Preliminary National Report

on the Targeted Safety Reassessment of the Paks NPP in the Republic of Hungary

Prepared for the European Commission
by the task force of
the Hungarian Atomic Energy Authority

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Executive Summary

To comply with the request of the European Council, taking into account the preliminary lessons learned from the Fukushima accident and by following the guidelines laid out in the Declaration of ENSREG (European Nuclear Safety Regulators Group) [1], the Targeted Safety Reassessment (TSR) of the Paks Nuclear Power Plant ("stress test") has been started.

The Hungarian Atomic Energy Authority (HAEA), as the endorsed nuclear safety authority in Hungary, has sent its detailed requirements [2] to the operator of the NPP. Paks Nuclear Power Plant Ltd. (Paks NPP) have prepared and submitted their Progress Report [3] on the results and statements of the assessment so far, ahead of the prescribed deadline. HAEA has compiled the current Preliminary National Report on the basis of the review of the Progress Report.

The TSR covers the three main topics proposed by the ENSREG, namely earthquake and flooding as external threats, the total loss of electricity supply (station black-out – SBO) and loss of ultimate heat sink (UHS), along with the management of severe accidents. According to the requirements issued by HAEA, the reassessment is extended to the internal initiating events, the low water level conditions in the Danube and also to extreme weather conditions.

Although the assessments are not yet completed, there are some unquestionably positive statements along with some findings which might weaken the capabilities of the plant against some extreme conditions. Some of these were already known before starting the TSR and appropriate corrective actions are being elaborated and implemented, some other parts were only revealed during this reassessment. The safety significance of the latter ones has not been established yet.

From the positive statements we emphasize that the design basis of the plant corresponds to the internationally accepted standards and, concerning all the initiating events within the design basis, the basic safety functions are maintained. This statement is largely based on the result of the Periodic Safety Review (PSR) of the plant completed in 2008. During the course of that review, the results of the actions decided during the previous PSR, carried out 10 years earlier, were evaluated and new safety enhancement arrangements were also decided upon. In the frame of these arrangements, several modifications and measures are already in the advanced stage, which are aimed at improving the management of events beyond the design basis – including severe accidents – in order to stabilize the processes and to effectively mitigate the consequences.

Some of the on-going beyond deign basis investigations, which were started prior to TSR should be highlighted: the problem of soil liquefaction and the consequences of loads due to extreme weather conditions. Three of the findings of the current TSR should be mentioned here, which require detailed safety assessment and, in case of necessity, corrective action.

One is the case of the desalinated water tanks of units 3 and 4, which are qualified for earthquake resistance but are situated next to an unqualified building; the second is the missing earthquake qualification of the warehouse and barracks of the on-site fire brigade; the third is the non safety-grade electric power supply to the active filters at the essential service water pumps. The assessments according to the regulatory requirements were still actively proceeding at the time of issuance of the Progress Report [3], thus the list of findings to take care of may be extended.

The TSR programme is progressing according to schedule and we have good reason to assume that the Final Report will cover the topics required by the authority and the European Union in appropriate depth.

Beyond the topics required by ENSREG, the investigations of HAEA are also encompassing the regulatory legal requirements within the field of nuclear safety. It can be stated, at the current stage of the investigations, that some of the nuclear requirements under investigation, which otherwise would be in line with the international practices, need modification and reinforcement.

