different in the case of the command centres designed for managing emergency response: both the Protected Command Centre and the Backup Command Centre corrective actions had to be decided ([<48>] and [<49>]). These are described in Topic 3.

2.1.10 Improvement of robustness of spent fuel pools for various events

Further actions, going beyond the contents of Section 1.2.2. and 2.1.2. of the Stress Test report [3] have also been identified: [<32>, <34>, <35>]; they appear in the field of emergency preparedness (see Topic 3).

2.1.11 Improvement of separation and independence of safety systems

One improvement action was decided in relation to separation (see: Section 2.1.2. and 2.2.4. of [3]). The intention is to timely shut down the large diameter and large flow-rate condenser cooling water systems, if damaged, and to allow for the whole water volume discharged [<7>]. In another respect, the stress test actions are rather meant to increase diversity than to improve separation and independence.

2.1.12 Flow path and access availability

Instead of maintenance of routes with special tools, actions rather meant to ensure parallel, diverse water and electric power supply routes were decided. Actions [<11>, <16>, <20>, <21>, <25>, <26>, <27>] were already mentioned in Sections 2.1.1. and 2.1.2., and actions [<32>, <33>, <42>] described in Topic 3. The latter is related to routes of liquid releases during severe accidents. Action [<16>] relates to ensuring accessibility and the tasks [<43>, <44>, <45>] also for accident conditions.

2.1.13 Provision of mobile devices and their adequate storage

Actions [<8>] and [<12>] described in Topic 1 and tasks [<34>] and [<18>] in Topic 3 are connected to mobile devices and appropriate storage.

2.1.14 Bunkered/hardened systems

Action [<24>], which also belongs to Topic 3, was concluded based on the considerations in Section 5.1.3 of the national regulatory stress test [3]. The placement of these diesels is regarded as hardened. Action [<32>] aimed at establishing a new, hardened coolant supply route to the spent fuel pool was discussed in Section 5.2.3. of the same report. The Protected Command Centre and the Backup Command Centre shall be reinforced according to actions [<47>] and [<48>]. These actions also belong to Topic 3. Action [<2>] discussed in Topic 1 on the hardened placement of fire brigade and personal protective equipment.

2.1.15 Improvement of response capability to multiple accidents on the site

The following actions of Topic 3 address the potential multiple accidents of the units on the site: [<24>, <36>, <37>, <41>].

2.1.16 Equipment inspection and training programmes

The necessity for a more elaborated formal control of NPP staff activity by procedures in relation to supplementary actions to be taken when an extreme low level of the Danube occurs was determined based on Section 5.2. of [3] that also included a more frequent training and exercise of the staff for these activities [<12>]. This belongs to the issues discussed in Topic 1.

2.1.17 Further studies to address uncertainties

Performance of further assessments was decided in concert with Sections 2.1.2., 2.2.1., 2.2.4., 6. and 7.3. of report [3]. Additional actions [<5>, <9>, <10>, <11> and <14>] discussed in Topic 1 can also be mentioned here. Action [<28>] which foresees a probabilistic assessment for closed reactor states under 150 °C primary circuit temperature can also appear in this part. Some actions of Topic 3 are also relevant to this issue: [<30>, <38>, <41>, <46>].

2.2 Tasks from the stress test peer review report of Hungary [5]

The report of the peer review team contains one recommendation in relation to this topic: *"The possibilities of interconnection of existing equipment are beneficial. However might also lead to loss of separation. Such improvements or modifications should be prepared carefully. Before the implementation, separation issues should be investigated.* (See Section 3.3 of [5]). No corrective action is required in relation to this recommendation. If the interconnections are

established as part of emergency/accident management, when it is necessary anyway to consider the pros and cons of the action in the given situation, then obviously no corrective action can be formulated as a preparatory action. Notwithstanding that the interconnections are established under normal circumstances as part of preparation for the accident situations, then these are modifications of the systems. The nuclear safety regulations specify the modification process and the requirements for the respective supporting analysis and the modification is subject to authority approval. This is a satisfactory provision to comply with the above recommendation.

2.3 Tasks from the recommendations of the 2nd Extraordinary Review Meeting of the CNS

Connecting topic: 2 – Design Issues
Recommendations based on the final summary report of the 2nd Extraordinary Review Meeting of the CNS [7] and the corresponding thematic rapporteur reports, which are not published, are listed below. Also the reasons are specified why no additional improvement actions are decided.

2.3.1 Increasing plant robustness to face unexpected challenges

The expectation, according to the detailed explanation, is the safety improvement of existing nuclear power plants and the improvement to designs of new reactors by taking account of natural hazards more severe than the ones considered in the design basis.

During the stress test [3] the beyond design basis effects were examined for Paks NPP and the necessary improvement actions were determined (see Topic 3). Additionally, the relevant regulation for new reactors, in harmony with international recommendations, contains the requirements for the extension of design basis and severe accidents.

2.3.2 Safety objective for new NPPs

The safety objective for new nuclear power plants is defined through the introduction of the approach of "design extension conditions": long term off-site radioactive contamination due to severe accident shall be prevented.

The recent update of the Hungarian Nuclear Safety Codes contains this requirement.

2.3.3 Safety requirements for equipment used in design extension conditions

Requirements for the equipment designed to apply in design basis extension state are included in the nuclear safety regulations both regarding fixed (installed) and mobile equipment and their storage location, in full compliance with the current international practices.

It should be noted in relation to each of the above themes that the HAEA follows, and the Hungarian regulations incorporate regularly the enhancements of the international safety standards and recommendations.

Topic 3: On-site emergency response, accident management and recovery

3.1 Tasks derived based on the ENSREG "Compilation of Recommendations and Suggestions" document [9]

The ENSREG document [9] details the expectations regarding on-site emergency preparedness and severe accident management, so the tasks in this issue are only described according to this document and recommendations of the CNS Extraordinary Review Meeting. Recommendations of the Stress Test Peer Review to Hungary [5] are referred to within the issues described.

3.1.1 Compliance with WENRA reference levels

3.1.1.1 Hydrogen mitigation in the containment

This issue is in relation to Theme 2.2. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS

Paks NPP had decided to introduce the Severe Accident Management Guidelines before the accident of Fukushima-Daiichi NPP as one of the conclusions of the earlier Periodic Safety Reviews, as well as the implementation of the respective technical modifications. One of the technical modifications was the installation of hydrogen recombiners in the containments designed to cope with severe accidents, which was accelerated as a response action to the accident in Japan and carried out before the end of 2011 for each of the units.

Section 6.3.2. of the Hungarian Stress Test report [3] and Section 4.2.1.3. of report [5] address this issue. No further action is necessary.

3.1.1.2 Hydrogen monitoring system

This issue is in relation to Theme 2.2. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Installation of the severe accident instrumentation has been taking place for Paks NPP unit also in the frame of the above describe technical modifications that had been decided before the accident of Fukushima Daiichi NPP. This involves the construction of the hydrogen monitoring system, which may be powered from the severe accident diesel generators. The modification has already taken place in unit 1 and unit 2, while it will be implemented in 2013 in unit 3 and in 2014 in unit 4 [<29>].

Section 6.3.7. of the Hungarian TSR report [3] and the Section 4.2.1.3. of report [5] address this issue. No further action is necessary.

3.1.1.3 Reliable depressurization of the reactor coolant system

This issue is in relation to Theme 2.2. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Installation of the severe accident diesel generators have also taken place for Paks NPP in the frame of the above described technical modifications decided before the accident of Fukushima Daiichi NPP. This modification is accomplished for all 4 units of the plant. As a

means of primary circuit depressurization, the system of overpressure protection valves connected to the pressurizer vessel was modified to ensure its power supply from the severe accident diesel generator, which means a significant safety gain from the aspect of implementation of depressurization.

Section 6.1.2.1. of report [3] described the modification, report [5] did not specifically address this issue. No further action is necessary.

3.1.1.4 Containment overpressure protection

This issue is in relation to Theme 1.4. and 2.2. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Section 6.3.3. of report [3] described the technical solutions available in Paks NPP in order to prevent over-pressurization of the containment. The report decided the following action for the severe accident pressure conditions to prevent unfiltered release [<30>]:
An analysis of the long-term (beyond 1 week) progression of severe accidents shall be carried out. Based on the analysis results, a system that is able to prevent the long-term, slow over-pressurisation of the containment shall be developed and implemented.
Section 4.2.2.2. of section [5] confirmed the necessity of such an action. Paks NPP prepared the concept for the implementation, which recommends the installation of an active cooling system.

