REGULATORY ASSESSMENT OF THE HUNGARIAN NUCLEAR FACILITIES AND RADIOACTIVE WASTE REPOSITORIES IN 2016

Hungarian Atomic Energy Authority

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Preamble

The performance evaluation of nuclear facilities and radioactive waste repositories, besides the licensing and inspection tasks, belongs to the most important element of the regulatory oversight. A main duty of the Hungarian Atomic Energy Authority (HAEA) is to guarantee nuclear safety, so to prevent the occurrence of a nuclear accident, in the frame established by laws, with the utilisation of the resources that are provided by the Hungarian citizens through their elected representatives. The HAEA, as a part of its nuclear safety regulatory activity, annually evaluates the safety performance of the nuclear facilities, the safety level of their activities.

The main task of the evaluation is to review and assess the operation of the facilities, so to detect deviations with the purpose of prevention preferably in an early phase, to present their safety effect, to reveal the potential causes, and to initiate effective measures to eliminate deviations.

The evaluation made by the HAEA is based on the safety performance indicator system developed specifically for nuclear facilities and radioactive waste repositories, the outcomes of inspections, the regular reports submitted by the facilities and the event reports aiming at the investigation of more significant deviations and their elimination. The primary objective of this evaluation report is to provide feedback to the licensees of nuclear facilities on the regulatory judgement on nuclear safety related experience gained in the given year, especially on the impact of operatory activities on the public, the environment and the workers of the nuclear facilities.

It can be stated about the year of 2015 in general that the nuclear facilities under the regulatory oversight of the HAEA (i.e. Paks Nuclear Power Plant, the new nuclear power plant units to be constructed on the Paks site, the Budapest Research Reactor BRR, the Training Reactor of the Institute of Nuclear Techniques of the Budapest University of Technology and Economics BUTE INT TR, and the Spent Fuel Interim Storage Facility SFISF) as well as the radioactive waste repositories (i.e. the National Radioactive Waste Repository NRWR and the Radioactive Waste Treatment and Disposal Facility RWTDF) operated according to the required conditions and parameters during the year.

It can be stated about the safety performance of Paks Nuclear Power Plant in 2016 that on the three main areas of evaluation a small improvement could be experienced in the area of “smooth operation” and “operational safety” in comparison with the preceding year, while a small transition towards the warning range could be experienced in the area of “commitment to safety”. The values measured during environmental release monitoring remained, as in the previous years, below the regulatory limits by magnitudes. The improvement in occupational radiation exposure continued, the collective dose and the maximum individual dose further decreased. The regulatory dose limit for workers (50 mSv/year), as well as the own objective of the nuclear power plant for individual dose (less than 20 mSv/year) were not exceeded either in 2016. The safety evaluation of events shows similar safety performance as in the preceding year.

The MVM Paks II. Nuclear Power Plant Developing Private Limited Company (hereinafter referred to as MVM Paks II Ltd.) is a project company established for the construction of

new nuclear power plant units. The execution of the site survey and evaluation programme was completed in 2016, and the project company submitted its site license application for the site of the new nuclear power plant units.

The safety performance of the SFISF slightly degraded in comparison with its safety performance in 2015. Measures became necessary in the case of attributes in the warning range, which could make the safety performance flawless. The operation of the facility did not mean health risk increment for both the employees of the SFISF and the public.

The safety performance of the BUTE INT TR is stable and good in one area for years, and it keeps the almost flawless quality level on the other two areas as well. The operation of the facility did not mean health increment for the employees of the BUTE INT TR, the students and training participants or the public.

The safety performance of the Budapest Research Reactor, in the “operation with low risk” area held its flawless qualification. Due to the warning qualifications and an inadequate qualification of the other two areas, the Licensee, supported by regulatory oversight, shall strive for eliminating deficiencies, to maintain and strengthen the safety level, including the level of safety culture.