1. The goal of the reassessment and of the preliminary report

On March 11th 2011 on the Eastern coast of Japan, as the result of an extreme strength earthquake and the following tsunami, the units 1-4 of the Fukushima Dai-ichi Nuclear Power Plant suffered a severe accident. The preliminary lessons learnt from this accident are to be drawn upon and utilized to improve the safety by all of the countries operating a nuclear power plant. To enhance this process, the Council of the European Union called upon the Commission, as well as its advisory group, the European Nuclear Safety Regulators Group (ENSREG) to elaborate the scope and methodology of the risk and safety evaluation of the European Nuclear Power Plants in light of the Fukushima events. To comply with this request, the ENSREG elaborated, in conjunction with the Commission, a Declaration [1] on the “stress test” to be carried out in European nuclear power plants. We further refer to this test as “Targeted Safety Reassessment” (TSR). There are two main components of this reassessment process. The first relates to external (mainly natural) stresses on the plant, whilst the second component is related to any human induced, malevolent acts. The two threads of the reassessment process are carried out independently of each other and the ENSREG activities relate only to the first one, since most of its member national regulators have no authority in the security field. Annex 1 of the ENSREG Declaration specifies in detail the goal and content of the safety reassessment. In addition, it specifies the roles and schedules. According to the roles, as the prime responsibility for safety lies with the licensee of the NPP, the safety reassessment shall be carried out by the operating organization. The national nuclear safety regulator shall review the reassessment report and on the basis of the review process shall prepare a National Report for European Commission on the safety of the NPPs operating within the given country. The National Reports shall be peer-reviewed by an international task force consisting of the delegates of national regulatory bodies. The milestones of this process are summarized in the table below:

	Progress report	**Final report**
Licensee report (Licensee → Regulator)	August 15th 2011	October 31st 2011
National Report (Regulator → EU Commission)	September 15th 2011	December 31st 2011
International review (Peer Review)	-	April 30th 2012
Consolidated Report (EU Commission /ENSREG → EU Council)	December 9th 2011	July 1st 2012

The Hungarian Atomic Energy Authority (HAEA) has sent its requirement document [2] to the licensee of the sole nuclear power plant within the territory of the Republic of Hungary, Paks Nuclear Power Plant Ltd. (Paks NPP) and at the same time has advised it to carry out the reassessment process accordingly. In addition to the assessments demanded in the ENSREG Declaration [1], the HAEA also requested the NPP to assess internal causes which may result in the loss of ultimate heat sink and loss of electric power, and the set of natural hazards assessed are complemented by the low water level situations of the Danube and by the extreme weather conditions. Due to the extremely tight time schedule, it is unrealistic to carry out a detailed analysis for every issue. Therefore, for complex issues, the reassessment process only specifies the goal and the time schedule of the analyses and any further action may be dependent on the outcome of the analyses.

Paks NPP has submitted the Progress Report of the TSR [3] on August 11th to HAEA. The regulatory body has reviewed and evaluated the report and sent the list of questions and comments to Paks NPP. The questions and comments mostly relate to the avoidance of any ambiguity during the course of the reassessment process and in the Final Report.

As said above, the goal of this Preliminary National Report is to present the current status of the on-going safety reassessment process of Paks NPP. On the basis of the Progress Report, it can be stated that the reassessment process is being carried out in the expected depth and detail, thus the Final Report shall cover all the topics expected by the European Council.

2. Introduction of Paks NPP

The site of the Paks NPP is located 5 km south of the city centre of Paks, 114 km south of Budapest, 1 km west of the Danube River and 1.5 km east of the main road No. 6. The elevation of the site is at 97.00 m above Baltic sea level.

The operating organization and licensee of the plant is Paks Nuclear Plant Ltd. which has been acting in the current corporate form since 14th of April 2006. The majority shareholder of the plant is the state owned Hungarian Power Companies Ltd.

The four units of the plant are of type VVER-440/V-213, which is a version of the series of Soviet designed pressurized water reactors. The nominal thermal power of the units is 1485 MW; the electric output is 500 MWe. This power level of the units is a result of a two step power increase from the original 440 MWe. The dates of connection to the national grid are as follows:

- unit 1: December 28th 1982,
- unit 2: September 6th 1984,
- unit 3: September 28th 1986,
- unit 4: August 16th 1987.