3.1.1.5 Molten corium stabilization

This issue is in relation to Theme 2.2. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Among the severe accident management measures decided by Paks NPP before the accident of Fukushima-Daiichi NPP the licensee of Paks NPP selected the strategy of in-vessel maintenance of the molten core. According to that, the molten core can be stabilized within the reactor pressure vessel by flooding the reactor cavity and external cooling of the vessel. The respective modification has already been implemented for unit 1 and unit 2, while it will take place in 2013 and 2014 during the refuelling outages of unit 3 and unit 4 respectively.
Section 6.3.5. of report [3] described the modification and Section 4.2.1.3. of report [5] addressed the issue [<31>]. No further action is necessary.

3.1.2 Severe accident management hardware provisions

This issue is in relation to Theme 2.1. and 5.5. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

The design basis for severe accident management modifications decided before the accident of Fukushima Daiichi NPP had been the provision of operability under the specified severe accident circumstances. In addition to that the following actions have been decided:
According to Section 5.1.5. of report [3] in addition to the existing severe accident diesel generators supplying electrical power to measurement and control systems described in accident management procedures, it is justified to install a diverse accident diesel generator, which can supply electrical power to safety consumers having roles in severe accident prevention and long term accident management. The capacity of the diverse accident support diesel generator shall be determined in such a way that it shall be capable of supplying electrical power to the required consumers, pumps and valves. The number and capacity of the independent accident diesel generators shall be determined with the consideration of the

safety principles. Simultaneous loss of power of more, even all, units shall be assumed and the cooling needs of the reactors and the spent fuel pools shall be considered. The independent severe accident diesel generators shall have appropriate protection against beyond design basis external hazards (earthquake, natural hazards, flooding) of the installed emergency diesel generators and they shall be totally independent of other systems (such as the cooling or electric supply systems) of the plant. The design basis for the independent severe accident diesel generators shall be determined in such a way that the accident diesel generators would be available even if the design basis loads of the installed safety diesel generators were exceeded. The concept document prepared for the action contains the installation of 1-1 diesel generator both for Installation I and II, the capacity of which is enough to supply one safety train [<24>].

According to Section 5.2.5. of report [3] the nuclear power plant has 9 wells, each having a large diameter and a depth of 30 m that are bored in the pebble bed of the Danube; these wells are permanent water sources providing an unlimited quantity of water independently of the water level of the Danube. A connection system is installed from the well plant to the essential service water system. Electric power supply shall be provided from a duly protected fixed or mobile diesel generator to supply, in emergency, the submersible pumps of the wells drilled into the pebble bed of the Danube bank [<18>].

According to Section 5.2.5. of report [3] a new water supply route connected in the courtyard by flexible means shall be constructed that is protected from external hazards (such as earthquake). The spent fuel pool shall be filled from the borated water reserve specified above via this line. The required operations shall be specified in procedures [<32>].

According to Section 6.1.5. of report [3] corresponding to management of severe accidents, for the construction of an external water supply route to the auxiliary emergency feedwater system, the equipment necessary for the connection of external origin mobile diesel generators and pumps to the systems shall be purchased [<33>].

3.1.3 Review of Severe Accident Management Provisions Following Severe External Events

This issue is in relation to Theme 1.2. and 5. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Development of severe accident management guidelines was one of the severe accident management actions decided by Paks NPP before the accident of Fukushima Daiichi NPP. One of the design aspects of the guidelines was the provision for their implementation under the assumed severe accident circumstances. The guidelines enter into force in the various units, when the respective technical modifications are completed: until the end of 2012 regarding unit 1 and unit 2, while in 2013 and 2014 in unit 3 and unit 4, respectively. In the course of the stress test the following action has been decided to supplement the guidelines:
A severe accident situation simultaneously taking place in the reactor and the spent fuel pool shall be managed by the development of a severe accident management guideline. Technical modifications, generated by the implementation of other actions, shall be implemented in the concerned Severe Accident Management Guidelines (SAMG), and the method of the use of external supply opportunity shall be described in procedures [<34>, <35>].

Section 6.1.1.2. of report [3] described the SAMGs and Section 4.1.5. of report [5] confirmed that they conform to the international expectations and it did not identify any need for additional actions.

3.1.4 Enhancement of Severe Accident Management Guidelines

This issue is in relation to Theme 1.2. and 4. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

In addition to that which has been described in Section 3.3.3., Section 6.3.8. of report [3] dealt with further improvement of severe accident guidelines for multi unit accidents. According to the conclusion the guidelines themselves can be applied independently for each unit respectively, but the resources are not sufficient to carry out the guidelines in parallel. So the following action has been determined:
The physical arrangement and instrumentation of the Technical Support Centre, established at the Protected Command Centre, shall be extended to provide sufficient resources for simultaneous management of severe accidents occurring on more than one (even all 4) units [<36>]. The structure of the organization responding to accidents affecting multiple units and the number of staff shall be determined; procedures shall be developed for personnel and equipment provisions, as well as for shift changes [<37>].

The issue was discussed in Section 4.2.1. of report [5], while its Section 4.3. confirmed the decided action.

A further action that increases the tools of the guidelines are that Paks NPP is to initiate the provision of black-start capability (start-up from its own diesel generator) for the Litér gas turbine, such action has also been discussed in Section 2.1.2 [<25>]. The action was grounded in Section 5.1.1.2. of report [3] and discussed by Section 3.2.2.1. of report [5].

3.1.5 Validation of enhanced severe accident management guidelines

The issue corresponds to Theme 1.2 of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

In the course of regulatory licensing of severe accident management guidelines, the authority obliged the operator to verify the guidelines in the frame of an emergency response exercise. This has taken place with a regulatory inspection. As the result of the verification the guidelines have been introduced for unit 1. A similar verification would take place after any supplementation or enhancement of the guidelines. Report [3] did not discuss this verification, but in the course of country peer review the international peers received information on the content of that. Report [5] did not foresee any action in this field.

3.1.6 Severe accident exercises

The area of emergency response exercises has been shortly discussed in Section 6.1.1.5. of report [3]. According to the Hungarian legislation the emergency response organization of the NPP is required to carry out a full-scale nuclear emergency exercise every year that involves the whole personnel of the organization. Off-site emergency response organizations shall be invited to take part in the exercise. The scenario of the exercise shall make it possible to practice the implementation of on-site organizational and technical measures in severe accident situations. No action was determined in this area.

3.1.7 Training of severe accident management

This issue is in relation to Theme 1.2. and 4. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

By the introduction and implementation of severe accident management guidelines and modifications the operator also introduced the training of severe accident situations (see 3.3.5.) and proposed its connection with emergency response exercises. Consequently the emergency response exercises provide an opportunity to practice the tools and procedures of severe accident management. In order to prepare for multi unit accidents the action described in Section 3.3.4. was determined. The training and exercise of multi unit emergencies can take place after the implementation of that action.

A software-based severe accident training simulator shall be developed [<38>]. In the first stage of the two-stage development the current simulator will be extended for the education of the staff of Technical Support Centre, while later it will be applicable to train a wider scope of the potential users.

Section 6.1.6. of report [3] and Section 4.2.4.2. of report [5] discussed the issue related to severe accident management. No further action is necessary.

3.1.8 Extension of severe accident management guidelines to all plant states

This issue is in relation to Theme 1.2. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

In the frame of severe accident management guidelines elaborated in the frame of severe accident management measures decided before the accident of Fukushima-Daiichi, NPP cover the low power and shutdown mode of the reactor, as well as the severe accident situation of the spent fuel pool. Section 6.2. of report [3] and Section 4.2.1.2. of report [5] discussed the guidelines. No further action is necessary in this area.

3.1.9 Improvement of communication

This issue is in relation to Theme 2.2. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Section 6.1.2.4. of report [3] discussed emergency communication and the improvement action below has been determined based on the considerations:

The methods to guarantee the conditions for radio communication shall be assessed in the case of permanent loss of electric power and earthquakes and the necessary actions shall be performed [<39>].

Informatics mirror storage computers shall be installed, both at the Protected Command Centre and the Backup Command Centre, containing the necessary scope of data (i.e. technical documentation, personal data, etc.) [<40>].

Section 4.2.2.2. of report [5] confirmed the actions.