Based on the amendment to the Atomic Act in 2013, the licensing and inspection of siting, construction, operation, modification and closure of radioactive waste repositories falls under the competence of the HAEA, as the atomic energy oversight organisation, as of June 30, 2014. After the Gov. decree 155/204 Korm. entered into force, the HAEA continued the regulatory activities commenced in the second half of 2014. The safety performance indicator system supporting the evaluation of radioactive waste repositories had been partly elaborated, the development of the comprehensive performance indicator system and the associated levels is in progress. The future application of the safety performance indicator system will further facilitate the monitoring of changes and qualification of deviations, analysis of trends and early recognition of tendencies.

Based on the evaluation of the safety performance of the NRWR in Bátaapáti in 2016, the HAEA can state that the facility operated in compliance with the legal requirements. The operation of the facility did not mean health risk increment either for the employees of the NRWR or the public.

Based on the evaluation of the safety performance of the RWTDF in Püspökszilágy in 2016, the HAEA can state that the facility operated in compliance with the legal requirements. The operation of the facility did not mean health risk increment either for the employees of the RWTDF or the public.

In addition to the maintenance and further enhancement of the level of nuclear safety, the most significant tasks of the HAEA for the next year are the preparation for and implementation of the regulatory oversight of the service life extension of the other unit of the nuclear power plant, the improvement measures determined based on the Targeted Safety Reassessment processing the lessons learned from Fukushima, and the licensing and inspection activities to be performed in connection with the new units. These tasks are performed by well-prepared officials of the Authority with responsibility

for the protection of the public and the environment and prevention of the occurrence of events adversely affecting safety.

Gyula Fichtinger
director general of the Hungarian Atomic Energy Agency

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1. Introduction

The fundamental tasks and obligations of the Hungarian users of atomic energy and their overseeing Authority, the Hungarian Atomic Energy Authority (HAEA) are controlled by the Act CXVI of 1996 (Atomic Act).

In line with the provisions of the Atomic Act, the HAEA annually assesses and evaluates the safety performance of the nuclear facilities and radioactive waste repositories falling under its competence. The main goal of the evaluation to provide the licensees of the evaluated facilities with feedback on the regulatory judgement of their nuclear safety related results reached in the given year, in order to facilitate the maintenance and enhancement of the quality level of nuclear safety.

Safety has an overriding priority above all other aspects during the application of atomic energy. The fundamental objective of the regulatory oversight of these activities is to ensure that the application of atomic energy shall not cause harm, in any way, to the people and the environment. Another important aspect is that the oversight shall not hinder, more than justified, the operation of facilities and equipment, and conduct of activities entailing such risks.

The safety of the operation of nuclear facilities and radioactive waste repositories is evaluated by systematic numerically quantified characteristics, so called safety performance indicators. In addition to these indicators, the Authority continuously applies the engineering, safety evaluation, since the safety performance of the facility can be evaluated only as a result of a comprehensive assessment. In many cases, only the comparison with the relevant results and performance indicators of previous years can provide an outcome.
The evaluation of safety performance is made based on the assessment and analysis of the conclusions of regulatory inspections, operational data, and events occurred during operation. In order to reach this goal, the HAEA:

- collects the operational data and creates their trends;
- reviews and investigates the events occurred during the year;
- performs the safety evaluation of events;
- performs the probabilistic based analysis of events,
- pays special attention on the investigation of human induced and reoccurring events;
- comprehensively evaluates the safety performance with the application of the safety indicator system.

The HAEA takes into consideration the degree of their potential hazards during the evaluation of the safety performance of nuclear facilities and radioactive waste repositories being under its regulatory oversight.

The evaluation criteria of safety attributes are determined by the HAEA in a way that takes into account the level of safety performance reached by the nuclear facilities and radioactive waste repositories, the national and international experience on the safety of the application of atomic energy, and to facilitate the licensees in the enhancement of their safety performance.

The first chapter of the evaluation is this introduction; the second chapter contains the summary evaluations for each facility. The methodology of the regulatory evaluation is described in Annex I. Annex II presents the relevant data of the Hungarian nuclear facilities and radioactive waste repositories.

