National Action Plan of Hungary

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

Hungarian Atomic Energy Authority

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	Name, assignment	Signature	Date
Edited by:	**István Mészáros** Head of Department, HAEA		
Verified by:	**Eszter Rétfalvi** Director, HAEA		
Verified by:	**László Juhász** Vice President, HAEA		
Approved by:	**Andrea Beatrix Kádár** President, HAEA		

1 Introduction

The accident at the TEPCO Fukushima Daiichi NPP triggered the European Commission 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 three 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 Commission by the deadline.

As the result of the first two steps of the international peer review, a draft country report was drawn up on the basis of the reports of the national authorities and the consultations. The draft country report 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 Unit 1 had to be finished 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] in December 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 Commission 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 Commission 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:

- External events,
- Design issues,
- Severe Accident Management and Recovery.

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 does not contain any information.

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.

1.1 Review at the end of 2014

The Hungarian Atomic Energy Authority published the Hungarian National Action Plan on its website in Hungarian language and on the ENSREG website in English. The Hungarian National Action Plan, together with similar plans of other EU member states, underwent a peer review process, which consisted of two stages: (1) a preliminary commenting period, where the

experts of other member states, the designated rapporteurs and the public could take comments and questions to the plan, and (2) a peer review meeting. The member states presented their plans in a meeting, answered the questions, then the rapporteurs designated per countries prepared evaluation reports of the national action plans. A summary report was approved by the ENSREG about the meeting [13].

The report on the Hungarian National Action Plan [14] contained the following conclusions:

- The structure of the Hungarian National Action Plan (NAcP) is compliant with the provided ENSREG guidance. The content of the Hungarian NAcP follows the ENSREG guidance, contains the necessary references.
- It reflects the items of the ENSREG Action Plan, contains the schedule of the actions and the Hungarian authority published the plan according to the expectations.
- The Hungarian authority built the supervision activities concerning the nuclear safety related actions into its annual oversight programme.
- The Hungarian authority inspects the completion of the particular actions or manages them during the related licensing procedures.
- Hungary has fully integrated the IAEA nuclear safety fundamentals and standards as well as WENRA reference levels into its nuclear safety legislation.
- The action concerning the prevention of long term containment overpressurization (development of external active cooling) was highlighted by the report. It drew the attention to the fact that this action means the most important challenge in terms of authority supervision.

The Hungarian Atomic Energy Authority has taken into account these aspects during the oversight of the implementation of the plan. Based on the ENSREG decision the national action plans should be reviewed until December 31, 2014, and a peer review workshop should take place in 2015 very similarly to the previous workshop in 2013. The ENSREG provided guidance on how to carry out the review, in which the following aspects were specified:

- Response/clarification on any issues identified in the rapporteur's report from the 2013 workshop.
- Progress on implementation and update of the NAcP.
- Main changes in the NAcP with justification, including: additional measures, measures removed or modified, changes in the schedule.
- Technical basis leading to the main changes identified in the NAcPs.
- Relevant outcomes of studies and analyses identified in the NAcPs.
- Nationally identified good practices and challenges during implementation so far.

Beyond that the WENRA reference levels revised in the light of the lessons learned from Fukushima should be taken into account to the extent possible.

The HAEA has taken into account the above aspects when carried out the review of the National Action Plan.

The National Action Plan has been supplemented with a new part (Part V), in which a new, simplified table describes the progress of the tasks. There have been no tasks removed or added to the plan, and for the time being there has been no official deadline modification. Many tasks have been completed before or in some cases well before the deadline, however there are such tasks as well, concerning which delays cannot be avoided. Regarding them the determination of new deadlines will take place at the beginning of 2015, when the second half-year report of the licensee for 2014 will be completed and reviewed.

1.2 2016 April review for the CNS report

The HAEA reviewed the National Action Plan again in 2016 April. The intention was to describe the status of the actions at the end of 2015 in the CNS report. For this purpose Annex V of the plan describing the status of the actions was updated. As a summary, out of the 51 tasks:

- 28 tasks have been implemented within deadline,
- further 9 tasks was reported complete by Paks NPP, but have not yet been closed by the HAEA,
- in the case of 10 tasks the deadline has not yet expired and can be met,
- delay is anticipated in relation to 4 tasks,
- according to the present situation all tasks will be closed until the end of 2018.

1.3 Review at the end of 2017

The HAEA reviewed the Action Plan again in 2017 December. The purpose was to describe the status of the actions at the end of 2017. For this purpose Annex V of the plan describing the status of the actions was updated. As a summary, out of the 51 tasks:

- 39 tasks have been implemented,
- regarding further 6 tasks the final deadline until the end of 2018 can be met,
- while in case of 6 tasks the implementation will undergo delay.

The HAEA pays extended attention concerning the tasks in delay. In most cases the time demands and rules of public procurement procedures has a major role in the delay.

1.4 Review at the end of 2019

The NPP dealt with the status and scheduling of the remaining tasks in the frame of the PSR, but did not anticipate the expected date of implementation of the tasks.
Taking into account the calculated additional risk during the annual regulatory inspection, the Authority has decided on new deadlines, which are included as a separate condition in the PSR decision. The HAEA reviewed the National Action Plan again in 2019. The purpose was to describe the status of the actions in December 2019. Therefore Annex V of the plan describing the status of the actions was updated. As a summary, out of the 51 tasks:

- 45 tasks have been implemented,
- 6 tasks have been rescheduled due to delay in the implementation. The new deadlines was determined by the PSR closure decision of HAEA. The task 1.28 and 1.29 was merged in the PSR decision.

The HAEA pays extended attention concerning the tasks in delay. The HAEA rescheduled these tasks in its decree on Periodic Safety Assessment. In most cases the time demands and rules of public procurement procedures, the changing legislation and modification of the technical specifications have primarily a major role in the delay.

1.5 Review at the end of 2021

The HAEA revised the National Action Plan again in 2021 November. In 2018 the HAEA rescheduled the remaining task in the final PSR decision. The final deadline of these task were 31 December 2021, and the implementation of the Backup Emergency Control Building (BECB) (TSR-1) was on 31 December 2022.

The purpose of this review is to present the status of the tasks. Therefore the Annex V, which sets out the current state of actions, has also been updated in the NAcP.

Status of tasks expiring at the end of 2021:

• For the implementation of the Unified Digital Radio communication System (TSR-2) the deadline was 31.12.2021. The deadline can be met, commissioning will be postponed to the first half of 2022.

• The installation of severe accident diesels (TSR-4) is not yet completed, the diesels have been procured and transported to the site, the condition of the diesel generators is checked every six months, and the commissioning of the Southern site will be postponed to the first half of 2022. The North site will be completed with a half-year lag.

• The spray system which prevents the slowly up building design pressure exceeding (TSR-5) is installed on Unit 3, the commissioning test will be held at the next overhaul in February 2022. This system can be used as a reference for the deployments on the other units.

The construction of the earthquake-resistant fire barracks, which task expires at the end of December 2021 (TSR-3), will not be completed on time. The authority will review the status of the overdue task in an officially induced procedure.