3.1.10 Presence of hydrogen in unexpected places

This issue is in relation to Theme 5. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

During the stress test (Section 6.3.8. of [3]) it was determined by conservative, lumped-parameter codes what amount of hydrogen is generated in the accident of two spent fuel pools, one reactor in shutdown and the other reactor in operation and what hydrogen concentration occurs in the reactor hall. According to the calculation results inflammable concentrations may occur, which can lead to turbulent burning. An action was therefore decided in order to determine the distributions using less conservative, three-dimensional analyses beyond the use of the lumped-parameter models [<41>].

The action was confirmed in Section 4.3. of report [5]. Need for further action will be the result of the analysis.

3.1.11 Large volumes of contaminated water

This issue is in relation to Theme 1.4. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Section 6.1.3.3. of report [3] determined that the plant is not fully prepared to manage liquid radioactive wastes generated in large quantities during a severe accident. The following action was therefore decided:
Procedures shall be developed for the management of liquid radioactive wastes during severe accidents. The risk, potential routes and possible monitoring tools and methods of liquid form release of radioactive materials shall be examined and the measures necessary, and possible to respond to in such a situation, shall be specified [<42>].

3.1.12 Radiation protection

This issue is in relation to Theme 1.4. and 6 of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Report [3] determined (6.1.3.5.) that the following actions are necessary in order to improve the access in severe accident conditions impaired by the adverse radiation conditions:

Procedures for collecting and transporting emergency response personnel shall be developed and the necessary means and rules of their provision shall be determined [<43>]. A shielded transport vehicle deployable at significant radiation levels shall be procured [<44>]. The rules for exemptions from the air ban around the plant shall be modified to manage airborne support [<45>].

According to authority resolution [10] the applicability of fixed radiation monitoring devices installed on, and in the vicinity of the site to support emergency response activities after an earthquake and total loss of power shall be assessed [<46>].

The actions were addressed in Section 4.2.1.5. of [5].

3.1.13 On-site emergency centre

This issue is in relation to Theme 3 of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

The NPP has an appropriate on-site emergency centre, the so called Protected Command Centre and shelters suitable for the stay of response personnel. In order to further improve the situation the following actions have been decided:

Seismic qualification of the on-site shelters not yet qualified shall be performed and non-earthquake resistant equipment in the shelters shall be improved. A nuclear emergency response centre resistant to earthquakes of peak ground acceleration higher than design basis earthquake shall be established [<47>].

Air-conditioning of the Protected Command Centre shall be re-assessed and an appropriate piece of power equipment shall be installed that can also be supplied by diesel generator [<48>].

A Backup Command Centre that complies with protection requirements and is equivalent with the Protected Command Centre in terms of management and communication shall be established [<49>].

The actions were discussed in Section 4.2.1.5. and 4.3. of report [5].

3.1.14 Support to local operators

According to Section 6.1.4 (and 6.1.3.1. and 6.1.3.9.) of report [3] the plant is duly prepared for getting support from external forces in severe accident situation. No further action is necessary. The area was discussed in Section 4.2.1.1. of report [5].

3.1.15 Level 2 Probabilistic Safety Assessments (PSA)

This issue is in relation to Theme 1.3. of Topic 3 of the 2nd Extraordinary Review Meeting of the CNS.

Paks NPP has Level 1 and Level 2 PSA assessment for each operating mode of the reactors and the spent fuel pools. Since the Severe Accident Management Guidelines are not event based, but symptom based, low probability event sequences are not excluded from the scope based on PSA results. No action is necessary.

The area is addressed in Section 3.1.3. of report [5].

3.1.16 Severe accident analyses

No additional actions have been determined for further enhancement of severe accident analyses of Paks NPP beyond those that have been described above.

3.2 CNS themes not, or not fully, addressed above

Theme 1.1: review of regulatory framework

Requirements for beyond design basis accidents and severe accidents appear in the regulatory requirements after being revised in 2011 and 2012. A new revision of the regulations is planned after the revision of IAEA safety standards and WENRA reference levels are completed and published. See Topic 4 in Part II!

Theme 1.4: others (including alternative water sources, recovery from SA, radiological analysis)

Section 2.1.1. discusses the alternative and new diverse coolant supply possibilities. Section 1.1.8. addressed the robustness of essential systems against extreme conditions. Certain aspects of long term severe accident management were covered in Sections 3.1.1.4. and 3.1.4.

Theme 4: multi-unit aspects

Section 2.1.2. discusses sharing of systems and establishment of cross-links between units.

Theme 5: spent fuel pool aspects
Actions for further enhancement of spent fuel pool cooling are included in Sections 2.1.14. and 3.1.2.

Theme 6
Decision-making process of the emergency response organization and its relation to severe accident management are described in Section 6.1.1.2. of report [3].

Part II: Additional topics from the 2nd Extraordinary Review Meeting of the CNS

Topic 4: National organizations

4.1 Review of nuclear safety and/or radiation protection laws, requirements and recommendations

This issue is in relation to Theme 1 of Topic 4 of the 2nd Extraordinary Review Meeting of the CNS.

As quoted from Act CXVI of 1996 on atomic energy (hereinafter referred to as Atomic Act), Article 8 (4) states that:

"*The organization supervising the use of atomic energy shall*

…

b) in the field of application of atomic energy

ba) follow the general directions of international development, especially the international development of regulations, and make proposals on the necessary national measures and the establishment of laws;

bb) follow the technical development results, international experience and expectations; and

bc) follow the compliance with the laws under its competence; initiate actions based on its conclusions, make proposals on the necessary amendment to laws or establishment of new laws;"

In accordance with Article 3 (7) of Govt. decree 118/2011 on the nuclear safety requirements for nuclear facilities and the related regulatory activities:

"*The Nuclear Safety Code, with the consideration of scientific results, national and international experience, shall be reviewed and if necessary updated at least every five years. The guidelines shall be reviewed periodically based on the decision of the nuclear safety authority or upon the request of the licensees.*"

As an outcome of the latest revision of the Hungarian nuclear safety regulations, the Govt. decree 118/2011. (VII. 11.) Korm. and its annexes (the so called Nuclear Safety Codes) were issued, which establish the national nuclear safety requirements. The fundamental objective of the revision was to utilize the new international expectations and the national experiences gained in the meantime. Govt. decree 37/2012. (III. 9.) Korm. supplemented and amended these regulations in order to establish requirements for a new nuclear power plant unit to be constructed in Hungary. As an outcome of the revision the new regulations include the WENRA (Western European Regulatory Association) Reference Levels (i.e., the expected safety levels generally approved by the European authorities) and the latest safety standards of the International Atomic Energy Agency. The revision, because of its schedule, did not aim at utilizing the experience gained from the Fukushima accident. The lessons to be learned regarding regulations can only be identified after the comprehensive assessment of the accident; the preliminary results have not required any immediate amendment to the legislation.

Hungary undertakes the utilization of the lessons learned from the Fukushima Daiichi accident during the next revision of the nuclear safety legislation. The review should be conducted taking into consideration the following:

- information available regarding emergency response,

- international experience and identified corrective actions,
- statements of the CNS review conference and the stress test on external threats, low probability events, performance of safety functions, emergency response, requirements for severe accident management and on the effective design basis.

The rules of regulatory activities, the independence of the authority, as well as the availability of the resources, needed for the supervisory activity should be reviewed.

Another important source of amending the legislations is the supplementation of the WENRA reference levels, which is expected to be completed by the end of 2013. Additionally, amendments to the nuclear safety legislation could be required after the review of the IAEA recommendations and the European nuclear safety directive; however they will be realized in a longer term.

4.2 Changes in the functions and responsibilities of the authority

This issue is in relation to Theme 2 of Topic 4 of the 2nd Extraordinary Review Meeting of the CNS.

The role, competence and tasks of the HAEA were presented in the CNS report. The analyses of the Fukushima accident have not yet revealed such a deficiency which requires any change in the functioning of the HAEA. At the request of the Hungarian Government, the IAEA IRRS mission will evaluate the performance of the authority in 2015. If the IRRS mission or the review discussed in Section 4.1 reveals any deficiency in the Hungarian regulatory system, then Hungary is committed to make the necessary modifications.

4.3 Review and improvements to aspects of emergency preparedness and response

This issue is in relation to Theme 3 of Topic 4 of the 2nd Extraordinary Review Meeting of the CNS.

The training and exercise programmes for the central, sectorial, regional and local organizations of the Hungarian Nuclear Emergency Response System, as well as for the on-site emergency response organizations are discussed in detail in Section 5.7.