2. Summary Evaluation

2.1 Paks Nuclear Power Plant

In 2016, the facility **operated in compliance with the regulations**. The **values measured during environmental release monitoring remained**, as in the previous years, **below the regulatory limits by magnitudes**.
The operation of the facility **did not mean health risk increment for both the employees of the nuclear power plant and the public**. The improvement in occupational radiation exposure continued, the collective dose and the maximum individual dose further decreased. The regulatory dose limit for workers (50 mSv/year), as well as the own objective of the nuclear power plant for individual dose (less than 20 mSv/year) were not exceeded either in 2016.

Figure 2.1-1: View of Paks Nuclear Power Plant (Source: www.atomeromu.hu)

It can be summarised based on the qualification of the safety performance indicators that the green-yellow-red ratio was the most favourable in the area of "operational safety" and the least favourable in the area of "commitment to safety". A small improvement could be experienced in the area of "smooth operation" and "operational safety" in comparison with the preceding year, while a small transition towards the warning range could be experienced in the area of "commitment to safety".

*In 2015, **the area of smooth operation** was characterised by 2 green, 3 yellow and 1 red indicators*. In comparison with the preceding year, the number of red indicators decreased by two, the number of yellow indicators increased by two, while the number of green indicators did not change. Among the 17 safety attributes providing basis of the indicators 12 were green, 4 were yellow and 1 was red.

- The *"Maintenance planning"* indicator improved to yellow after seven years of continuous red qualification. Both the *"Ratio of performed and planned work orders"* the "*Ratio of planned and real length of main overhauls"* attributes became yellow.
- Due to the yellow qualification of the "Unsuccessful technical safety insepctions" attribute, the "Repairs" indicator became yellow again, after the green qualification obtained in the last year.
- The "Use of load cycles" attribute is yellow, which caused the yellow qualification of the *"Material condition"* indicator.
- The *"State of the barriers"* indicator improved from red to green thanks to the change of "Fuel reliability" attribute from red to green.
- The *"Unplanned shutdowns and power reductions"* indicator has not changed from green for three years.
- The *"Reportable event"* indicator became red again, due to the qualification of the *"Authority ordered event investigations" attribute*.

*In **the area of operational safety**, there is one yellow indicator besides the six green ones.* Compering to the previous year, the number of green indicators kept its excellent value, a red indicator disappeared and a yellow indicator appeared. There were 18 green and 1 yellow among the 19 safety attributes composing the basis for the indicators.

- The *"Actual challenges of safety systems"* was continuously green since 2006.
- The qualification of the "Availability" indicator showed a mixed picture during the years. It obtained yellow qualification in 2012 and 2014 due to the *"Inoperability revealed during test"* attribute, even if the other attributes were excellent. The indicator became green in 2015 and then in 2016.
- The *"Operator preparedness"* indicator, following its green qualification between 2012 and 2014, became red in 2015 due to *"Number of failed licensing exams"* attribute, then it improved to yellow in 2016.
- The *"Emergency preparedness"* indicator was green since 2006.
- The *"Risk during operation"* indicator obtained green qualification in the last two years.
- The *"Risk in analysis"* indicator was green since 2011.
- The *"Environmental risk"* indicator was yellow in two years since 2010; otherwise, as in 2016, it obtained green qualification.

Essentially, **the area of commitment to safety** contains the measurable characteristics of safety culture. In 2016, there were *2 green, 6 yellow and 1 red indicators*. The number of red indicators decreased by one in comparison with the preceding year, the yellow ones increased by four, while the number of green indicators decreased by one. There were 10 green, 10 yellow and 2 red attributes among those 22 safety attributes that provided basis for the indicators.

- The qualification of the *"Deviation from planned state"* improved to yellow in 2016.