1.6 Review at the end of 2023

The HAEA revised the Action Plan again in 2023 November. The purpose of the review was to describe the status of the actions in November 2023. Therefore Annex V of the plan describing the status of the actions was updated. As a summary, out of the 50 tasks:

- *46 tasks have been implemented*
  The deployment of the Unified Digital Radio System (CBF-2) was completed in 2022.
- *4 tasks have been rescheduled due to delay in the implementation.*
  a. A Backup Command Center (BCC) equivalent to the Protected Command Center (PCC) must be established (CBF-1). New deadline: 31 December 2024. The reason for the delay is that the licensee had to deal with a lot of additional work. The technological systems have been updated, those included in the original plans have become obsolete in the meantime. It was important to provide for the increase of air filtration capacity, surface contamination measurement and a decontamination room, to protect workers.
  b. Even in the event of a safety earthquake the protection of personnel and equipment must be ensured by strengthening the building of the fire brigade barrack (CBF-3). New deadline after the enforcement procedure: 31 December 2026. The

HAEA issued a construction permit under reference No. PAE-HA7572. Construction has begun. The prescribed deadline can be met based on the licensee's statement.

c. Adequate emergency diesel generators with protection against external hazards (earthquake, extreme weather conditions, flood) must be installed, which can be operated independently from the other water and power supplies of the NPP (CBF-4). New deadline: 31 December 2024. The two diesel stations are separated.

Southern, Unit 1-2: Construction has finished. Fuel (Diesel) loaded for the tests. 24 hours running test was carried out successfully. Diesel Generator is in operation since September 2023.

Construction of northern extension 2 has been completed. The main equipment has been constructed and the diesel engine has been installed. The auxiliary systems have also been fully assembled. The mechanical piping and cable trails have been completed. The 24-hour running test was successful and the licensee plans to have the system fully operational in January 2024.

d. A system shall be implemented in the containment to prevent the gradual build-up of pressure in excess of the design pressure (CBF-5). New deadline for units 1, 2, 4: 31 December 2023. At units 1 and 2 the systems are commissioned. At unit 4 the pressure test was carried out successfully, commissioning is planned the first half of 2024. The licensee has applied for deadline extension until the end of 2024.

At unit 3 the new deadline is 31 December 2024, commissioning is planned for the first half of 2024.

The HAEA pays extended attention concerning the tasks in delay. In most cases the time demands and rules of public procurement procedures and modification of the technical specifications have primarily a major role in the delay. Safety analyses show that the conservative value of the risk reduction due to a 3-year delay in the restructuring is less than 1.9E-6.

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 action plan 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 into two basic groups:

A.) The supervisory activities for (nuclear safety related) modifications requiring authority approval are to be performed in line with HAEA decree 1/2022. (IV. 29.) OAH on the nuclear safety requirements of nuclear facilities and related regulatory activities (hereinafter 1/2022. HAEA Decree); 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 according to the rules of the 1/2022. HAEA decree. 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 successfully 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.

The HAEA, in addition to the oversight activity of the individual modifications (the particular method is described at the given action), reviewed the bi-annual reports submitted by the licensee and overviewed the status of each action during two inspections:

- Until the time of the review Paks NPP submitted reports on the activities performed in the first and second half of 2013 and in the first half of 2014.
- The HAEA conducted two inspections on 8 March 2013 and on 18 September 2014 to confirm the status of the actions in the action plan. The results were recorded in inspections protocols in both cases.
- Additionally, until the end of 2015, Paks NPP submitted the status reports on the activities performed in the second half of 2014 and in the first half of 2015.
- In addition to the inspections conducted in relation to the modifications meant to implement the particular actions, the HAEA conducted one more inspection on September 24 2015 to confirm the status of the actions. An inspection protocol was again prepared on the results.
- By the end of 2018 Paks Nuclear Power Plant submitted the respective status reports for the second half of 2015, the first and second half on 2016 and the first half of 2017. During the PSR of 2017-2018 the status of the tasks were reviewed, and safety assessments were submitted due to further delays on the tasks, that already have significant delay and would not be finished until the end of 2018 The HAEA reviewed the status reports in each case and confirmed the correctness of the information in relation to the performed modifications.
- The HAEA performed inspections in three more cases (28 September 2016, 06 December 2017, and 25 September 2018) in order to keep track of implementation of the tasks. Inspection protocols were taken in both cases.
- During the third PSR in 2017 the Paks NPP reviewed the progress of the Targeted Safety Re-assessment tasks and assessed the additional risk of the tasks delays. During the review in the regulatory decree on the PSR the 5 missing tasks were rescheduled considering the time demand of the tasks and the need to get acquainted with the new legislation.
- At the end of November 2021, HAEA revised the status of the tasks expiring on 31 December 2021.

Further deadline amendments:

- Installation of emergency diesel generators and their auxiliary equipment until 31 December 2023. The planning and construction of the building monitoring system, as well as the pandemic periods of the recent years, have greatly slowed down the progress of the work processes.
- Construction of the system to prevent the gradual build-up of pressure in the containment that exceeds the design pressure on Units 1, 2, 4: until 31 December 2023.
- The new deadline for the task related to the construction of the Backup Command Center (BCC): 31 December 2024. The HAEA has reviewed the delay as part of an official procedure.

- The task related to the earthquake-resistant fire barracks was not completed on time, the deadline expired at the end of December 2021. The HAEA reviewed the delay as part of an official procedure. The new deadline is December 31 December 2026.
- The construction of the earthquake-resistant fire barracks, which task expired at the end of December 2021, was not completed on time. The authority reviewed the status of the overdue task in an officially induced procedure. The new deadline is 31 December 2026.

- *At the end of November 2023, the HAEA revised the status of the tasks. Taking into account the stage of completion, it can be stated that during the event of an earthquake induced accident, the cooling of the reactor and the spent fuel pool and the protection of the personnel and the public are provided.*

c) Review of nuclear safety laws

The review of the nuclear safety requirements for nuclear facilities based on the lessons learned from the Fukushima accident, are enshrined in Topic 4 of Part II.

The post-Fukushima requirements were incorporated in the Nuclear Safety Code for new units at the end of 2014. Based on the 5-year cycle review of the nuclear safety requirements according to the law a new modification of the Code was developed in 2017 that contains the Fukushima experience also for the existing nuclear facilities. The Government of Hungary sent the draft regulation to the European Commission in a notification procedure. The version of the Code is promulgated in the first quarter of 2018.

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: External events, 2: Design issues, 3: Severe Accident Management and Recovery) 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: External events

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 the fire

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

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. IAEA, 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 analysed 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 described 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, 4 and 6 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 paragraph 4 point b) states that:

"8. § (4) *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;"

The basis of the domestic nuclear safety regulation was the implementing decree of the Atomic Act, the Government Decree No. 118/2011 (VII. 11.) on the nuclear safety requirements of nuclear facilities and the related regulatory activities (hereinafter: Government Decree No. 118/2011 (VII. 11.)) between 10 August 2011 and 30 April 2022. On 30 May 2022, Government Decree No 118/2011 (VII. 11.) was repealed due to the transfer of legislative powers and responsibilities to the HAEA, and its provisions were delegated to the President of the HAEA. HAEA Decree No 1/2022 (IV.29.) entered into force on 1st May 2022, preserving the rules of Government Decree No 118/2011 (VII.11.) with essentially unchanged content.

According to Article 3 paragraph 7 of HAEA Decree 1/2022 (29.IV.) [Article 3 paragraph 7 of Government Decree 118/2011 (VII. 11.)]:

"3. § (7) *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.*"

In order to comply with the requirement of the five-yearly review, three major amendments have been made to Government Decree 118/2011 (VII.11.). The main purpose of the revisions was to build on new international requirements and domestic experience.

1. Government Decree 37/2012. (III.9.) amending certain government decrees related to nuclear energy supplemented and amended Government Decree No 118/2011 (VII.11.) by introducing the requirements for new nuclear power plant units to be built in Hungary. Due to its timing, the review in 2012 was not intended to draw lessons from the Fukushima accident. The preliminary results of the analysis of the accident did not justify an immediate amendment of the legislation.