The integration of external forces to fire fighting and technical rescue is discussed in Section 5.4.

The emergency planning zones were established based on the relevant IAEA recommendations; the re-sizing of the emergency planning zones is not a need based on the lessons learned from the Fukushima Daiichi accident.

In line with the international convention on early notification, Hungary maintains bilateral cooperation agreements with each neighbouring country. According to these bilateral agreements, Hungarian experts visit the emergency exercises of the neighbouring countries as observers, as well as Hungary invites the experts of these countries to participate in major Hungarian exercises as observers.

No action is needed based on the experience gained from the Fukushima Daiichi accident.

Nevertheless, the Fukushima Daiichi accident revealed certain areas, where the level of preparation should be verified in the frame of an emergency exercise. The main objectives of the national exercise planned to be held in the first half of 2013 are to practice communication with the media and to practice the implementation of certain protective actions with the involvement of invited members of the public. [<51>].

4.4 Openness, transparency and communication improvements

This issue is in relation to Theme 4 of Topic 4 of the 2nd Extraordinary Review Meeting of the CNS.

In accordance with Article 8 (4) d) of the Atomic Act

”*The organization supervising the use of atomic energy ... shall inform the public on the safety of the use of atomic energy, nuclear security, its own activities, its major decisions and their substantiation, as well as on the applied safety, security and safeguards requirements via publishing the relevant information on its website;”*

The HAEA, on its website, continuously informed the public on the situation evolved in Japan and its consequences. The authority made available all relevant information on the preparation for, and execution of, the TSR as well as on the extraordinary review made by the IAEA.

The public information on the implementation of TSR actions does not require daily information provision; however, information could be provided regarding certain major events (e.g. when the implementation of the TSR action plan was ordered or during the annual press conferences). The interested parties can continuously follow the events on the website of the HAEA, since the major news is released thereon by the authority. Additionally, a "Bulletin" is published every six months, which includes information that may satisfy professional needs as well; Bulletins are sent in printed format to wider scope of people and organizations. The HAEA newsletters should also be mentioned as a communication channel, through which the authority provides information on the major events every three months; its part targeted at the general public is available at the HAEA website. The HAEA, according to law, annually reports its activity to the Hungarian Parliament. This report is discussed within the professional committees of the Parliament, who finally endorse it.

The outcomes of the analyses of the Fukushima Daiichi accident have not revealed such deficiency, which requires any change in the area of openness, transparency and communication.

4.5 Post Fukushima safety re-assessments and action plans

This issue is in relation to Theme 5 of Topic 4 of the 2nd Extraordinary Review Meeting of the CNS.

Based on the expert review, the action plan prepared by the licensee and on the regulatory review (see Introduction), the HAEA ordered the scheduled execution of the required safety improvement measures. The authority continuously monitors, inspects and evaluates the progress in the implementation of the planned actions.

4.6 Human and organizational factors

This issue is in relation to Theme 6 of Topic 4 of the 2nd Extraordinary Review Meeting of the CNS.

The outcomes of the analyses of the Fukushima Daiichi accident have not revealed any such deficiency, which requires any change in this area. If the international reviews, or the review presented in Section 4.1, reveal the need for changes in the field of human and organizational factors, then Hungary is committed to implement the necessary changes.

Topic 5: Off-site emergency response[2]

This issue is in relation to Topic 5 of the 2nd Extraordinary Review Meeting of the CNS.

5.1 Legal background

The organizational structure of the national disaster management system, the tasks of ministers and governmental bodies concerned in disaster management regarding prevention, preparation and response, and the tasks of the disaster management organization are regulated by Act CXXVIII of 2011 on disaster management and the amendment of certain relating acts, as well as by the implementing Govt. decree 234/2011. (XI. 10.).

The organizational structure and tasks of the Hungarian Nuclear Emergency Response System (HNERS) are regulated by Govt. decree 167/2010. (V. 11.) Korm. The Disaster Management Coordination Inter-ministerial Committee, and its organizational and operational rules are established by Govt. resolution 1150/2012. (V. 15.) Korm.

The comprehensive review of, and amendment to, the legal background completed in the last two years provided the basis for the establishment of a modern and effective national disaster management system. In harmony with the renewal of disaster management and with the consideration of the practical experience gained during the last decade, an implementing decree regulates the tasks of the organizations participating in the response as along with the general rules of international disaster management support and assistance request.

5.2 Hungarian Nuclear Emergency Response System (HNERS)

The preparation for the response to radiological or nuclear events occurring during the peaceful application of atomic energy, as well as the mitigation and elimination of the consequences, are the tasks of the HNERS. The HNERS consists of those central, sectorial, regional and local organizations, which are concerned in the prevention of events entailing non-planned exposure to the public, as well as the mitigation and elimination of the consequences of such events.

The Disaster Management Coordination Inter-ministerial Committee is responsible for supporting the disaster management related decisions of the Government and for the harmonization of disaster management related tasks of the various ministries.

The Hungarian Nuclear Emergency Response Plan (HNERP) is maintained and regularly updated by the Higher Level Working Group consisting of the representatives of the relevant central, sectorial and regional organizations. As outcomes of these reviews, several guidelines and technical guidance documents were prepared during the recent years. The last version of the HNERP was published in November, 2011; currently, the HNERP is under review.

The county defence committees and their working bodies operate on regional and local levels. The disaster management and nuclear emergency response working committees are chaired by the chairpersons of County Defence Committees. Their tasks are the development of defence plans, county level direction of preparation, response and recovery, providing professional recommendations on response and recovery in the case of a potential or real emergency, submitting proposals, planning and organization of rescues from any aspect, as well as the direction of rescue works. The work of the chairperson is supported, as an assistant chair-person, by a disaster management expert.

[2] Topic 5, in accordance with the authorizations established in the Atomic Act, was prepared by the Ministry of Interior - National Directorate General of Disaster Management

In normal operating state the HNERS performs the following tasks: continuous monitoring of the nation-wide radiological situation; collection, verification, analysis of radiological data, and alarming; operation and maintenance of the HNERS alerting system; updating of nuclear emergency response plans; preparation and exercising of organizations concerned in nuclear emergency response; provision of material and technical resources required for the performance of nuclear emergency response tasks.

Tasks to be fulfilled, in addition to those listed above, in alert operating state are: strengthened monitoring; forecasting of unplanned radiation exposure to the population; provision of reliable and timely information to the public on the event occurred and the nation-wide radiological situation; preparation for the commencement of the emergency operation, should it become necessary.

In emergency operating state, the HNERS performs: the assessment, mitigation and termination of the consequences of the extraordinary event inducing the nuclear emergency; forecasting of the radiological consequences of nuclear accident occurring outside the borders of the country and in space, or of a national situation induced by an event entailing radiation hazard; the determination and implementation of the tasks required by the situation. Amendment to the legislation should not be initiated.

The HNERS was established in compliance with the relevant international standards; thus it is at an internationally recognized level.

5.3 Radiation protection

The National Radiation Monitoring and Alarming System (NRMAS) is operated to provide decision making support to the governmental coordination body. The operation of the NRMAS and the direction of its professional work are performed by the minister responsible for disaster management.

The leading organ of the NRMAS is the Nuclear Accident Information and Evaluation Centre, which performs the central tasks of early forecasting in the case of a nuclear emergency and of the international radiological monitoring data exchange system; additionally it provides contribution to public information, support to decisions made by the governmental coordination organization; forecasts the expected dispersion route of radioactive materials discharged from an event having adverse safety influences; operates the international real-time on-line nuclear emergency decision support system.

A sub-system of the NRMAS consists of the installed automatic remote measurement stations of the Radiological Remote Measurement Network, which is the early warning system in the case of a nuclear emergency; the system continuously monitors the radiation dose-rate in the county and the more important meteorological parameters. Currently, gamma dose rate measurement data from 132 measuring stations of six sectors are collected in the national radiological monitoring centre. The network of mobile radiological laboratories means the other sub-system of the NRMAS, which identifies and analyses the radiation contamination in the case of a nuclear emergency. The third sub-system of the NRMAS is the network of fixed laboratories, which measure the radioactivity of the collected samples (i.e. food, milk, soil, water, etc.). These measurements provide basis for the implementation of long-term protective measures (i.e. grazing ban, limitation of food and water consumption, etc).

The operation of the radiation protection monitoring systems under the direction of the Minister of the Interior is regulated by Ministerial decree 7/2012. (III. 7.) BM. No justification for further amendment to the legislation is revealed.