- The *"Violations of requirements"* indicator is highly dependent on the *"Violation of licensing conditions"* attribute; usually, this attribute worsens the indicator. The indicator improved to yellow in 2016.
- The *"Deviations in the reporting system"* indicator turned to red. This qualification in 2016 was caused by the red qualification of the *"Delay in reporting of non-immediate reportable events"* and *the "Delay in the submission of event investigation reports"* attributes. Another attribute frequently affecting this indicator, namely the *"Delay in reporting of immediate reportable events"* was green in the last two years, since the reporting requirement was always fulfilled within two hours.
- The *"Radiation protection programme effectiveness"* indicator turned from green to yellow, which is the consequence of the yellow qualification of the *"Significantly radiation hazardous work programmes"* attribute.
- The *"Industrial safety pogramme effectiveness"* indicator remained yellow in 2016, due to the yellow qualification of the *"Workplace accidents"* attribute.
- The *"Human factor"* indicator became green in 2016 due to the improvement of the *"Inappropriate condition for working*" attribute.
- The *"Self-assessment"* indicator was green as of 2007.
- The *"Corrective measures"* indicator was continuously green between 2008 and 2014. It became green in 2015, then turned to yellow again in 2016, due to the yellow qualification of *the "Corrective measures of investigations"* attribute.
- The *"Operational experience feedback"* indicator turned back to yellow after three years, due to the degradation of the *"Reoccurring events*" attribute from green to yellow.

The HAEA identifies the critical safety attributes each year. These are those attributes, which are above the unacceptable level for at least three years. There was no critical safety attribute in 2016.

Events

17 reportable events occurred in 2016, including one immediately reportable event. The number of reportable events show a decreasing trend in the recent years; with a small fluctuation, even in a longer period of time.

Events with SCRAM I actuation occurred once, while with SCRAM III actuation occurred twice in 2016. Human or documentation errors were identified 12 times by investigations. The authority determined ten events as reoccurring event. Real ECCS actuation did not occur either in 2016; however, a false actuation of the ECCS system occurred once during the test of the reactor protection system. Natural phenomenon did not cause any event. In addition, one event related to radiation safety occurred during the year.

Based on the experience gained during recent years, the events and failures in relation to Diesel generators have to be emphasised. According to the quarterly reports of the MVM Paks NPP Co. the most frequently affected system during reportable events (eight times in 2016, four times in 2015, six times in 2016, nine time in 2013) was the Diesel generator. In 2013, based on the operational experience, the HAEA initiated the review and assessment of the availability of the Diesel generators and the connected supporting systems. The assessment aimed at revealing and eliminating the operational safety risk factors based on the operational, maintenance and testing data, and internal and

international experience. The special attention and the investigation of causes are still justified.
The HAEA pays special attention to the assessment and management of issues relating to the activities of the suppliers and their oversight.
The HAEA and its technical support organisation, the NUBIKI performed the probabilistic based safety analysis of the reportable events of Paks Nuclear Power Plant to identify the impact of all the events together and each individual event on the safety of the nuclear power plant. In the reporting period, the cumulated core damage risk increase including all the events together is still small, since the calculated core damage frequency values as well as those complemented with the increment meant by the events are still under the regulatory limits. The evaluation of the events showed that every event is insignificant from the viewpoint of the core damage probability increment. Among the events, the Event No. 1910 is significant from the risk increment point of view; however the associated conditional core damage probability increment did not reach the threshold value of 1.0E-06 applied for the identification of precursor events.

It can be stated based on the safety evaluation of the events that changes are visible in several areas, in comparison with the previous years. Such areas are, among others, the number of reportable events, events associated with the Diesel generator, reoccurring events, radiation safety related events, and of events entailing forced power reductions exceeding 50%, and the events entailing SCRAM III actuation, where a slight increase could be experienced compering to the preceding year; however, except the number of events related to the Diesel generators, every number is low. Every event was classified as INES 0, without safety significance. The number of events entailing SCRAM I and the inoperability of two safety systems decreased; events entailing the violation of the TS has not occurred since 2014. The ratio of events induced by human errors decreased, their number stagnated.
Nevertheless, the efforts of the Licensee have to be further strengthened towards safety to eliminate deviations, and to maintain and further enhance the safety level, including a strong safety culture.