2. Hungary undertook the utilization of the lessons learned from the Fukushima Daiichi accident during the next revision of the nuclear safety legislation. The review took into consideration the following:

- information available regarding emergency response at Fukushima,
- 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.

In the light of experience, the legislation concerning the authority's supervisory activities needed to be reviewed as well as the rules concerning its independence and the conditions necessary for its supervisory work.

The Fukushima requirements for the new units were incorporated into Government Decree No. 118/2011 (VII.11.), which entered into force on 1st January 2015 [via Government Decree No. 357/2014 (XII.29.) amending Government Decree No. 118/2011 (VII.11.) on the nuclear safety requirements for nuclear facilities and the related regulatory activities and Government Decree No. 190/2011 (IX.19.) on physical protection and the related licensing, reporting and control system in the use of nuclear energy].

3. As a result of the regular, five-yearly review of the Hungarian nuclear safety regulations due in 2016, Government Decree 70/2018 (IV. 9.) amending certain government decrees related to nuclear energy entered into force on 10 April 2018 and amended Government Decree 118/2011 (VII. 11.).The amendment included the WENRA (WESTERN European Regulatory Association) reference levels (the expected levels of safety jointly agreed by European authorities) and the new IAEA requirements, as well as the Fukushima experience for existing nuclear installations.

The next review of the domestic nuclear safety regulation was launched in December 2022. As a result of the legislative work and legal amendments, Act CXXI of 2023 amending Act CXVI of 1996 on Nuclear Energy was published on 27 December 2023. The amendment eliminates the duplication of and parallel licensing procedures in the construction phase of new nuclear power plants, streamlines regulatory supervision and creates the possibility of regulatory control over independent control bodies.

Legislative work on the implementing regulations for the Act is expected to be completed in the first half of 2024.

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 evaluated the performance of the authority in 2015. If the IRRS mission or the reviews discussed in Section 4.1 reveal 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 a 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 Govt. decree 234/2011. (XI. 10.) implementing Act CXXVIII of 2011 on disaster management.

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.

[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

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 preparation of the Government's decisions related to disaster management and the sectoral coordination of tasks related to protection are carried out by the Interdepartmental Committee for Disaster Management Coordination, a body of the Government which provides proposals, opinions and advice.

The OAH operates a High-Level Working Group for the regular review of the National Nuclear Accident Emergency Response Plan (hereinafter referred to as HNERP) and the technical-scientific document, with the involvement of the relevant state administrations.

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.

At the regional and local level, there are regional and local protection committees and working groups. The head of the Disaster and Nuclear Accident Response Working Committee is the chairman of the District Territorial Defence Committee (the Chief Bailiff of the District Government Office). The local defence committees are adapted to the district system, and are therefore chaired by the head of the district office. He is supported by a disaster prevention specialist as vice-chairman. 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.

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 firefighting 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 the decision on it, the distribution of iodine tablets is performed according to the HNERP.

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 the duplication and optimizing the tasks 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.

Topic 7: Closure of the stress test tasks

7.1 The implemented tasks

2012

The seismic instrumentation and the SCRAM-signal generation during accidental earthquake were reviewed. In 2012 the need of a separate earthquake SCRAM to implement was examined, for the scenarios where a particular acceleration had been exceeded. But it was justified by scientific research and safety analysis, that the existing system appropriately manages and controls the reactor protection processes taking place during an earthquake. The existing earthquake monitoring and warning system and the functioning of FIVE (Earthquake-Protection Isolation Controlling Unit) were tested. (1.1)

2013

a) In 2013 the operative operational operating instruction (OpI) was issued that can be used to manage the station blackout state of the unit. The OpI is valid for the electric power supply of a safety system train in case of a station black out (ÁOKU/ECA0.0 or L-ÁOKU/ECA0.0)) taking place in a unit (beyond design basis accident). Within a twin unit, on a dedicated route, with diesel generator at a unit in BDA2 state, the power supply of consumers of safety systems without supply at a unit in BDA2 state can be achieved. It is possible to supply the consumers of safety systems of a unit in TFV state with a turbo generator on house load in islanding mode trough a dedicated route between two twin units. The task was accomplished with the implementation of dedicated supply routes at 6 kV level. (1.22)
b) The nuclear safety demands the unconditional safety of cooling water. The water supply must be provided in every cases, even at the possible lowest River Danube level. An Action Plan to provide the water supply is valid, and includes the protection levels and the

measures belonging to them. The tasks in detail related to the power plant and the water works are included in Chapter 3.9 of 1PR42 and in execution procedure TLÜ301_VU05_V01. The actions were complemented with the inspection, testing and maintenance instructions related to the equipment. The annual tests of the Pajtás pumps are supervised by the HAEA, too. (1.24)

c) Analyses were conducted to determine the amount and distribution of hydrogen in the reactor hall generated during the severe accident. According to the studies 80% of the hydrogen in the reactor hall can originate from fuel damage in spent fuel pool. The burn of hydrogen endangering the reactor hall integrity is prevented by independent water supply planed into the spent fuel pool. In this case the continuous heat removal provides safety of the stored fuel, so hydrogen generation must be taken into account only at the reactor vessel opened for main outage, but this time the hydrogen concentration will not reach the limit necessary for burning. (1.46)

2014

a) The 6 wall penetrations located in the machine hall of essential service water 95.12 m above Baltic Sea got additional water isolation in order to prevent machine hall flooding in case of water level higher than this. The pumps of VX, VY and VW essential service water systems are located there. (1.4)

b) The fuel level of the emergency diesel generator's fuel tank was raised to the highest possible. The modification was implemented in the documentation and the minimal level to hold was increased to 80 m^3. The amount of diesel necessary in case of incidents, enough for 120 hours operation is 60 m^3. The minimal fuel level of the fuel tank in the OLC is 70 m^3, and it has been increased to 80 m^3 now. The 70 m^3 of diesel written in the OLC makes 140 hours of diesel generator operation possible, where the 80 m^3 written in the operational instruction provides 160 hours operation. This way the 30% capacity increase undertaken in the TSR report has been accomplished with the limit modification in operational instruction. The contract with the fuel supplier subcontractor was modified in order to complement the consumed diesel within 24 hours after the order given in case of non-foreseen, extraordinary events. Taken into account all these factor the fuel amount is provided at the highest possible level. (1.5)

c) The demineralized water has important role at the loss of ultimate heat sink function, because the heat removal of the decay heat generated in the shutdown reactor vessel can be provided for an extended time with the inventory of the demineralized water system despite even the loss of the essential water system. The inventory of the demineralized water system is a strictly regulated parameter, as the water accessible here provides reserve water for the normal operation of the units in addition to providing coolant for the shutdown and cool down of the units in normal or incident conditions. In the implemented tank according to the plan in the implemented tank the useful volume had started by 1.5 m above the tank bottom. With the modification of the suction side nozzle of each tanks elongating the nozzles with 90º curved pipe section the tank volume to use effectively was increased by more than 117 m³ almost 15%. This is cca. 700 m³ for the six tanks together and can be considered as a tank plus. (1.7)

d) Despite the safe operation of the Hungarian electricity system preparation shall be done to prepare for the black-out as the greatest incident. After this event the black-start capable power stations are extraordinarily important during network operation restore. In Hungary there are three black-start capable machine: has an open cycle fast ignition gas turbine GT in Lőrinci Power Plant, the gas turbine GT2 of unit XV in Dunamenti Power Plant and the