The reactors of the units are encapsulated in low pressure containments, corresponding to the design of the VVER-440/V-213 type, which is also known as a “hermetic compartment”. In these containments, in the case of a large break LOCA the passive bubble-condenser system effectively reduces the pressure. In the case of other accident situations the bubble-condenser trays provide a significant additional amount of borated water applicable for the emergency cooling of the reactor. Detailed analyses and experiments have proven that for the accidents within the design basis the containment satisfies its safety function: serves as a satisfactory barrier to limit the release of the radioactive materials to the environment, should the fuel and the primary system of the reactor fail. In this task, the emergency core cooling system with threefold redundancy (3 times 100%) plays a central role, so that only one train alone is able to cool the reactor satisfactorily.

Units 1 and 2, similarly units 3 and 4, form "twin units", the first two units sharing Service Building I, while the second two share Service Building II. Some of the systems are common for the elements of twin units. The most significant common structure for the twin units is the reactor hall, which is located above the central part of the containments of the units. When one of the reactors is under maintenance and re-fuelling, its containment is opened into the common reactor hall.

The primary ultimate heat sink (UHS) for Paks NPP is the Danube River, though in some cases the atmosphere may serve this function. The essential service water system serves as the link between the primary loop of the reactor and the Danube River. This system is part of the threefold safety system of the reactors. If this link is not usable for whatever reason, then the residual heat can be removed through the steam generators in such a way that the non-radioactive steam produced by the steam generators is released into the atmosphere. However, this process requires a significant amount of desalinated water to replace for the released steam.

The spent fuel pools next to each reactor, which store the spent fuel assemblies after removal from the reactor for 3-5 years, can be served from the reactor hall. During the re-fuelling of the reactor, after opening the containment into the reactor hall and then the reactor vessel, the space above the vessel is filled up with borated water after which the gate between this volume and the spent fuel pool is removed. In such a situation therefore the spent fuel pool and primary circuit of the reactor forms a common body of water. When no such manipulation is in progress, then the gate is closed and the spent fuel pool is covered by reinforced concrete slabs. The spent fuel pools have two independent cooling circuits, comprising one pump and one heat exchanger in each. In normal operation one branch is operational and one is in reserve. The heat removal from the heat exchangers is achieved by using the essential service water system.

After implementation of the recent preventive accident management measures and procedures, the estimated fuel damage frequency according to the probabilistic safety assessment (PSA) from a former low value have fallen to a negligible level. In case of an accident in the spent fuel pool, the radioactive release goes directly into the reactor hall, then into the environment. In spite of this, the consequences are lower compared to the large possible release from a severe accident occurring within the reactor. This is due to the fact that the radioactive material content of the spent fuel, as well as its heat production, decreases over time.

The units of Paks NPP are connected to the 400 kV substation on the site, through the so-called unit lines. This substation supplies the 120 kV substation via two transformers. The substations are connected to the national main grid of 400 kV through 5 lines of different direction, whilst they are also connected to the 120 kV distribution grid through 7 different lines. This highly redundant connection scheme guarantees the very low probability of total loss of the grid connection.

Should an external grid disturbance occur or should the connection of the plant be lost, the automatic system separates the plant from the grid and reduces the power of the units to a level which is necessary for its own consumption. If this action is unsuccessful, then diesel generators with threefold redundancy at each unit ”kick-in” automatically.

During the last decade of the 20th century, a comprehensive safety re-evaluation programme of Paks NPP was carried out by re-calculating the complete set of safety analyses using state-of-the-art tools and methodologies, further by extending the set of postulated initiating events. As a result of this programme, an extensive set of safety enhancing modifications was implemented. In addition, in that period, the seismic characteristics of the site were also re-evaluated. Taking into account the newly evaluated seismic characteristics of the site, the equipment necessary for shutting down the units, cooling down the reactors and the building structures encompassing those pieces of equipment were qualified for earthquake resistance. This included several modifications and reinforcements to increase the earthquake resistance of some equipment to the necessary level. Due to the modifications and reinforcements the core damage frequency, determined by the PSA analyses was reduced by an order of magnitude, by which the safety of Paks NPP became comparable with other NPPs in the world being of a similar age. In the recent years, within the on-going programme for preparation of the service life extension of the units, the plant has elaborated such modifications, which are primarily aimed at enhancing the capabilities of the plant in managing severe accidents and mitigating their consequences. The implementation of these modifications is in different stages at the various units. According to schedule, they will be completed at all units by 2014.