5.4 External resources and tools that can be utilized for on-site emergency response

The chairperson of the Emergency Response Organization of the nuclear power plant, if needed, can request external resources for the response. At the same time, the chairperson of the organization leading the national level emergency response can send forces to support on-site emergency management, if he/she judges that the nuclear power plant is not able to manage the situation with its own resources.

External forces are involved in fire fighting and technical rescue, depending on the severity of the occurred situation.

Detailed data, on mobile equipment available at the administrative and national economy organizations for the provision of the electric supply and internal energy supply to the Paks NPP, is included in the survey conducted by the Directorate General for National Disaster Management in the frame of the Targeted Safety Re-assessment. This data primarily refers to the capacity, number, location and activation time (i.e. taking them to transportable condition, their transportation and putting into service) of the available Diesel generators, pumps and fuel transportation vehicle. The vehicles for the transportation or hauling of the generators are selected by the competent disaster management organizations. Operators are available for the generators and pumps requiring special operatory knowledge.

The equipment can be air transported by helicopters of the Hungarian Defence Forces; however air transportation requires the lifting of the air ban around the plant.

5.5 Protective actions

The three counties within the Urgent Protection Action Zone (i.e., the area within the 30 km radius around Paks NPP) are: Bács-Kiskun, Fejér and Tolna Counties. They fulfil their response tasks according to their regional and local emergency response plans.

5.5.1 Iodine prophylaxis

The necessary stock of iodine tablets for the citizens of the settlements within 30 km radius of Paks NPP are provided and maintained by the Medical Stock Management Institute. The tablets are stored in the offices of the local governments concerned, at the family doctors and the duty services of first responder organizations. Following the receipt of a decision on the distribution of iodine tablets, the professionals of the Public Health Professional Body of the County Government Office performs the iodine tablet distribution.

5.5.2 Evacuation of the workers of Paks Nuclear Power Plant

The evacuation plan of the workers of Paks NPP is included in the General Emergency Response Plan of the plant. According to the plan, the employees should use their own vehicles, the train owned by Paks NPP and the buses put at the disposal of the plant by the regionally competent bus company.

5.5.3 Evacuation and reception

As a part of the emergency response plan, the disaster management organizations established evacuation and reception plans for the public. The reception of the affected population can be arranged, should the evacuation be ordered.

5.5.4 Provision of the public with protection tools

The protection breathing tools (protective hoods) required for the rescue and evacuation are available for those living in settlements located in the dispersion route of the radioactive plume; the protective hoods are distributed at the meeting points.

The protective hoods are stored in the settlements' warehouses for those living within a 9 km radius of the plant; the rest of the stock is stored in the county warehouses (outside of the 30 km zone); the latter are distributed based upon the local effects of the nuclear emergency situation.

5.6 Alerting the public, public information

5.6.1 Alerting the public

Within the 30 km radius of Paks NPP, the technical tool of alerting is the installed public information and alerting system. Altogether 227 modern public information and alerting devices alert about 225,000 people living in 74 settlements on 2,800 square kilometres.

The acoustic terminals are powered by uninterruptible power supplies, thus the public can be alerted and informed in the case of loss of the electrical power supply. The high capacity loud speakers, in addition to traditional siren signals, are appropriate to transmit voice messages, thus the population can be provided with the essential information by way of live broadcasts.

The control centres of the system are installed at the Protected Command Centre, Plant Control Centre and at the Tolna County Disaster Management Directorate; additionally, a mobile control unit is available.

The operability of the sirens is tested by humming signals (i.e. at reduced volume) on the first Monday of each month, and by transmitting a full loud emergency hazard along with end of emergency signals twice a year.

5.6.2 Public information

As required by Govt. decree 165/2003. (X.18.) Korm. on the rules of public information in the case of a nuclear or radiological emergency, public information plan shall be prepared at national, sectorial, county and facility levels by the central bodies and organizations of the HNERS, as well as by those bodies and organizations that are obliged to prepare Emergency Response Plans. The public information plans are to be prepared for providing timely and reliable information to the public; the plans include those available information principles, methods and tools, which can be applied for effective communication.

5.7 Preparation, training and exercising of organizations participating in emergency response

The training and exercising of those having roles in national level emergency response are organized in line with Govt. decree 167/2010. (V.11.) Korm. on the Hungarian nuclear emergency response system. The Training and Exercise Working Committee prepares the annual Training and Exercise Plan, which is then endorsed by the Disaster Management Coordination Inter-ministerial Committee (DMCIC). This annual Plan establishes the major training and exercise programmes for the subject year and the major directions for the subsequent year. It includes the minimum required training and exercise activity, with the consideration of the Long-Term Training and Exercise Plan. The DMCIC, by endorsing the plan, identifies the expectations for the central, sectorial, regional and local organizations of the HNERS. The tasks included in the plan shall then be integrated into the individual Training and Exercise Plans of the HNERS organizations.

A conduct and evaluation plan is prepared for each exercise. The exercises shall be evaluated in line with the viewpoints defined in advance in the conduct and evaluation plan. Based on the evaluation of an exercise, an action plan is established in order to eliminate the identified non-compliances and deficiencies; the progress of the implementation of the actions shall be monitored by the organizations concerned.

5.8 Summary

The experience gained from the TSR and the Fukushima accident has not revealed any such deficiency in the field of off-site emergency preparedness and response, which requires the modification of the Hungarian disaster management system or that of the Hungarian nuclear emergency response system. Following the completion of the international review, based on its outcomes, Hungary will re-assess the need for modifications and, if appropriate, take the necessary steps.

Topic 6: International cooperation

6.1 Strengthening the peer review process of CNS and of missions (IAEA, WANO and Industry)

This issue is in relation to Theme a) of Topic 6 of the 2nd Extraordinary Review Meeting of the CNS.

Hungary will provide information in the CNS national reports on the results of the review missions conducted in the field of nuclear safety, and will offer monitoring of the progress of the implementation of their recommendations.

Hungary, with its own resources, supports the development of the effectiveness and scope of the international nuclear safety expert missions, as well as the enhancement of the coordination between different missions.

Hungary takes part in the improvement of the processes and effectiveness of the CNS, and in the improvement of the reviews conducted in the frame of the CNS.

After the Chernobyl accident, Hungary participated in the safety re-assessment of the Russian design nuclear power plants built based on Russian design, the lessons learned were integrated into the legislation and the safety improvement programme of the nuclear power plant.

6.2 Optimization of the global safety regime

This issue is in relation to Theme b) of Topic 6 of the 2nd Extraordinary Review Meeting of the CNS.

Hungary, with its own resources, supports the rationalization of the responsibility and task sharing between certain international organizations and welcomes those initiatives, which aim at limiting and optimizing the duplication of tasks being in connection with international cooperation.

Hungary studies the potential participation in the establishment of a regional crisis centre.

6.3 Strengthening communication mechanisms through regional and bilateral cooperation

This issue is in relation to Theme c) of Topic 6 of the 2nd Extraordinary Review Meeting of the CNS.

Hungary, with its own resources, supports the enhancement of nuclear safety and the nuclear safety regulatory system in countries opting for nuclear energy; Hungary participates in the related activities of the international organizations.

In the field of nuclear safety, Hungary maintains bilateral cooperation with the neighbouring countries. In meetings organized in the frame of these cooperation agreements, Hungary provides information on nuclear safety related information and events.

Hungary is a member of the WENRA Mutual Assistance Working Group, which aims at enhancing the cooperation between nuclear safety authorities in the case of a nuclear accident.

6.4 Effectiveness of experience feedback mechanisms

This issue is in relation to Theme d) of Topic 6 of the 2nd Extraordinary Review Meeting of the CNS.

Hungary takes part in all fora serving for the exchange of experiences in the field of nuclear safety (i.e., IRS, INES, WANO, EU Clearinghouse, VVER Forum) and strives to utilize the experience gained from other sources as well.

The HAEA participates in the working groups aiming at utilizing the lessons learned from the Fukushima Daiichi accident, as follows:

- ENSREG (HAEA is represented at high management level),
- ENSREG nuclear safety working group (WG1),
- WENRA reactor harmonization working group,
- WENRA mutual assistance working group,
- WENRA accident management working group,
- EU nuclear security ad-hoc working group,
- IAEA Action Plan – occasionally, participation in regular IAEA working groups and activities,
- IAEA CNS – Hungarian delegation participates in the extraordinary and regular review conferences,
- OECD NEA WGOE working group.