gas turbine GT1 in Gyönyű Power Plant. Regarding the Paks NPP the gas turbines of the Dunamenti Power Plant and Gönyű Power Plant can be basically considered as power sources connected to an outer supply route in case of a station-black out. . Therefore the access to two independent supplies has been realized. During the former tests in addition to the Dunamenti Power Plant → Paks NPP supply route the Gönyű → Litér and the Litér → Paks route was tested. (1.13)

e) During former diesel generator tests it occured several times the essential service water system outage caused loss of engine cooling and led to delay in switch between safety system trains. In order to avoid this several equipments to facilitate the diesel generators' supply connection from fire-extinguishing water were purchased. By this the temporary supply from fire-extinguishing water for diesel generators has been provided. (1.20)

f) It was reviewed whether the available symptom-based emergency operating procedures (SEOP) support the optimal restore after combined occurrence of earthquake and primary circuit damage. The scope of the review was the instruction beginning with code „E" or „L-E" of procedures 1PR100 and 1PR200. The review results are shown in the symptom-based emergency operating procedures' (SEOP) instructions with code FM and in the summary table of the SEOP. All steps or substeps of the SEOP were classified as „yellow" where there was any seismically non-classified equipment. Also those steps got „yellow" classification, that steps cannot be performed due to other equipment classified previously non capable to service. Several equipment with no seismic classification can have a role in a step, but the step itself can remain successful if it includes an alternative, that is classified. With the procedures the controlled stable state is achievable also in case of earthquake. Though the lack of mock-up water and sampling results difficulty. (1.21)

g) The execution procedure (EP) ÁVIT_VU77_V01 of General Emergency Response Plan (GERP) was modified in 2014.In connection with the GERP the EP introduces the design requirements of the Emergency Response Team human support, the relevant definitions, data, requirements and equipments in detail. The described instructions provide the physical and mental intervention capabilities and long term readiness for work of the emergency response team. (1.32)

h) By this time there is a restricted zone for flight over the Paks NPP and the Spent Fuel Interim Storage Facility, the legislation related to the restricted zone was modified. There is a goal to carry out rescue missions under the control of military air control in the restricted zone in accordance with the Act on Atomic Energy of 1996 in case of nuclear emergency and over base threat sabotage in order to help the accident management and rescue. The MIT (relevant Ministry) announced the possibility of implementing temporary airspace structure among predefined circumstances but it comes with the temporary airspace reclassification. (1.34)

i) It was examined via probabilistic methods for operational states of closed RPV under 150°C, if it is reasonable to elaborate and implement a time limit taking into account the smooth risk distribution. Conclusively the OLC E2, E4 and F states limitations were modified. The core damage frequency is relatively high in those operational states, where the primary circuit temperature is below 150°C but the RPV is closed. Its reason is, there is no cooling available through the ECCS heat exchangers in these states, and because the high pressure injection is disabled and injection with the low pressure injection is available only after pressure drop. The loss of ultimate heat sink in these states is higher than the above defined in these states in total. It must be emphasised, these are transitionary states that occur during shutting down or restart of the reactor and are significantly shorter than other states. Taking into account NPP experiences, 2 week long time limitation was

uniformly suggested for each operational state. This time interval can be used to declare a state deviated from the normal operation and enforces the operator in a justified manner to reassess the risk, to implement safety enhancement measures including to switch between operational states. After completing the time limit suggested for the operational states, the safety and the risk conditions of the unit shall be reassessed taking into account the given circumstances and system configuration. In case of need, risk reduction measures must be determined. (1.43)

2015

a) Tools or spare part or equipment in the turbine hall or the reactor hall, which can tilt (tumble, slide, and roll) without some stabilization, has risk on safety during earthquake. The maintenance tools, equipments and spare parts having potential risk to safety components and not being part of the technology systems, therefore used only temporarily, must be fixed and have an earthquake resistant stabilization in the reactor hall and the turbine hall. The reviewed scope covered the electric maintenance tools and mechanical equipments. The implementation of the measures was not always fixation, the store of many tools was relocated to secluded areas, far away from safety systems and components. (1.3)

b) The safe cooling and keeping cooled of the Paks NPP reactors is provided by the available systems and diesel generators for minimum 120 hours in case of SL2 level earthquake. The purpose of the project is to strengthen the selected power cable routes (from 400/120 kV substation) as much as required and thus providing power supply from the transmission system in long term for the safety systems. Connection to the power lines was implemented with provisional cables in order to provide power supply from any 120 kV power line still in operation for the auxiliary systems in case of emergency. The provisional connection between 120 kV cables laying in field 11 and 19 and classified as earthquake resistant had to be provided, as they connect the start-up-reserve transformers BT's and the 120 kV switch. The power transmission through the existing cable routes into the NPP’s 6 kV network has become possible, as the start-up transformers BT's and the 120 kV equipment were modified to resist earthquake. For supplying the safety systems, it was necessary to strengthen the earthquake resisting capabilities of the 6 kV safety buses BL and BM and the structures endangering them during earthquake. (1.6)

c) Within the framework of the task the movement/damage of unloaded surface and the buildings and structures due to soil liquefaction during earthquake had to be determined, if these agents endanger the safety function of operating systems and components in Safety Class/Seismic Class. Furthermore the effects of movements on the buildings were analysed. The determined task included the on-site soil examination, seismic and soil-mechanic analysis and the building sinking investigation. After the review it may be announced that the strengthening of the main building due to soil liquefaction is not necessary, but the settling must be continuously monitored. (1.11)

d) The demineralized water system is not a safety system with the exception of the related demineralized water storage that has significant role in cool down during accident. The system in total is not earthquake resistant. It must not be relied on in case of bigger earthquake or loss of normal safety power supply. In that case only the water in the tanks is available. The goal of construction of new transfer routes to provide demineralized water supply from the tanks to auxiliary feed water system indirectly. Before the closing valves, new ends for hose connection were constructed on the suction pipes of the 6 demineralized water tanks. It is difficult to connect to the hose ends of the auxiliary feed water system

tanks supply pipes, as they are at the bottom of the tanks. Therefore the cooling system pipes had to be modified to have the hose end below the cover of the shaft, so it is not necessary to climb down to connect. Therefore in case of need the demineralized water tank and the supply pipes can be connected with a fire hose. With this solution long term heat removal through the steam generators can be provided. (1.14)

e) During this modification the essential service water system was connected through the process cooling water system to the NPP firewater system. The later one serves as a coolant supply alternative safety water reserve in case of need. By this the essential service water supply from firewater system is provided. (1.19)

f) The purpose of the modification is to provide electric power supply from any operable diesel generator to any intact safety train without the use of outside transmission system, even between twin units. This can be implemented with the lengthwise connection between the reserve buses through alternative routes and the cross connection of buses BM, BL at each unit. (1.23)

g) A special, radiation shielded vehicle had been purchased for the Emergency Response Team. Its function is to provide safe transport for the stuff carrying out measurement tasks in accidental conditions and for the staffs in separate shifts during physical protection events to the area. (1.33)

h) The auxiliary emergency feed water pumps, taking water from the demineralized water tanks, can supply water directly into the steam generators. Through the pipelines it is possible to supply into the auxiliary emergency feed water system of a separate train of the twin unit. There is another opportunity to connect to the pipeline from the courtyard. If in the case of severe accident the steam generator pressure can be reduced, it will be possible to provide low pressure water supply. The new, outer connection points were built on the demineralized water pipelines at tanks, and they are easily accessible even in accident conditions. (1.35)

i) The execution procedures of GERP had to be modified due to the changes of the organisation contributing in emergency situations affecting several units. The ÁVIT_VU19 and ÁVIT VU77 documents were modifies GERP_EP. The relevant procedure of the GERP describes in detail the design requirements of human supply of the Emergency Response Team, the related concepts, data, requirements, equipment, the maintenance of mental and physical capabilities of the staff. (1.37)