3. The status of the reassessment process

By reviewing the Progress Report submitted by Paks NPP to the regulatory body, we can ascertain that the reassessment programme is proceeding according to schedule and the major part has been completed to date. Some of the topics which are not finalised yet cannot be completed within the timeframe of the programme, since they need detailed analyses. However, it will be necessary to evaluate or estimate the safety significance of every finding resulting from the TSR programme.

In line with the EU/ENREG expectations [1], the assessments cover the consequences of external loads of natural origin, both within the design basis and beyond. In addition to the international expectations, in accordance with the requirements issued by the HAEA [2], the reassessment also covers the initiating events of internal origin, when they may result in losing the electricty supply or the connection to the ultimate heat sink. Regarding the loss of the electric power supply and loss of connection to the ultimate heat sink, every option to restore, or substitute for, these resources were investigated. The assessment also covers the possible options for managing severe accidents, including the related equipment and procedures, taking into account the on-going related programmes, as well as the emergency preparedness activities.

In the preparations phase of the Progress Report, the HAEA carried out an inspection at the Paks NPP, to inspect the methodologies applied for the assessment and progress of the programme. Taking into account the unusually tight time frames, the HAEA was satisfied with the applied methodologies, the way of deployment of external experts, and the documentation of individual investigations along with the quality management of the programme.

The HAEA has reviewed and evaluated the submitted Progress Report [3], the questions raised were discussed with the representatives of the licensee and the consolidated questions and remarks were handed over to the leader of the reassessment programme in order to ensure that the scope of the final report will be complete.

The targeted safety reassessment of the Paks NPP corresponds to the requirements published in Annex 1 of the ENSREG Declaration [1] issued on May 13th 2011; furthermore in some fields its scope is even wider. From the information provided in the Progress Report, the scope of the reassessment programme complies with the HAEA requirements [2].

4. Preliminary statements of the reassessment

The final report shall contain the assessment results, the qualification of the states as revealed and the problems in the thematic structure as the ENSREG requirements have presented. The preliminary report contains only general statements and points out such identified situations which might necessitate further safety improvement measures. These statements also demonstrate the depth and ampleness of the assessment. The statements are, so far, preliminary and may essentially change by the termination of the assessment. Consideration of safety significance of the statements is also in progress, the final evaluation shall appear in the final report of the reassessment. It may already be observed that the statements do not challenge the level of safety specified in the design basis of the plant and do not reveal a situation, which as such, would considerably influence the risk of occurrence of a severe accident phenomenon.

4.1 General statements

a) Reassessment of the design basis

The reassessment has reinforced those former statements, according to which the total loss of electricity supply or total loss of final heat sink is practically not possible for the effect of internal initiating events within the frames designated by the design basis. Thanks to the threefold redundancy, and the physical separation of the safety systems, the theoretical frequency of such a situation is so low that it is not justifiable to assume it.

Reassessment of design basis of the Paks Nuclear Power Plant for effects of natural origin was completed apart from some analyses. Determination of the design basis for the hazard factors of natural origin (according to the current regulations such effects shall be taken into account, if the theoretical frequency is in exceedance of 10^{-4}/year) is in compliance with the Hungarian regulations and with the international good practices.

The seismic hazards concerning the site of Paks NPP have been determined in line with the Hungarian requirements, international standards and good practices based upon appropriate geological, geophysical, seismic and geotechnical research. This work laid down the seismic hazard curves down to the frequency of 10^{-7}/year. The maximum free surface horizontal acceleration that belongs to the frequencies exceeding 10^{-4}/year in the seismic hazard curve is 0.25 g[1] and the maximum free surface vertical acceleration is 0.2 g, so these values were taken into account in the design basis. In conclusion of the geological investigations the geological structures in and around the site are inactive to a high probability.