The tasks set by the above working groups are performed by the designated members, who can live with the possibility to involve other professionals.

Hungary supports striving for emphasizing the experience feedback during expert review mission.

6.5 Strengthening and expanded use of IAEA Safety Standards

This issue is in relation to Theme e) of Topic 6 of the 2nd Extraordinary Review Meeting of the CNS.

Hungary fully integrates the IAEA nuclear safety fundamentals and standards into its nuclear safety legislation (see Section 4.1); Hungary constantly supports the development of these standards in order to continuously enhance nuclear safety. Hungary agrees that the prevention and consequence mitigation should be more reasonably represented among the requirements.

Part III

In line with Reference [8] Part III would list those actions that are identified in such areas that have not been discussed in the previous topics, i.e., which cannot be grouped under previous topics (under Part I and Part II). The review has not identified the need of such actions.

Part IV: Summary table of actions

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
	1.	**Natural hazards**						
1.	1.1.	Recurrence frequency taken into account in the design basis	Considering natural hazards of 10 thousand year recurring frequency. For earthquake, flooding and low water level of Danube.	Successful termination of assessments in December, 2011. No open task in this area.		Task completed.	2.1.1	3.1.1
2.	1.2.	Secondary effects of earthquakes	1 - Interventions to protect the personnel and equipment in the fire brigade barrack, which is made of reinforced concrete, but has not yet been seismically qualified.		1.2.	15.12.2015.	2.3.3, 3.1.1	3.1.2
3.			2 - The demineralised water tanks in Installation II that play an important role in ensuring demineralised water stocks are located in the direct vicinity of the medical and laboratory building. The walls of the building shall be seismically qualified and, if necessary,		1.9.	15.12.2015.	2.1.2	3.1.2

[3] All references to these serial numbers are in [<xx>] form

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			reinforced or provide appropriate protection of the tanks by other means.					
4.			3 - The underground lines and connections (pipelines, cables) at risk due to potential settlement of the main building shall be re-qualified and, if necessary, modified to allow for a relative displacement.	According to the current conservative analyses, soil liquefaction might occur in the acceleration ranges slightly exceeding the design basis, which can cause an uneven settlement of the buildings.	1.11.	15.12.2017.	2.2.1.1	3.1.2
5.			4 - A state-of-the-art analysis shall be performed for the proper assessment of the existing margins of earthquake-initiated building settlement and soil liquefaction phenomenon.		1.45.	15.12.2018.	2.2, 2.2.1.1.	3.1.2
6.	1.3.	Protected volume approach	1 - The water penetration through the walls would accumulate in a sump and a permanently installed sump pump can remove it. Modification of the wall penetrations to a sealed design shall be carried out.	Certain wall penetrations in the machine room of essential service water pumps are not provided with water sealing, so flooding of the machine room may occur if a beyond design basis flood takes place.	1.4.	15.12.2015.	3.1.2	3.1.3
7.			2 - Automatic shutdown of the		1.10.	15.12.2015.	2.1.2	3.1.3

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			main condenser coolant pumps shall be provided when the condenser pipeline is damaged due to earthquake or other reason. It shall be ensured that the pipeline trenches are applicable to receive and drain the discharged water. If necessary, the slope shall be elevated or a protective dam shall be constructed to avoid the flooding of the turbine hall or the cable tunnels.					
8.		Safety culture	Fixing of the non-process equipment and tools that could adversely impact process equipment during outages shall be provided.		1.3.	15.12.2014.	2.1.2. and 2.2.4.	
-	1.4.	Early warning notifications for extraordinary natural impacts	No action necessary.	Taking into account the relatively small size and geographical situation of Hungary, the current practice is satisfactory from every aspect and no task has been identified.		-		3.1.4
9.	1.5.	Seismic monitoring system	In the frame of the reconstruction project of seismic instrumentation, which	Currently no such system exists, which would initiate an automatic shutdown of	1.1.	31.12.2012.	2.1.2; 2.1.2., 2.2.1.,	3.1.5

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			is in the preparatory phase, the question of automatic shutdown shall be revisited.	the reactors for a given acceleration level.			2.2.4., 6. and 7.3.	
-	1.6.	On-scene inspections, qualified walkdowns	A regular activity is going on, it is not necessary to modify the current practice.	If specific international standards, requirements become available for such inspections and walkdowns, both the authority and the licensee shall adopt and apply them.		-		3.1.6
-	1.7.	Flooding margin assessments	No action necessary.	The stress test assessment determined that the site of Paks NPP is not prone to flooding.		-		3.1.7
-	1.8.	Assessment of external hazard margins	The latest Periodic Safety Review dated to 2008 required new, supplementary analyses.	Evaluation of loads caused by weather impacts is not in compliance with the modern expectations.		31.12.2012.		3.1.8
10.		Further tasks independent of the above expectations	1- The existing symptom-based emergency operating procedures shall be reassessed as to whether they support an optimal recovery in such combined situation.	Due to implications from Fukushima Daiichi accident, such improbable, complex cases shall also be taken into account as extension of the design bases.	1.21.	15.12.2013.	2.1.2.	
11.			2 - Protection of the not seismically reinforced 400 kV and 120 kV substations and the	The 400 kV and 120 kV substations though not safety systems and not	1.6.	15.12.2014.	2.2.1.2, 5.1.1.3, 5.1.5, 5.2.5	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			automatisms switching the plant to isolated operation against earthquakes shall be evaluated and increased if necessary.	seismically reinforced, might provide many alternative electric supply opportunities, if they are not damaged.			and 5.3.1, 2.1.2., 2.2.1., 2.2.4., 6. and 7.3.	
12.			3 – Periodic inspection, maintenance and operational testing of the equipment to be applied in case of low water level of the Danube shall be supplemented. The respective, missing inspection, testing and maintenance instructions shall be developed.	During the stress test the plant identified that the maintenance and inspection procedures to be applied in the situation of extreme low level of the Danube were not satisfactory	1.24.	15.12.2013.	5.2.2; 5.2	
13.			4 – A list of such system components important to safety, which are endangered by electromagnetic effects (including the effects induced by lightning) shall be compiled and display whether a given component is adequately qualified.	Based on the list the authority and the licensee can specify reinforcements and corrective actions. HA5444-1.2.3	1.42.	15.12.2015.		
14.			5 - It shall be analyzed if the lack of seismic qualification of the machine racks and travelling water band screens		1.41.	15.12.2015.	2.1.2., 2.2.1., 2.2.4., 6. and 7.3.	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			of the essential service water system jeopardizes the ultimate heat sink function and, if necessary, the adequate exclusion measures shall be implemented.					
	2.	**Design issues**						
15.	2.1.1.	Application of means providing alternate cooling and heat sink	1- The operator shall maximize the available inventory of the stored demineralised water in all operation states.		1.7.	15.03.2014.	5.2.5	
16.			2- Access to the connection point of the auxiliary emergency feedwater system in accident conditions shall be improved, new connection points shall be established on the demineralised water tanks.		1.14.	15.12.2015.	5.2.5	
17.			3- The potential setting of the boron concentration of water inventories from external sources and its storage shall be solved and supply mode of borated water inventories to the containment shall be regulated in an operating instruction.		1.15.	15.12.2018.	5.2.5	
18.			4- By provision of appropriate electrical power supply it shall		1.17.	15.12.2015.	5.2.5, 5.1.1.3,	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			be established that the bank filtered well plant, which can be used irrespective of the water level of the river, be able to supply water to the essential service water system via the existing connections in accident situations.				5.1.5, 5.2.5 and 5.3.1.	
19.			5- The accessibility of the water reserve available in the closed segment of the discharge water canal for the earthquake resistant fire water pump station of Installation II that is equipped with individual diesel power supply shall be solved.		1.18.	15.12.2018.	5.2.5	
20.			6- Similar to the connection existing on Installation I, the water supply shall be solved also for Installation II from the fire water system to the essential service water system through the technology cooling water system.		1.19.	15.12.2015.	5.2.5	
21.			7- The equipment necessary for the cooling water supply to at least one diesel generator of		1.20.	15.12.2015.	5.2.5, 5.1.1.3, 5.1.5, 5.2.5	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			each unit from the fire water system shall be provided and the operating instruction shall be completed with the measures to be implemented.				and 5.3.1.	
22.	2.1.2.	Enhancement opportunities of on-site and off-site AC power supply	1- Utilizing the fuel storage capacity of the safety diesel generators the amount of diesel fuel to be stored shall be increased and this shall be incorporated in an administrative procedure.		1.5.	15.03.2014.	5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	
-			2- See: [<11>]			30.09.2013.	2.2.1.2, 5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	
23.			3- Power-operated filters of the essential service water system shall be established.		1.8.	15.12.2015.	5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	
24.			4- Appropriately protected independent severe accident diesel generator(s) shall be installed after assessment of the necessary number and capacity, and determination of the design requirements		1.12.	15.12.2018.	5.1.3; 5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			including beyond design basis hazards.					
25.			5- Out of the two power plants being able to supply external electric power via dedicated lines, the black-start capability (start-up from own diesel generator) shall be created for the Litér gas turbine.		1.13.	15.12.2014.	5.1.1.2, 5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	
26.			6- Procedures shall be developed for the use of the possible, but currently not applied cross-links between the units for normal operation and for the backup and safety buses.		1.22.	31.07.2013.	5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	
27.			7- Possible cross-links shall be studied and the concluding modifications shall be carried out for providing safety electrical power supply from any operable emergency diesel generator in any unit to the safety consumers of any other unit.		1.23.	15.12.2015.	5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	
-	2.1.3.	Enhancement opportunities of DC power supply.	No action necessary.					