Licensing
The HAEA, in the frame of its public administration proceeding and oversight activity associated with the nuclear safety of facilities, made 188 regulatory decisions in 2015, including 134 resolutions and 54 decisions. Among the decisions, 167 decisions were related to Units 1-4 of Paks Nuclear Power Plant.
The building authority tasks of the nuclear facilities, including Paks Nuclear Power Plant are performed by the HAEA. On-scene walkdowns were conducted prior to granting license for utilisation, where the representatives of the competent authorities and the Licensee took part.
The number of decisions related to Paks Nuclear Power Plant increased in comparison with 2015. Majority of the decisions were made necessary by the tasks and modifications entailing significant safety improvement, inspection of equipment and system components, elimination of deviations revealed during maintenance, replacement to more modern and new types, reconstructions, renewals and equipment modernisations.

Additional licensing proceedings were connected to the condition review and inspection activities related to the cooling circuits of the spent fuel pools.
Among the licensed building activities, the continuation of the renewal and reconstruction of buildings, building reinforcements and the increase of the integrity of fire sections should be mentioned.

Inspection
In 2016, 503 inspections were recorded at Paks Nuclear Power Plant and one comprehensive inspection was conducted by the HAEA, in accordance with its annual inspection plan. On-site inspections were performed by the Authority in connection with the periodic test of safety equipment and system (41), monitoring the operating state of the concerned unit and the general technical conditions of the facility (165), specific modifications (32), and activities made during the main overhauls of the units (90).
There was no need for any immediate action or intervention to the operation. The nuclear safety inspectors inspected 212 times the adequacy of the preliminary safety assessment of the planned modifications (inspection records were not made in such cases, they were recorded in a separate database). The HAEA inspected the documentation of the safety engineering reviews of pressure retaining systems 44 times, including the review of several hundred documents.
In 2016, the Documentations Substantiating the Operation After Modification were approved in 47 cases.

Nuclear Emergency Response
In accordance with the Nuclear Safety Code, the MVM Paks NPP Co. shall conduct, once a year, a full scale nuclear emergency response exercise with the participation of the entire Emergency Response Organisation, with the involvement of off-site contributing organisations. This exercise was held in November 2016 by the MVM Paks Co. A full cross sectional tube rupture in a hot leg of Unit 3 was the initiating event of the exercise, which then led to core damage. The MVM Paks NPP Co. excellently performed its tasks and adequately informed the off-site organisations about the occurrences.
As an outcome of the Targeted Safety Re-assessment performed after the Fukushima accident, the MVM Paks NPP Co. prepared for the management of nuclear emergencies affecting more units on the site simultaneously. During the Severe Accident Management (SAM) exercises, the Emergency Response Organisation demonstrated that it could respond to multi-unit emergencies.
Besides, the MVM Paks NPP Co. conducted six unannounced alerting drills for the duty officers of the Emergency Response Organisation, in order to verify their appropriate readiness.

Human Factor
An organic part of the inspection and evaluation activities of the HAEA is the oversight of the Licensee's safety culture, training, suppliers, safety policy and utilization of external experience. During the regulatory activities in relation to the assessment of human factors, no problem that could fundamentally jeopardise was identified, and there was no need to order any immediate regulatory measure.

2.2 Spent Fuel Interim Storage Facility

Based on the evaluation of the safety performance of the SFISF in 2016, the HAEA concluded that the **facility operated in compliance with the legal requirements**. The operation of the facility **did not mean health risk increment for both the employees of the SFISF and the public**. The occupational radiation exposure was as low as in the recent years. The radioactive release was also very low, much lower than the regulatory limit values. The facility was operated in compliance with the regulations and the Operational Limits and Conditions (OLC).

It could be concluded that the enhancement of the safety culture required more attention, due to the warning, yellow attributes (violation of licensing requirements, violations of the OLC).

Figure 2.2-1: SFISF bird view (source: http://www.rhk.hu/images/letesitmenyeink/kkat-tavlati-kep.jpg)

The **area of smooth operation attributes** had been green since 2015. The *"State of systems and equipment"* indicator maintained its green qualification; thus, it can be stated that the indicator creation problem identified during the analysis of the causes of the continuous yellow, warning level before 2015 was adequately dealt with.
The re-definition of the time planned for the management of received containers that affects the value of the *"Adequate planning of fuel loading period"* attribute resulted in a value that is closer to reality. Consequently, the indicator became applicable to forecast potential problems.