When a design basis earthquake occurs, and in addition it is assumed that after the quake no external electricity supply and no external source to supply secondary coolant is available for 72 hours, the safe shutdown and safe cooling down of the nuclear power plant is ensured. Seismic protection of the systems required for these operations is appropriate. The reassessment, however revealed some such factors (see section 4.2), which may cause difficulties in the activities to be performed after an earthquake. More detailed analyses are required in these cases.

In the course of design and qualification of safety systems for earthquake conservative methods were applied, so in this respect the due margins are available to avoid any cliff-edge effect[2].

With regard to design basis earthquake, the margin against soil liquefaction and so the resulting building settlement, according to the conservative calculations performed so far, is not wide. In order to more accurately identify the margins further examinations are required.

[1] Acceleration is usually characterized by the ratio to free fall acceleration (g = 9.81 m/s2)

[2] Exceeding a critical value of a hazard factor causes catastrophic consequences.

Integrity of spent fuel pools is preserved in a design basis earthquake; the cooling systems can ensure the uninterrupted heat removal.

Hazard curves, similar to the seismic ones, were also determined for extreme meteorological conditions. Accordingly, concerning the meteorological parameters in the scope the estimated extreme values are available up to the the frequency of 10^{-7}/year. From these the design basis parameters belong to the frequencies exceeding 10^{-4}/year of the hazard curve. Assessment of resistant capacity against design basis effects and evaluation of beyond design basis conditions is in progress in the frame of the measures decided upon after the Periodic Safety Review in 2008.

Based upon the elevation conditions of the site, and that of dams at the opposite side of the Danube, no flooding caused by the river needs to be taken into account in the design basis of the nuclear power plant and its systems.

Evaluation of flooding due to dynamic effects, such as damage of the Gabčikovo dam or occurrence of ice blockage was commenced in the TSR, but is not yet completed.

Water intake is not impaired with high confidence concerning the low water levels taken into account in the design basis. The feasibility of interventions required when the Danube level is much below the level considered in the design basis were tested earlier, however the regular inspections, maintenance and testing of the equipment needed to perform this operation are not complete. The respective evaluation is in progress. The values of low water level are based on results of statistical calculations and hydrologic examination of drought/low level of the catchment basin around Paks. Accordingly, supplementary analyses are being prepared for the final TSR report.

b) Beyond design basis situations

Natural effects beyond design basis, total and long term loss of electricity supply (SBO) and long term loss of ultimate heat sink (UHS), although are not being part of design basis of Paks Nuclear Power Plant, appeared in the former analyses as beyond design basis events. In the course of the reassessment, those event sequences and assumptions were reviewed, which served as basis for the extension of design basis, the level 2 PSA and severe accident management analyses, and as a supplement, new events and event combinations were also determined.

Since the cooling of diesel generators requires the availability of UHS, also the essential service water pumps are supplied by the diesel generators, should a loss of off-site power occur, the loss of UHS and SBO might quite possibly occur simultaneously. The loss of UHS by itself is only possible if the off-site electric power is available, but for some reason the UHS is not.

In the case of total and long term **loss of electric power** (SBO) the cooling of the fuel elements in the shutdown reactors and spent fuel pools of the plant could not be ensured, but during the period available to interact there is a good chance of recovering the electricity supply. The reassessment did take a stock of such opportunities. If the recovery of the electricity supply is not successful, damage of the fuel elements in the reactor is anticipated no sooner than 10 hours after the loss of power. Dry out and significant heat up of the elements in the spent fuel pool, according to analyses performed with conservative assumptions, may begin in 14 hours.

The emergency operating procedures contain all of the interventions to manage the SBO situation, by way of which the damage of fuel elements in the reactors or spent fuel pools can be avoided or delayed.