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-	2.1.4	Operational and preparatory actions.	Respective actions are discussed in Topic 1 and/or Topic 3.					
-	2.1.5	Instrumentation and monitoring.	Respective actions are discussed in Topic 1 and/or Topic 3.					
-	2.1.6	Shutdown improvements	Discussed in Section 2.1.17 and Topic 3.					
-	2.1.7	Reactor coolant pumps seals	Not relevant for VVER-440/213					
-	2.1.8	Improvement of ventilation capacity in total loss of power supply.	Section 2.1.2. of [3] dealt with the provision of AC power supply. No separate action was necessary except for the Protected Command Centre, which is discussed under Topic 3.	No separate action was necessary except for the Protected Command Centre.				
-	2.1.9	Improvement of main and backup control rooms for long term habitability after a total loss of power	Tasks were only identified for emergency command centres, which are discussed under Topic 3.			15.12.2018.		
-	2.1.10	Improvement of robustness of spent fuel pools for various events.	Respective actions are discussed in Topic 1 and/or Topic 3.					

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-	2.1.11	Improvement of separation and independence of safety systems.	Timely shut down the large diameter and large flow-rate condenser cooling water systems, if damaged, to avoid flooding of safety systems. Identical to [<7>].			15.12.2015.	2.1.2. and 2.2.4.	
-	2.1.12	2.1.12 Flow path and access availability.		Instead of maintenance of routes with special tools, actions rather meant to ensure parallel, diverse water and electric power supply routes were decided during the stress test.				
-	2.1.13	Provision of mobile devices and their adequate storage.	Respective actions are discussed in Topic 1 and/or Topic 3.					
-	2.1.14	Bunkered/hardened systems.	Respective actions are discussed in Topic 1 and/or Topic 3.					
-	2.1.15	Improvement of response capability to multiple accidents on the site.	Respective actions are discussed in Topic 1 and/or Topic 3.					
-	2.1.16	Equipment inspection and training programmes.	Respective actions are discussed in Topic 1 and/or Topic 3.					
28.	2.1.17	Further studies to	Probabilistic assessment for		1.43.	31.12.2012.	2.2.1.,	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
		address uncertainties.	closed reactor states under 150 °C primary circuit temperature, whether a time limit considering the balanced distribution of risk is reasonable to be established and introduced and actions [<9>], [<11>], [<10>], [<18>], [<5>].				5.2.4. and 5.2.5; 2.1.2., 2.2.1., 2.2.4., 6. and 7.3.	
	3.	**On-site emergency response, accident management and recovery**						
-	3.1.1	Compliance with WENRA reference levels	After completion of amendment of WENRA reference levels the missing requirements will be incorporated in the nuclear safety regulations.			15.12.2018.		3.3.1
-	3.1.1.1	3.1.1.1 Hydrogen mitigation in the containment	One of the technical modifications was the installation of hydrogen recombiners in the containments designed to cope with severe accidents, which were installed for all of the 4 units before the end of 2011. No action necessary.			31.12.2011.		3.3.1

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
29.	3.1.1.2	Hydrogen monitoring system	Installation of hydrogen monitoring system as part of the severe accident instrumentation for units 3 and 4.	Installation of a hydrogen monitoring system as part of the severe accident instrumentation has already been completed for units 1 and 2, while it will be completed in 2013 and 2014 for units 3 and 4 respectively.		15.12.2013.	6.3.7	3.3.1
-	3.1.1.3	Reliable depressurization of the reactor coolant system	Installation of the severe accident diesel generators has taken place for Paks NPP in the frame of severe accident management actions for all 4 units of the plant. No action necessary.					3.3.1
30.	3.1.1.4	Containment overpressure protection	The system that is able to prevent the long-term, slow over-pressurisation of the containment shall be developed and implemented.	Paks NPP prepared the concept for the implementation, which recommends the installation of an active cooling system.	1.25.	15.12.2018.	2.1.2., 2.2.1., 2.2.4., 6. and 7.3.; 6.3.3	3.3.1
31.	3.1.1.5	Molten corium stabilization	Among the severe accident management measures Paks NPP selected the strategy of in-vessel maintenance of the molten core. No further action is necessary.	The molten core can be stabilized within the reactor pressure vessel by flooding the reactor cavity and external cooling of the vessel. The respective		31.12.2014.	6.5.3	3.3.1

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
				modification has already been implemented for unit 1 and unit 2, while it will take place in 2013 and 2014 during the refuelling outages of unit 3 and unit 4 respectively.				
-	3.1.2.	Severe accident management hardware provisions	1 - Appropriately protected independent severe accident diesel generator(s) shall be installed after assessment of the necessary number and capacity and determination of the design requirements including beyond design basis hazards. Identical to [<24>].	The concept document prepared for the action contains the installation of 1-1a diesel generator for both Installation I and II, the capacity of which is enough to supply one safety train.		15.12.2018.		3.3.2
-			2 - By provision of appropriate electrical power supply it shall be established that the bank filtered well plant, which can be used irrespective of the water level of the river, be able to supply water to the essential service water system via the existing connections in accident situations. Identical to [<18>].	The nuclear power plant has 9 wells each having a large diameter and a depth of 30 m that are bored in the pebble bed of the Danube; these wells are permanent water sources providing an unlimited quantity of water independently of the water level of the Danube.		15.12.2015.		3.3.2
32.			3 - A new water supply route		1.16.	15.12.2018.	1.2.2. and	3.3.2

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			connected in the courtyard by flexible means shall be constructed that is protected from external hazards (such as earthquake). The spent fuel pool shall be filled from the borated water reserve specified previously via this line. The required operations shall be specified in procedures.				2.1.2.	
33.			4 - Corresponding to management of severe accidents, for the construction of an external water supply route to the auxiliary emergency feedwater system, the equipment necessary for the connection of external origin mobile diesel generators and pumps to the systems shall be purchased.		1.35.	15.12.2016.	5.2.5; 5.1.1.3, 5.1.5, 5.2.5	3.3.2
34.	3. 1.3.	Review of SAM Provisions Following Severe External Events	Severe accident situations simultaneously taking place in the reactor and the spent fuel pool shall be managed by the development of a severe accident management guideline. Technical	The guidelines enter into force in the various units, when the respective technical modifications are completed: by the end of 2012 regarding unit 1 and unit 2, while in 2013 and	1.26.	15.12.2018.	1.2.2, 2.1.2.	3.3.3

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			modifications generated by the implementation of other actions shall be implemented in the concerned SAMG.	2014 in unit 3 and unit 4, respectively.				
35.			The method of usage of external supply opportunity shall be described in instruction documents.		1.36	15.12.2017.	1.2.2, 2.1.2.	3.3.3
36.	3. 1.4.	Enhancement of Severe Accident Management Guidelines	The physical arrangement and instrumentation of the Technical Support Centre established at the Protected Command Centre shall be extended to provide sufficient resources for simultaneous management of severe accidents occurring on more than one (even all 4) units.		1.38.	15.12.2018.	6.3.8	
37.			The structure of the organization responding to accidents affecting multiple units and the number of staff shall be determined; procedures shall be developed for personnel and equipment provisions, as well as for shift changes.		1.37.	15.12.2017.	6.3.8	
-			Paks NPP initiates the			15.12.2014.	5.1.1.3,	3.3.4