The yellow qualification of the *"Installed radiation protection monitoring system"* attribute appeared once in 2014 did not return; thus, the attribute was green again.
The other indicators of the area, the *"Storage characteristics"* and *"Events"* has been continuously green for years. In the case of the *"Events"* indicator, the regulatory review of the criteria was planned to more sensitively present the changes occurred in the area.

In the **area of operation with low risk,** the *"Risk"* indicator changed from green to yellow, because the *"Violation of the OLC"* attribute was changed due to the incompliance with a condition defined in the OLC during the event recorded in the HAEA log as No. 1912. The event was investigated and the necessary corrective actions were implemented by the Licensee, which were reviewed and approved by the Authority. The other indicator of the area, the *"Environmental risk"* was continuously green for years.

The *"Human factor"* and the *"Violation of requirements"* indicators in the **area of operation with a positive safety attitude** turned from green to yellow. The value moved to the warning range again, thus the Licensee shall pay more attention to the area.
The *"Independent internal audits"* attribute of another indicator of the area, the *"Striving for improvement, self-assessment"* indicator improved from red to green, since the internal audit and the management review were performed, in line with the validity period of the certificate of the organisation, in the first quarter of 2016.
The other indicators of the area, the *"Experience feedback"*, the *"Radiation programme effectiveness"* and the *"Industrial safety programme effectiveness"* were continuously green for years.

Events
In 2016, event related to construction activity did not occur. One operation related reportable event entailing the violation of the OLC occurred. The HAEA, during a planned and announced inspection, observed that two loading border walking plates were simultaneously removed during the storage tube closure process. The closure process was in progress at a storage tube, while the preparation at another one. The event was classified as INES 0, without safety significance. The event had no effect on nuclear safety, since the aim of the OLC limitation is to prevent an unpermitted increase of the dose intensity in the hall during an assembly handling action. Since assembly movement action was not performed in the hall, thus there was no real effect of the violation of the OLC.

Licensing
The HAEA made 5 regulatory decisions related to the SFISF in 2016. These decisions were related to the approval of the Workplace Radiation Protection Rules (WRPR), the modification of the bridge path measuring system, and the deadline extension in the case of the safeguards and technology camera systems.

Amendment to the construction license of the SFISF in relation to Chambers 25-33

The earlier extended construction license for the construction of SFISF Chambers 12-33 lost its validity in the middle of 2015. The validity of the construction license could not be further extended according to legal provisions. The HAEA, on the request of the PURAM Ltd, in a proceeding initiated in 2014, with the involvement of the competent co-authorities, granted the license for the construction of additional (21-33) chambers in 2015. The design of the SFISF includes the construction of altogether 33 chambers. The currently valid construction license for the 21-33 chamber module of the SFISF was granted, with the involvement of the competent co-authorities, by the resolution of the HAEA on June 26, 2015, with the validity until December 31, 2033. This construction license related to the extension with chambers according to recent technical designs.

The PURAM Ltd, in addition to extending the storage facility, assessed whether the SFISF capacity could be further increased on the same safety level in chambers 25-33, by increasing the efficiency of the storage. The design of the new concept takes into account 20 years long spent assemblies having relatively low residual thermal power, instead of assemblies spent only for three years. This assumption makes further capacity increase possible; 703 storage tubes would be placed in identical hosting geometry. The assemblies spent in the storage facility for more than 20 years will be moved to chambers 25-33 having increased capacity from chambers 1-15. The civil engineering parameters of the increased capacity chamber will not change, the storage tubes will be installed in a more dense configuration. This modification requires the modification of the loading board. This increasing storage capacity will make possible to store, in 33 chambers, 17,743 spent fuel assemblies, which capacity will be sufficient until the end of the service life of the nuclear power plant, taking account of its 20 years lifetime extension.
Accordingly, the PURAM Ltd submitted its license application “No. HA6017 amendment to the construction license of the SFISF in relation to chambers 25-33” on February 8, 2018, based on which the HAEA initiated a licensing proceeding aiming at amending the construction license. The proceeding was completed in 2017 by the issuance of the license.