j) Several conditions, factors have influence on the operational safety of the essential service water. Among these the cleanliness and operational reliability of the filters have an important role, as the essential service water pumps suck through these. In case of an earthquake on the one hand the ground movement passing through the building has an effect on the filters on the other hand the increased level of offal has an effect. The conducted investigation examined the earthquake resistance of the prefilter stage of the essential service water pumps, and justified, that their integrity remains intact in the case of safety earthquake. (1.41)

k) The NPP had built and operates a complex monitoring system in order to control the radioactive release and the radioactivity load on environment. This system had to be modified to earthquake resistant and available for cases of station black-out. For the severe accident measurements it is suggested to extend the UPS and battery supply time to 72 hours. For the case of station black out conditions mobile gamma dose meters were purchased for the bunkered emergency control building, backup emergency control building, bunkers and courtyard. The communication cabling of the courtyard gamma dose

meters can suffer damage or became unavailable. In order to enhance the operational availability, the communication was completed with the wireless communication used also in the case of mobile dose meters. The wireless communication was established according to the safety philosophy of Paks NPP. (1.44)

2016

a) The power supply of the essential service water (ESW) filters was modified in order to be able to function with safety power supply. The action is needed, because in case of a long term electric power loss the suction filters of the ESW pumps may be clogged and that can lead to loss of essential service water. After the modification in case of long term loss of normal power supply, such in case of 4 unit power loss, the diesel generator providing power for the safety systems will supply the filters in order to maintain the ESW supply. (1.8)

b) Water tanks had been built to store the demineralized water necessary to cool down and keeping cool the reactors of twin unit II. in case of safety earthquake. The action was justified by the maintaining of radiation level as low as reasonable. 3 tanks had to be installed in the direct vicinity of the central building, 2 m away of the east facade. The tanks have significant role during earthquake, but the main building was not investigated for earthquake neither at its design stage nor during the lifetime extension analyses. The building and its east facade was dangerous to the tanks and also to systems and pipelines serving them. The tanks were installed next to the main building, between the tank house and the machinery hall, where no non-earthquake classified building mean any harm to the tanks and the pipelines. (1.9)

c) Protective action is needed to avoid the flooding of cable shaft and turbine hall after condenser coolant pipeline break. The modification reason is to provide protection against the coolant pump shutdown in case of earthquake or pipeline break. Against the water break in into the ESW pump machinery hall water resistant penetrations were made. (1.10)

d) New electric power supply was built for the diving-pumps with shore-based filtering, that is available even in emergency conditions. This pump compound provides a virtually infinite water reserve independent from the Danube level, that can be used for reactor cooling in case of ESW unavailability in case of severe accident. The unavailability of normal power supply in severe accident conditions justified the modification. With it the dive-pumps got a new supply properly protected from diesel generator. (1.17)

e) The use of outer coolant supply methods were written into procedures, specifically into the GERP. Its paragraphs introduce the possible water reserves and the inta connection points. The person ordering the execution decides from which reserve to which connection point the coolant supply equipment must be installed. The GERP covers the necessary steps to switch back to normal operation and to maintain and test the pipeline system regularly. (1.36)

f) The implementation and instrumentation of the Technical Support Centre at the shielded Emergency Control Building (ECB) had been expanded. Therefore the ECB was made capable to manage concurrent severe accident on several units. With the modification not a new, independent system was created, but the functioning one gained 2 additional workstation equal to the other from HW-SW and function point of view. (1.38)

g) For severe accident conditions a liquid radioactive waste handling procedure was worked out.The radioactive waste release risk and possible paths were investigated, a release

monitoring system was installed. The GERP requires the liquid radioactive waste management for severe accident conditions. The Severe Accident Management Procedure established limitations on the management of the radioactive water in order to provide sufficient amount for decay heat removal. Declared, controlled, stabile operation is required for returning to the normal operation radioactive waste management according to the regulation. Until this stabile state only coolant storage takes place. (1.40)

h) The list of components important to safety was created covering the components endangered by electromagnetic effects (lightning consequences included) and possibly requiring reinforcement against those effects. The EMC compliance investigation of the detailed equipment and component database had been completed. Noise signals, shielding efficiency and electrostatic charging measurements were performed at the relevant locations of the safety systems. The lightning's electromagnetic pulse effect of lightning, EMC and electrostatic discharge were investigates at the sensitive locations. The investigations did not reveal non-compliances, further actions were not necessary. (1.42)

i) The Paks NPP design base did not include the soil liquefaction after earthquake, because the soil liquefaction probability for the unloaded ground as well as the ground loaded with buildings was less than 1E-04/year in the site investigation. The seismic PSA, however it managed the liquefaction danger and its consequences in a coarse way, draw the attention to these consequences and the danger of cliff-edge effect as well as the demand to determine the margin against liquefaction. The investigation outcome says, there is no unacceptable movement after an earthquake neither for the buildings nor the pipelines nor the structure. (1.45)

2018

a) At units 3-4 with the help of diesel engine operated fire water pumps the water reserve of the warm water outlet can be used as cooling water if the ESW system is not available. According to the requirements for the modification the fire water system has two functions in emergency: providing extinguisher and supplying coolant into the ESW system as long as the warm outlet provides water. (1.18)

b) A programme was established to provide training on the severe accident management for the Technical Support Centre stuff, plant managers, unit shift supervisors and emergency response team leaders. It covered introduction to severe accident scenarios, and detailed study of Severe Accident Management Procedures, severe accident monitoring system and severe accident simulator. The training programme includes basic and refreshing education in addition to periodic practical training. (1.39)

c) Storage and borating opportunity for water reserves from outer, alternative sources got possible in the courtyard. Second part of the task, introducing the route setting into Severe Accident management Procedure, had been completed by the end of 2018. (1.15)

d) The direct, alternative water supply of the spent fuel pool, resisting outer hazards had been built, but the application has been introduced into the Severe Accident Management Procedure's execution procedure in 2018. (1.16)

e) The direct, alternative water supply of the spent fuel pool had to be integrated into the existing procedures. The applicability of the new boric acid source has to be investigated in every Symptom-based Emergency Operating Procedure and Severe Accident Management Procedure (supply to primary circuit, hermetic compartment). The Symptom-based Emergency Operating Procedures and Severe Accident Management Procedures will

be part of the standard training programme. The SAMP was extended with multiple unit severe accident management. SSG (Supporting Systems Guideline was developed), it is referred in the other procedures (SEOP, SAMP). (1.26)

f) The earthquake protection modification of bunkers (nr. 1009, 1010) had been completed and approved by the HAEA. The architecture reinforcement of the protected emergency command centre had been completed, its occupancy after modification had been supervised together by the National Directorate of Disaster Management and the HAEA. (1.27)

g) According to the construction licence the on-site works in Safety Class 3 scope (HVAC supporting structures, wall reinforcement, aggregate purchase and storage building construction) had been completed. The Protected Emergency Command Centre modification in Safety Class 4 scope (division wall, electrical repair, HVAC) has been completed by the end of 2018. (1.29)