If total inoperability of the safety diesel generators occurs, recovery of electric power supply may be carried out – under some circumstances – from the other operable units of the plant, or from the other two external power plants of the electric power grid of Hungary dedicated to supply the nuclear power plant. The circumstances are subject to investigation in TSR.

The sensitivity curves to earthquakes of each system participating in electric power supply are known, from which it can be determined that the probability of SBO reaches the 0.5 value if the horizontal free surface acceleration exceeds 0.46 g. Such an acceleration may occur with a frequency of around 10^{-5}/year at most. The most important failure mode in this case is building settlement caused by soil liquefaction. It is under investigation whether the re-qualification or modification of underground lines and connections jeopardized by building settlement may improve the availability.

Independent from the safety electric supply system, one severe accident mobile diesel generator is provided for each unit. These low-power (100 kW) generators are air-cooled and stored in a protected place and are capable of supplying electricity for severe accident interventions and measurements. Currently there is no mobile diesel generator of greater power available to supply the safety systems. The applicability of additional diesel generators and off-site mobile equipment that could also supply the safety systems is under examination.

Ultimate heat sink (UHS) function is realized by a chain of several systems, the last element of which is the Danube. The possibility of cooling might be lost if the connection between the cooling systems of the plant and the Danube is broken. Since in the case of loss of the essential service water system, the cooling of the reactor and the fuel elements require the operation of the desalinated water system and the emergency feedwater system or the auxiliary emergency feedwater system; these were also matters of evaluation. The cooling system of the spent fuel pools was also evaluated.

The reassessment determined that, if the Danube as ultimate heat sink would not be applicable for any reason, there are several alternate water supplies of large capacity. Such are the pools of the fire water system, the on-site well station filtered at the river-bank and the fishing lakes at the border of the site. The conditions and circumstances of their use are subject to further investigation.

In case of an accident, alternate heat removal opportunity is ensured via the steam generators by water supply through a recently built external connection point. The containment can be supplied with water via the steam generators using their secondary relief valves, and even the reactors can be supplied with coolant water by using existing structures and means from the containment.

The spent fuel pools have no external, independent water supply opportunity. Gravitational drainage of the upper bubble-condenser trays of the accident localisation tower can provide make-up water without an external power supply. The applicability of this operation may be limited if an accident is in progress in the reactor, since in that case the water of the trays would be necessary for other purposes. In addition, dose rates occurring during the accident might hinder the operation of the manual valves in the drainage route. According to the assessment, there are several different ways available for cyclic cooling of the spent fuel pools.

Systems providing the UHS function would not unconditionally be damaged simultaneously should a beyond design basis earthquake occur. The most important failure mode is building settlement caused by soil liquefaction (see the paragraphs describing total and long term loss of electric power supply).

Examination of the sensitivity of **containment function** for beyond design basis earthquake is in progress in the frame of TSR.

Analysis of **meteorological effects** causing extreme loads is under way in the frame of safety upgrading measures decided upon as a result of the Periodic Safety Review.

c) Severe accident management and emergency preparedness

With regard to the analysis of severe accident sequences the assessments are considered as full scope. The frequency assigned to core melt and large release is in compliance with international expectations.

The severe accident management strategy has been determined on the basis of the level 2 PSA performed earlier for the Paks Nuclear Power Plant. Two key elements of severe accident management are the implementation of technical modifications and the introduction of application of Severe Accident Management Guidelines (SAMG). By the application of the severe accident management the risk of large radioactive release significantly decreases, although the detailed assessment is not yet completed. Modifications aimed at creating the possibility for severe accident management are in progress. In unit 1 of the plant, where the technical modifications have already been completed, the introduction of SAMGs will begin at the end of this year. Technical modifications and introduction of SAMGs regarding the other units will be completed by 2014. Before starting the TSR process, a decision was made by Paks NPP management that the passive catalytic hydrogen-recombiners – discussed in the next paragraph – will be installed at all four units by the end of this year.