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			establishment of black-start capability (start-up from its own diesel generator) for the Litér gas turbine. Identical to [<25>]-el.				5.1.5, 5.2.5 and 5.3.1.	
-	3. 1.5.	Validation of enhanced severe accident management guidelines	No separate task is necessary	As the result of the verification the guidelines have been introduced for unit 1. A similar verification would take place after any supplementation or enhancement of the guidelines.				3.3.5
-	3. 1.6.	Severe accident exercises	The scenario of the exercise shall make it possible to practice the implementation of on-site organizational and technical measures in severe accident situations. No action was determined in this area.	According to the Hungarian legislation the emergency response organization of the NPP is required to carry out a full-scale nuclear emergency exercise every year that involves the whole personnel of the organization.				3.3.6
38.	3. 1.7.	Training of severe accident management	The training and exercise of multi unit emergencies can take place after the implementation of that action.	By the introduction and implementation of severe accident management guidelines and	1.39.	15.12.2017.	6.1.6	3.3.7

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			A software-based severe accident training simulator shall be developed. In the first stage of the two-stage development the current simulator will be extended for the education of the staff of Technical Support Centre, while later it will be extended to train a wider scope of the users.	modifications the operator also introduced the training of severe accident situations to the scope of emergency response exercises.				
-	3. 1.8.	Extension of severe accident management guidelines to all plant states	Already implemented.	The severe accident management guidelines cover the low power and shutdown mode of the reactor, as well as the severe accident situation of the spent fuel pool.				3.3.8
39.	3. 1.9.	Improvement of communication	1 - Conditions for radio communication shall be assessed in the case of permanent loss of electric power and earthquakes and the necessary actions shall be performed.		1.30.	15.12.2018.	2.1.2., 2.2.1., 2.2.4., 6. and 7.3.	3.3.9
40.			2 - Informatics mirror storage computers shall be installed both at the Protected Command		1.31.	15.12.2016.	6.1.2.4.	3.3.9

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			Centre and the Backup Command Centre containing the necessary scope of data.					
41.	3. 1.10	Presence of hydrogen in unexpected places	Distributions using less conservative, three-dimensional analyses beyond the use of the lumped-parameter models shall be performed. Need for further action will be resultant on the analysis.	According to the calculation results inflammable concentrations may occur, which can lead to turbulent burning.	1.46.	31.12.2012.	2.2.1., 5.2.4. and 5.2.5; 2.1.2., 2.2.1., 2.2.4., 6. and 7.3; 6.3.8.	3.3.10
42.	3. 1.11	3.1.11 Large volumes of contaminated water	Procedures shall be developed for the management of liquid radioactive wastes during severe accidents. The risk, potential routes and possible monitoring tools and methods of liquid form release of radioactive materials shall be examined and the measures necessary and possible to respond to in such a situation shall be specified.	The plant is not fully prepared to manage liquid radioactive wastes generated in large quantities during a severe accident.	1.40.	15.12.2015.	2.1.2., 2.2.1., 2.2.4., 6. and 7.3; 6.1.3.3.	3.3.11
43.	3. 1.12	Radiation protection	1- Procedures for collecting and transporting emergency response personnel shall be developed and the necessary	The goal is to improve the access in severe accident conditions impaired by the adverse radiation	1.32.	15.12.2017.	6.1.3.5.	3.3.12

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			means and rules of their provision shall be determined.	conditions.				
44.			2- A shielded transport vehicle deployable at significant radiation levels shall be procured.		1.33.	15.12.2018.	6.1.3.5.	3.3.12
45.			3- The rules for exemptions from the air ban around the plant shall be modified to manage airborne support.		1.34.	15.12.2014.	6.1.3.5.	3.3.12
46.			4- The applicability of fixed radiation monitoring devices installed on, and in the vicinity of, the site to support emergency response activities after an earthquake and total loss of power shall be assessed.		1.44.	15.12.2014.	2.1.2., 2.2.1., 2.2.4., 6. and 7.3; 4.2.1.5	3.3.12
47.	3. 1.13	On-site emergency centre	1- Seismic qualification of the on-site shelters not yet qualified shall be performed and non-earthquake resistant equipment in the shelters shall be improved. A nuclear emergency response centre resistant to earthquakes of a peak ground acceleration higher than design basis earthquake shall be established.		1.27.	15.12.2016.	4.2.1; 5.1.3	3.3.13

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
49.			2- Air-conditioning of the Protected Command Centre shall be re-assessed and an appropriate power equipment shall be installed that can also be supplied by diesel generator.		1.29.	15.12.2015.	5.1.3. and 4.2.1; 2.1.2.	3.3.13
49.			3- A Backup Command Centre that complies with protection requirements, and is equivalent with the Protected Command Centre in terms of management and communication, shall be established.		1.28.	15.12.2017.		3.3.13
-	3. 1.14	Support to local operators	The plant is duly prepared for getting support from external forces in severe accident situation. No further action is necessary.					3.3.14
-	3. 1.15	Level 2 probabilistic safety analysis	No action necessary.	Paks NPP has Level 1 and Level 2 PSA assessment for each operating mode of the reactors and the spent fuel pools.				3.3.15
-	3. 1.16	Severe accident analyses	No action necessary.					3.3.16

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
	4.	**National organizations**						
50.	4.1.	Review of nuclear and/or radiation protection laws, requirements and recommendations	The laws on regulatory supervisory activity, as well as the independence of the authority and the existence of conditions required for regulatory supervisory activity, should be revised in the mirror of the lessons learned.	Another important source of the amendment to laws can be the supplementation of the WENRA reference levels, which may be established in 2013. Additionally, the amendment to nuclear safety regulations can be required by the revisions of IAEA recommendations and the EU nuclear safety directive; however their realization is a future issue.		15.12.2016		
-	4.2.	Changes in the role and responsibility of the authority	No action is needed.	At the request of the Government of Hungary, the performance of the Authority will be reviewed by the IAEA IRRS mission in 2014.				
51.	4.3.	National review of emergency response activity, and developments	One of the main objectives of the national exercise planned to be organized in the first half of 2013 is to practice media communication, as well as to			15.12.2013		

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			practice the execution of certain protective actions with the participation of the invited representatives of the public.					
-	4.4.	Steps in the area of openness, transparency and communication	No action is needed.					
-	4.5.	Post-Fukushima safety re-assessment and action plan	No action is needed.	The Authority ordered the scheduled execution of the required safety improvement measures, and continuously verifies and evaluates the progress of execution.				
-	4.6.	Human and organizational factors	No action is needed.					
-	**5.**	**Off-site emergency preparedness and response**	Currently, no task is needed to be set.	After the conclusion of the international review, based on their results, Hungary will re-assess the need for modifications and be ready to take the necessary actions.				
	6.	**International cooperation**						

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-	6.1.	Strengthening the effectiveness of the CNS process and other missions	It is a continuous activity; no additional action is needed.					
-	6.2.	Optimization of the global safety environment	It is a continuous activity; no additional action is needed.					
-	6.3.	Strengthening the communication on a regional and bilateral basis	It is a continuous activity; no additional action is needed.					
-	6.4.	Improving the effectiveness of experience feedback	It is a continuous activity; no additional action is needed.					
-	6.5.	Development of IAEA safety standards and extension of their application	It is a continuous activity; no additional action is needed.					

Note: 4 actions out of the 51 numbered actions have been accomplished or will be accomplished by the end of 2012.

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[4] Post-Fukushima "STRESS TESTS" of European Nuclear Power Plants– Contents and Format of National Reports, HLG_p(2011-16)_85 http://www.ensreg.eu/sites/default/files/HLG_p(2011-16)_85/Post/Fukushima/Stress/Tests/-/Contents/and/Format/of/National/Reports.pdf

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[10] Authority resolution on the termination of regulatory inspection on the targeted safety reassessment of Paks NPP, HAEA docket number: OAH-01170-0003/2011-EH, Resolution number: HA5444. HAEA, December 29, 2011.

[11] Action plan of Paks NPP on the implementation of tasks identified during the targeted safety reassessment, HAEA docket numbers: OAN-01384-0001/2012, OAH-01384-0003/2012 and OAH-01384-0009/2012.

[12] Authority resolution on the implementation of action plan of Paks NPP, HAEA docket number: OAH-01384-0010/2012-EH, Resolution number: HA5589 HAEA, December 17, 2012.