2021

a) In all operating states of the units (also in the case of incidents included in DB and extended the DB) the using of wireless communication had to be implemented. The construction of the radio and antenna system defined in the task will be completed by the end of 2021, however, the commissioning of the system is expected in february 2022, during the nex maintenance. (1.30)

b) Severe accident diesel generators with protection against external hazards have been procured and transported to the NPP site. The condition of the diesel generators is checked every six months. The construction of the diesel tank room and the installation are delayed, but in an accident involving a complete loss of voltage, the delivery of diesel fuel to the site is resolved. The commissioning of the Southern site will be postponed to the first half of 2022. the North site will be completed with a half-year lag. (1.12)

c) The spray system which prevents the slowly building uppreassure in the containment (TSR-5) is installed on Unit 3. All the elements of the system are installed and the sprinkler commissioning test can be held at the next maintenance in February 2022. The experience of Unit 3 system serves as a reference for deployment on additional units (1.25)

2023

a) In all operating states of the units (also in the case of incidents included in DB and extended the DB) the using of wireless communication had to be implemented. The construction of the radio and antenna system defined in the task **was completed by the end of 2022**. The fullfilment of task has beeen accepted by the HAEA (OAH-2021-00003-0062/2022). (1.30)

b) Severe accident diesel generators with protection against external hazards have been commissioned of unit 1-2 generators in September of 2023, the commissioning of the unit 3-4 generators are expected until the end of 2023. (1.12)

c) The commissioning of the spray system which prevents the slow building up of preassure in the containment has been completed on units 1 and 2, the system has been constructed on unit 3 and its commissioning will take place in the first half of 2024. The construction of the system of unit 4 will be completed and it will be commissioned in the first half of 2024. (1.25)

d) The construction of the Backup Command Centre equivalent to the Protected Command Centre (1.28 and 1.29) has been completed and commissioning is expected to take place until the end of 2023. It is expected to be put into use in the first half of 2024.

e) The procurement process for the construction of the fire brigade barracks is underway, with construction expected to start in the first half of 2024.

7.2 Rescheduled tasks

The NPP dealt with the status and scheduling of the remaining tasks in the frame of the PSR, but did not anticipate the expected date of implementation of the tasks

Taking into account the calculated additional risk during the annual regulatory inspection, the Authority has decided on new deadlines, which are included as a separate condition in the PSR decision. The regulatory inspection in 2018 took into account the calculated over plus risk and the Regulatory Body determined new deadlines, which are included among the PSR conditions.

The extension decisions:

Most of the rescheduled tasks, (3 pcs) will be completed in the first half of 2024, the commissioning is expected in the first half of 2024 and this way, the HAEA approval is expected as well in the first half of 2024.

a. A Backup Command Center (BCC) equivalent to the Protected Command Center (PCC) must be established (CBF-1). New deadline: 31 December 2024. Decision No. PAE-HA7607

b. Even in the event of a safety earthquake the protection of personnel and equipment must be ensured by strengthening the building of the fire brigade barrack (CBF-3). New deadline after the enforcement procedure: 31 December 2026. Decision No. PAE-HA7490. The power plant decided to approve the construction of a new fire brigade barrack. The design work has been completed and the construction contract is being prepared.

c. Adequate emergency diesel generators with protection against external hazards (earthquake, extreme weather conditions, flood) must be installed, which can be operated independently from the other water and power supplies of the NPP (CBF-4). New deadline: 31 December 2024. Decision No. PAE-HA7383.

d. A system shall be implemented in the containment to prevent the gradual build-up of pressure in excess of the design pressure (CBF-5). New deadline for units 1, 2, 4: 31 December 2023. Decision No. PAE-HA7212.
For unit 3 the new deadline is 31 December 2024. Decision No. PAE-HA7061.

In the extension request, the licensee submitted safety analyses, in which the impact of the delay of the tasks on nuclear safety was analysed and demonstrated. The conservative value of the risk reduction due to the delay in the modifications is of the order of E-6.

Safety justification:

- In the event of a major earthquake and the static fluctuation of a fire barracks, urban firefighters will protect the power plant. With building a new fire station, the core damage frequency would drop by 9.4%. Therefore the risk reduction loss due to implementation delay falls into range of 4.93E-07. Accordingly, it can be stated that the risk reduction loss due to the 2,5 years delay has a conservative maximal value of 1.2 E-06. It is tolerable according to the safety analysis.
- According to the information provided by the licensee, the implementation of the Accidental Diesel Generator will be completed by 31.12.2024 at the latest. Due to the 3-year delay in the conversion, the conservative value of the risk reduction (ΔLRP) is certainly less than 1.9E-6.
- According to the data provided by the licensee, the implementation of the long-term cooling of the containment is completed by 31.12.2024 at the latest. Due to the 3-year delay in the conversion, the conservative value of the risk reduction (ΔLRP) is certainly less than 1.9E-6.

The Nuclear Authority has reviewed the status of the delayed task (PAE-VE7477) and has defined new conditions for the implementation.

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		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
			qualified and, if necessary, 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	1.4.	15.12.2015.	3.1.2	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
				beyond design basis flood takes place.				
7.			2 - 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 slope shall be elevated or a protective dam shall be constructed to avoid the flooding of the turbine hall or the cable tunnels.		1.10.	15.12.2015.	2.1.2	3.1.3
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		-		3.1.4

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
				every aspect and no task has been identified.				
9.	1.5.	Seismic monitoring system	In the frame of the reconstruction project of seismic instrumentation, which is in the preparatory phase, the question of automatic shutdown shall be revisited.	Currently no such system exists, which would initiate an automatic shutdown of the reactors for a given acceleration level.	1.1.	31.12.2012.	2.1.2; 2.1.2., 2.2.1., 2.2.4., 6. and 7.3.	3.1.5
-	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	Due to implications from Fukushima Daiichi accident, such improbable, complex cases shall also be	1.21.	15.12.2013.	2.1.2.	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			optimal recovery in such combined situation.	taken into account as extension of the design bases.				
11.			2 - Protection of the not seismically reinforced 400 kV and 120 kV substations and the automatisms switching the plant to isolated operation against earthquakes shall be evaluated and increased if necessary.	The 400 kV and 120 kV substations though not safety systems and not seismically reinforced, might provide many alternative electric supply opportunities, if they are not damaged.	1.6.	15.12.2014.	2.2.1.2, 5.1.1.3, 5.1.5, 5.2.5 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	Based on the list the authority and the licensee can specify reinforcements and corrective actions. HA5444-1.2.3	1.42.	15.12.2015.		

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			and display whether a given component is adequately qualified.					
14.			5 - 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.		1.41.	15.12.2015.	2.1.2., 2.2.1., 2.2.4., 6. and 7.3.	
	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		1.15.	15.12.2018.	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
			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.					
18.			4- 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.		1.17.	15.12.2015.	5.2.5, 5.1.1.3, 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		1.19.	15.12.2015.	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
			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.					
21.			7- 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.		1.20.	15.12.2015.	5.2.5, 5.1.1.3, 5.1.5, 5.2.5 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.	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
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 including beyond design basis hazards.		1.12.	15.12.2018.	5.1.3; 5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	
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.	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
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.					
-	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,	No separate action was necessary except for the Protected Command Centre.				