Preparation for the PSR of the SFISF

The operating license of chambers 1-20 of the SFISF will expire on November 30, 2018. A Periodic Safety Review (PSR) that is due every ten years shall be performed by the licensee of the facility to obtain the operating license again. The HAEA issued a regulatory guideline to support the performance of the review. In addition to the safety requirements established in the national legislation, the newest international regulating documents were also taken into account by the HAEA during the development of the guideline.

Activities associated with the extension of the SFISF

According to the valid licenses the extension of the SFISF, designed to host 33 chambers, was in progress with 4 chambers (chambers 21-24). The schedule of the realisation of the extension was in harmony with the storage needs of the nuclear power plant. The construction license of the actual module (Stage III Phase 2) expired in 2015; thus, in the frame of a new proceeding, the HAEA granted license for the construction of the module

containing chambers 21-24. The major technology system components required for the extension of the SFISF were manufactured in 2015, under periodic inspections of the HAEA. The manufacturing and assembly was conducted according to the defined schedule. The installation of each loading board steel structure and the support structures of the storage tubes was completed in the relevant phase of the construction works.
The manufacturing and inspection of the storage tubes (about 2,100 pieces) were completed in 2016. The manufacturing of the leakage control monitoring system of the storage tubes, and the rail path and power supply system of the refuelling machine was completed in; their installation was performed in 2016, based on the licenses issued by the HAEA in 2015. The commissioning activities of the SFISF extension with chambers 21-24 will start in 2017; the commissioning requires the license of the HAEA. The issuance of the operating license is based on the evaluation of commissioning experience; it is planned for 2018.

Inspection
The HAEA conducted 10 inspection at the facility. The most important inspection was the comprehensive inspection that is due every three years. The HAEA, in line with the activities performed in the SFISF, inspected the loading, maintenance and extension related activities on the site. The inspections related to the modification of the path measuring system of the bridge of the SFISF refuelling machine, the modification of the instrumentation and control system and the modification of the RPMS appearing in the HAEA inspection plan of 2016 were rescheduled by the Authority to 2017, due to the postponement of the works.

<u>Comprehensive inspection</u>
In 2016, the HAEA conducted a comprehensive inspection at the SFISF. The inspection aimed to inspect the nuclear safety management processes and certain operating processes of the SFISF. During the comprehensive inspection, the professionals of the HAEA performed their reviews in 4 working groups, as follows:
- Organisation and management system
    - •Policies, safety culture, self-assessment
    - •Pre-qualification practice, evaluation and inspection of suppliers, assessment of the prime responsibility
    - •Experience feedback
    - •Knowledge management
- Project management
    - •Project preparation and direction
    - •Actualisation of plans
-Technical issues
    - •Ageing management
    - •Maintenance
    - •Assembly lifetime, condition of storage tubes
    - •Management of inhermetic assemblies
-Other areas
    - • Waste management

- Radiation protection
- Emergency response
- PSR preparation
- Utilisation of Fukushima experience

Other inspections

The HAEA inspected, on the site, the closure process of chambers 21, 22, 23 and 24, the non-existence of foreign material and the cleanness of the chambers prior to the final closure. The Licensee closed the chambers in full compliance with the assembly technology approved by the HAEA.

The HAEA inspected three times the complex pre-delivery tests of storage tubes on the site of the supplier. Deviation was not observed during the inspections, the examinations were made by the personnel of the manufacturer in compliance with the examination technology approved by the resolution of the HAEA. The results of the leakage tests of the selected storage tubes were in compliance with the requirements determined in the technology.

During the assembly loading action, the HAEA observed that an effective OLC regulation was violated during the works performed in the loading board hall, which was qualified as a reportable event.

During the inspection of maintenance activities, the HAEA identified as a good practice that the evaluation of the maintenance experience was performed in a regulated manner at the SFISF.