The amount of hydrogen that would be generated during a severe accident was determined. In the frame of accident management modifications, passive hydrogen-recombiners are installed to prevent combustion/explosion in closed containment. In the case of open reactor or spent fuel pool the hydrogen concentration that would build up in the reactor hall would not reach the combustible concentration. The generation and spread of hydrogen when more reactors and/or spent fuel pools are simultaneously in trouble, is the subject of further investigation in the TSR.

Probability of containment failure due to high pressure damage of the reactor pressure vessel was reduced to a negligible level due to the effect of primary pressure reduction measures introduced earlier in the emergency operating procedures. The application of the 100 kW mobile accident diesel generators increases the reliability of this operation.

The modifications make the external cooling of the reactor pressure vessel possible, by which the molten core could be kept inside the reactor pressure vessel; consequently neither steam explosion, nor base plate melt through and core-concrete interaction could occur.

Phenomena leading to severe accident of spent fuel pools were also determined in earlier examinations. The preventive measures decreased the frequency of occurrence to an acceptably low level. However, if loss of heat sink and loss of electric power supply occur, some of the measures are ineffective. Opportunities for consequence mitigation accident management are still being assessed in the TSR.

According to the investigations so far, the failure, damage of radioactive waste storage system would not entail large radioactive release, although the reassessment is still in progress.

Paks NPP basically has the human and objective conditions and resources to cope with nuclear and traditional emergencies. The emergency intervention capability is designed in line with the international recommendations and in compliance with the Hungarian regulations. Guidelines and particular design bases of emergency preparedness are ensured not only for nuclear accidents, but also for responding to other emergencies. The complex assessments in compliance with the authority's TSR requirements were still in progress at the time of preparation of the progress report.

4.2 Specific findings, investigations

With respect to the consequences of earthquakes the review revealed two potential problems:

- The on-site fire brigade barracks and equipment store are not qualified for earthquake, however even a design basis earthquake might require the deployment of the fire brigade to intervene in fires and flooding. Action plans developed for beyond design basis events definitely rely on the contribution of the fire brigade.
- The desalinated water tanks of Service Building II are duly reinforced to withstand design basis earthquake, however they are located next to such a building, which is not qualified

for earthquake. Consequently, the availability of the tanks after an earthquake cannot be guaranteed.

It was established that the active filters located at the suction leg of the essential service water pumps have no safety grade electric power supply. If after the loss of off-site power, each of the four units shuts down, the filters would clog after a period, which would cause the loss of the essential service water system. The assessment of this case is in progress in the TSR.

In case of a beyond design basis earthquake, occurrence of soil liquefaction cannot be excluded. In such a case settlement of the various building structures may be different. It is a matter of further investigation that, at which connection locations and by which method it is possible to perform the necessary interventions.

Independent from the reassessment, the refurbishment of seismic instrumentation is under preparation. The issue of necessity and feasibility of automatic reactor shut down will be re-evaluated.

As part of the TSR, at the time of publication of the progress report, the following on-going investigations are to be highlighted:

- challenges and possibilities of management of such extraordinary situations when more, even all four, units are affected;
- options aimed at preventing the slow over-pressurization of the containment during severe accident progress (filtered venting, internal cooling of containment);
- possibilities of consequence mitigation accident management after a severe accident of a spent fuel pool.

5. Future steps of reassessment

Based on the evaluation of the progress report, the HAEA will officially inform the Paks Nuclear Power Plant about the expectations concerning the final reassessment report.

The Paks Nuclear Power Plant shall develop and submit the final reassessment report to the HAEA by October 31st 2011. The report will be simultaneously published on the webpage of both organizations. The HAEA will evaluate the final report and then, taking into account the statements of the reassessment, will develop the National Report on TSR, which will be sent to the European Commission by December 31st 2011.

Subsequently, the HAEA will issue a resolution for the implementation of safety improvement measures required based on the reassessment.

According to the general agenda described in Chapter 1, the HAEA will also participate in the international peer review process. The HAEA will use the statements and recommendations of the international peer review during its future proceedings.

References

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