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			which is discussed under Topic 3.					
-	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.					
-	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.		31.12.2018	Special vehicle was purchased. It maintains security and radiation	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
							protection functions.	
-	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 address uncertainties.	Probabilistic assessment for 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>].		1.43.	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.	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
	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
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		15.12.2013.	6.3.7	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
				2014 for units 3 and 4 respectively.				
-	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. TSR-5	Rescheduled: 30.06.2024	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 modification has already been implemented for unit 1 and unit 2, while it will take place in 2013 and 2014 during the refuelling		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
				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.	TSR-4	Rescheduled: 31.12.2023.		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 connected in the courtyard by flexible means shall be constructed that is protected from external hazards (such as	There are only administrative deficiencies. The technical part has been finished.	1.16.	15.12.2018. Accepted: August 2019	1.2.2. and 2.1.2.	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
			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.					
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 modifications generated by the implementation of other	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 2014 in unit 3 and unit 4, respectively.	1.26.	15.12.2018. Accepted: August 2019	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
			actions shall be implemented in the concerned SAMG.					
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	

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-			Paks NPP initiates the establishment of black-start capability (start-up from its own diesel generator) for the Litér gas turbine. Identical to [<25>]-el.			15.12.2014.	5.1.1.3, 5.1.5, 5.2.5 and 5.3.1.	3.3.4
-	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

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
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. 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.	By the introduction and implementation of severe accident management guidelines and modifications the operator also introduced the training of severe accident situations to the scope of emergency response exercises.	1.39.	15.12.2017.	6.1.6	3.3.7
-	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		1.30. TSR-2	30.06.2024.	2.1.2., 2.2.1., 2.2.4., 6. and 7.3.	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
			necessary actions shall be performed.					
40.			2 - Informatics mirror storage computers shall be installed both at the Protected Command Centre and the Backup Command Centre containing the necessary scope of data.		1.31. TSR-1	PCC is completed and commissioning is underway for BCC 30.06.2024.	6.1.2.4.	3.3.9
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	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	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

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
			respond to in such a situation shall be specified.					
43.	3. 1.12	Radiation protection	1- Procedures for collecting and transporting emergency response personnel shall be developed and the necessary means and rules of their provision shall be determined.	The goal is to improve the access in severe accident conditions impaired by the adverse radiation conditions.	1.32.	15.12.2017.	6.1.3.5.	3.3.12
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		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
			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.					
48.			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.	TSR-1	1.28.	31.12.2023.		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

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-	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
	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		

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-	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 was reviewed by the IAEA IRRS mission in 2015.				
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 practice the execution of certain protective actions with the participation of the invited representatives of the public.			15.12.2013		
-	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.				

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-	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**						
-	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.					

Task[3]		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
-	6.5.	Development of IAEA safety standards and extension of their application	It is a continuous activity; no additional action is needed.					

Part V: Progress in the action plan

Review 1, 18.12.2014.
Review 2, 11.04.2016 (with reference date end of 2015)
Review 3, 20.12.2017
Review 4, 30.11.2021

Number of task	Identifier in the HA5589 resolution	Action	Deadline	Description of progress, justification of modifications, technical justification, results
1	-	Considering natural hazards of 10 thousand year recurring frequency. For earthquake, flooding and low water level of Danube.		Completed before the preparation of the action plan.
2	1.2.	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.	15.12.2015. New deadline: 31.12.2026.	They will be delayed due to change of technical content. Instead of reinforcement of the old building, a new one will be constructed. The technical plans were completed for a new fire brigade barrack. Construction license was granted to Paks NPP. Construction plan is developed; it is currently under commenting period within the plant. The task can be completed as early as 2017. At the end of 2015 the task was under tendering. *After two unsuccessful procurement process the Licensee returned to the original concept (reinforcing the the existing building). Implementation will be finished by the end of 2021according to the decree on PSR.*

3	1.9.	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, reinforced or provide appropriate protection of the tanks by other means.	15.12.2015	A new analysis changed the technical content. At first the tanks were to be protected, now rather the reinforcement of the building is decided. The new analysis, construction planning, and time needs of public procurement procedure cause delay. A new schedule will be ready by 2015 February. The proof of completion was submitted to authority approval at the end of 2015. *Completion of the task was approved by the authority in March 2016.*
4	1.11.	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.	15.12.2017	Seismic input data will be ready by the end of 2015. (Action 5. (1.45.)). The scope of the concerned pipelines was completed. The technical solution is in the planning phase. The concept for management of small diameter (d < 100 mm) pipelines is ready. The completion of the task may undergo delay because the appropriate technical solution for large diameter pipelines should be found; in addition a delay due to the public procurement procedure is also expected. No modification is necessary based on the assessment performed in Task 1.45.
5	1.45.	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.	15.12.2018	The work is in progress, determination of settlement parameters will be completed by the end of 2015. Deadline can be met. The assessment was completed and submitted to authority acceptance at the end of 2015. *Completion of the task was approved by the authority in May 2016.*

6	1.4.	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.	15.12.2015	Completed 29 months before the deadline.
7	1.10.	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 slope shall be elevated or a protective dam shall be constructed to avoid the flooding of the turbine hall or the cable tunnels.	15.12.2015	The construction plans are finished, the public procurement procedure is in progress. Construction can start in first half of 2015. Deadline can be met. Implementation has started, completion is anticipated by 2016 August. *Completion of the task was approved by the authority in December 2016.*
8	1.3.	Fixing of the non-process equipment and tools that could adversely impact process equipment during outages shall be provided.	15.12.2014	Completed by deadline.
9	1.1.	In the frame of the reconstruction project of seismic instrumentation, which is in the preparatory phase, the question of automatic shutdown shall be revisited.	31.12.2012	Completed by deadline.
10	1.21	The existing symptom-based emergency operating procedures shall be reassessed as to whether they support an optimal recovery in such combined situation.	15.12.2013	Completed by deadline.
11.	1.6.	Protection of the not seismically reinforced 400 kV and 120 kV substations and the automatisms switching the plant to isolated operation against earthquakes shall be evaluated and increased if necessary.	15.12.2014	Construction is in progress, at least some parts will be completed by the beginning of 2015. Completion of the task was approved by the authority in November 2015.
12.	1.24.	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.	15.12.2013	Completed 17 months before the deadline.

13.	1.42.	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.	15.12.2015	Supplementary repair of external lightning protection systems based on the revealed deficiencies is in progress. Modification of cable paths and shielding of relay tables have been commenced. Construction will be completed in 2015. The licensee submitted the task completion at the end of 2015 for authority acceptance. Completion of the task was approved by the authority in September 2016.
14.	1.41	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.	15.12.2015	The work has commenced. Deadline can be met. Completion of the task was approved by the authority in November 2015.
15	1.7	The operator shall maximize the available inventory of the stored demineralised water in all operation states.	13.03.2014	Completed by deadline.
16	1.14	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.	15.12.2015	The plant is prepared for the work, it will be performed during the main overhauls in 2015. Completion of the task was approved by the authority in November 2015.
17	1.15	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.	15.12.2018 Accepted: August 2019	The work progresses proportionally, the task will be completed by deadline. The task will be completed by the deadline. Licensing of mechanical and electrical modifications is completed, licensing of construction is in progress, the work will start in the beginning of 2018, the deadline can be met.

18	1.17	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.	15.12.2015	Construction plans have been completed. The task will be completed by deadline. The licensee submitted the proof of completion for authority acceptance at the end of 2015. Completion of the task was approved by the authority in March 2016.
19.	1.18	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 individual diesel power supply shall be solved.	15.12.2018	The work has commenced, deadline can be met. Licensing of the modification has commenced, the deadline can be met. The work was completed in 2018. The HAEA closed the task.
20.	1.19	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.	15.12.2015	The work has been completed. The final technical acceptance takes place in 2014. Completion of the task was approved by the HAEA in June 2015.
21.	1.20	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.	15.12.2015	Completed 21 months before the deadline.
22.	1.5	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.	15.03.2014	Completed 6 months before the deadline.

23.	1.8.	Power-operated filters of the essential service water system shall be established.	15.12.2015	Construction plans are ready; they are under licensing. The task can be completed in 2015. The licensee submitted the proof of completion for authority acceptance at the end of 2015. Completion of the task was approved by the authority in March 2016.
24.	1.12. TSR-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 including beyond design basis hazards.	15.12.2018 New deadline: 31.12.2023 *Completed by deadline*	2 independent diesel generators protected against external hazards will be provided. They will have accident as well as maintenance functions. Deadline can be met. The technical content has changed, one common Diesel generator will be installed for the 4 units in a building protected against internal and external hazards. The deadline can be kept. Finally 2 diesel generators will be installed according to the reviewed concept. Modification licensing and implementation is in delay due to looking for a new supplier. It was rescheduled in PSR. *The diesel generator arrived to the NPP site in 2020. The fuel storage building is under construction.*
25.	1.13.	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.	15.12.2014	Completed 17 months before the deadline.
26.	1.22.	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.	31.07.2013	Completed by deadline.

27.	1.23.	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.	15.12.2015	Major part of the works took place in 2014, it will be completed in 2015. Completion of the task was approved by the authority in November 2015.
28.	1.43.	Probabilistic assessment for 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.	31.12.2012	Completed by deadline.
29.	-	Installation of hydrogen monitoring system as part of the severe accident instrumentation for units 3 and 4.	15.12.2013	Severe accident modifications were completed at all units.
30.	1.25. TSR-5	The system that is able to prevent the long-term, slow over-pressurisation of the containment shall be developed and implemented.	15.12.2018 New deadline: 30.06.2024. *Completed by deadline*	A feasibility study was prepared. Technical planning has started. Deadline can be met. License application has not been yet prepared for the modification. The building license application is under preparation. The deadline can be met. *The technical plans had to be modified, the implementation plans are being developed. Licensing was completed in 2019. The construction is only available during the periodicaly maintenance. The implementation is already finished on the 3rd and 2. unit the startup is excepted on the next maintenance.*
31.	-	Among the severe accident management measures Paks NPP selected the strategy of in-vessel maintenance of the molten core. No further action is necessary.	31.12.2014	Severe accident modifications were completed at all units.

32.	1.16.	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 previously via this line. The required operations shall be specified in procedures.	15.12.2018 Accepted: August 2019	Prepared for licensing in 2015. The task progresses, the deadline can be met. The licensing documentation of the modification is under preparation, the work can be completed in 2016. The modification was implemented, evaluation is in progress.
33.	1.35.	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.	15.12.2016	The task is almost ready. Deadline can be met. Completion of the task was approved by the authority in June 2015.
34.	1.26.	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 modifications generated by the implementation of other actions shall be implemented in the concerned SAMG.	15.12.2018 Accepted: August 2019	The task depends on other tasks (1.15, 1.16, 1.35, 1.36). The compliance with the deadline also depends thereon. The incorporation of technology changes into the SAM takes place on a continuous basis, when the particular modifications are completed. No change, the deadline can be met. The completed tasks are being incorporated into the SAMG, the deadline can be met.
35.	1.36	The method of usage of external supply opportunity shall be described in instruction documents.	15.12.2017	The task depends on task 1.35. Accordingly it can be completed by deadline. Completion of the task was approved by the authority in November 2015.
36.	1.38.	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.	15.12.2018	The task progresses, the deadline can be met. The licensee submitted the proof of completion for authority acceptance at the end of 2015. Completion of the task was approved by the authority in December 2016.

37.	1.37.	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.	15.12.2017	The task is in progress, the deadline can be met. Completion of the task was approved by the authority in June 2015.
38.	1.39.	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. 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.	15.12.2017	The simulator is in test operation already. The licensee submitted the proof of completion for authority acceptance at the end of 2015. The regulator approved the completion of the task.
39.	1.30. TSR-2	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.	15.12.2018 New deadline: 30.06.2024. Completed by deadline	The deadline can be met. The public procurement process is under preparation, the deadline can be met. *The public procurement process was unsuccessful due to amendment of certain regulations, it has to be repeated. Licensing was performed at the beginning of 2019, but the deadline can not be met. The delay is managed in the decree approving the PSR.* *The construction will be finished in June 2024.* *The* authority acceptance expected in Q2 of 2022.

40.	1.31. TSR-1	Informatics mirror storage computers shall be installed both at the Protected Command Centre and the Backup Command Centre containing the necessary scope of data.	15.12.2016 New deadline: 31.12.2023. *will be completed by deadline*	The deadline can be met at both locations. Procurement has started, the deadline can be met. Installation took place at the Protected Command Centre. Implementation can be completed after construction of the Backup Command Centre. The delay is managed in the PSR. The construction finished in December 2023. The computer commissioning is underway for BCC 30.06.2024.
41.	1.46.	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.	31.12.2012	The task was completed by deadline.
42.	1.40.	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.	15.12.2015	The examinations were completed. A separate procedure is being prepared. The task will be completed by deadline. The licensee submitted the proof of completion for authority acceptance at the end of 2015. Completion of the task was approved by the authority in September 2016.
43.	1.32.	Procedures for collecting and transporting emergency response personnel shall be developed and the necessary means and rules of their provision shall be determined.	15.12.2017	Completed 25 months before the deadline.
44.	1.33.	A shielded transport vehicle deployable at significant radiation levels shall be procured.	15.12.2018	Implementation is in progress, it could be completed in 2015. Completion of the task was approved by the authority in June 2015.

45.	1.34.	The rules for exemptions from the air ban around the plant shall be modified to manage airborne support.	15.12.2014	Completed. The related proposal was taken by the plant. However no modification is necessary to exempt from the ban, it can be decided by the government in the case of an emergency.
46.	1.44.	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.	15.12.2014	The examination was completed. The task will be completed by deadline. A plan is being prepared to solve the identified problems. Completion of the task was approved by the authority in June 2015.
47.	1.27.	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.	15.12.2018 Accepted: August 2019	Qualification is complete. Reinforcement of the equipment at two shelters took place. A slight reinforcement of the protected command centre is necessary for DBE. It can be completed when the new backup command centre will be ready. Deadline can be met. It was completed for the shelters, reinforcement of the Protected Command Centre was completed by the deadline (together with 1.29).
48	1.29.	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.	15.12.2015 Accepted: August 2019	The task can be carried out after the reinforcement of the PCC (Task 47 (1.27)) or in the frame of that task; so the completion will be significantly delayed. The task was completed by the end of 2018, start of implementation had to wait for completion of Task 1.28.

49	1.28. TSR-1	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.	15.12.2016 New deadline: 31.12.2023. *will be completed by deadline*	A delay is probable due to public procurement procedures endangering the deadline of other tasks (1.27, 1.29). Implementation of the task will commence in 2016, but the deadline cannot be met. *The construction started in the beginning of 2018, the deadline cannot be met. The new deadline is managed in the PSR.* *The construction was completed, the commissioning and the building occupancy permit procedure is ongoing.*
50	-	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.	15.12.2016	Modification of the Nuclear Safety Code was proposed by the HAEA for the new units reflecting to the experiences. The proposal is in front of the government. The 5-year regular review of the nuclear safety regulations will take place in 2016, which will take account of the new WENRA RLs and modified IAEA documents also for the existing nuclear facilities. The modified requirements for the new units were published in the end of 2014. The review of the NSC due every five years is in progress. The deadline can be kept. The 5-yeaerly review of the NSC was completed, the Government sent the draft regulation to the European Commission for notification. The amended Code is expected to be promulgated in first quarter of 2018.

51.	-	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 practice the execution of certain protective actions with the participation of the invited representatives of the public.	15.12.2013	Completed. The whole national emergency response system was involved in exercising the public information activities during the ONER-3-2013 exercise. A demonstration exercise took place as part of Phase 2 of the exercise, which contained sheltering, dissemination of iodine pills and evacuation of a certain, preliminary designated and informed part of Paks town.

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