During the inspections, ordering any immediate regulatory action was not justified.

Nuclear emergency response

In the case of an emergency at the SFISF, the Emergency Response Organisation (ERO) of the Paks Nuclear Power Plant performs the necessary tasks; thus, due to the joint ERO organisation, further information on the nuclear emergency response activities associated with the SFISF can be found in the previous section describing the nuclear emergency response activities of the nuclear power plant.

Human factors

In the frame of the comprehensive inspection, in relation to human and organisational factors, the HAEA reviewed the regulation of the work-load of the refuelling machine operators, the duty activities, the training policies, the suppliers' activities and the knowledge management.

The HAEA identified the establishment of the training database and the maintenance of its up-to-date status as a good practice.

The Authority requested the License to develop an action plan for the management of the deviations revealed during the inspection.

2.3 TUBE INT Training Reactor

Based on the evaluation of the safety performance of the TUBE INT TR in 2016, the HAEA judged that the **facility operated in compliance with the legal requirements**. The operation of the facility **did not mean health risk increment for the employees of the TUBE INT TR, the students and training participants and the public**. The occupational radiation exposure was as low as in the recent years. The radioactive release was also very low, much lower than the regulatory limit values. The reactor was operated in compliance with the regulations and the Operational Limits and Conditions (OLC).

It can be summarised about the safety performance that the area of "smooth operation" is continuously good for years, the "operation with low risk" area, with fluctuations, maintains the good qualification, while the "operation with a positive safety attitude" area holds its flawless qualification.

Figure 2.3-1: Budapest University of Technology and Economics, Training Reactor
(Source: https://www.bme.hu/sites/default/files/hirek/20150603_SzatmaryZ_06.JPG)

All the indicators of the **area of smooth operation** area, namely the *"Operating performance"*, the *"State of systems and equipment"*, the *"State of safety barriers",* and the *"Reportable events"* indicators obtained green qualification for years.

In the **area of operation with low risk**, the *"Safety systems, equipment"* indicator kept its green qualification, because the *"Number of safety protection system failures"* attribute

became green again based on the data of 2016. The other indicators of the area, the *"Risk"* and the *"Releases"* got green qualification for years.

In the area of **operation with a positive safety attitude**, the *"Human factor"* indicator held its yellow qualification, because the *"Number of violations of the requirements"* held its yellow qualification from the previous years. Out of the 5 regulatory requirements prescribed in its resolutions by the HAEA, 1 was fulfilled by deadline, 1 was received by the Authority with a few days delay, while in the case of other requirements the Licensee requested deadline modification, the result of which will be presented in the next evaluation. Due to the long-lasting yellow qualification, the Authority examined, in the frame of a revealing inspection, the situation associated with the violations of requirements, including the records of prescriptions. The inspection concluded that the area required greater management attention. The Authority considered the implementation of further measures necessary.
The other indicators of the area, *"Striving for improvement, self-assessment"*, *"Operating experience feedback"*, *"Radiation protection programme effectiveness"* and *"Industrial safety programme effectiveness"* had been continuously green for years.

Events
Reportable event (event entailing violation of the OLC or operation under the effect of the OLC, or event induced by a natural phenomenon, radiation safety related event, etc.) did not occur at the TUBE INT TR in 2016.

Licensing
The Authority issued 3 decisions in relation to the TUBE INT TR in 2016. Two out of the three related to the instrumentation and control reconstruction of the nuclear measuring chains, while one related to the Periodic Safety Review (PSR) that was in progress.
Based on the PSR of the facility, the HAEA ordered the reconstruction of instrumentation and control systems. This was the last step of the completion of the comprehensive reconstruction of the technological measurement chains and other connecting components of the Training Reactor. The new, commissioned measurement system consists of five measurement chains. The progress of the modification was continuously monitored by the HAEA. The installed measurement system met the legal requirements.
During the regulatory assessment of the PSR, supplementation was requested by the Authority, because the submitted documentation was not complete.
In 2016, the renewal of the entire high power and lighting systems, the venting of the building and its air conditioning, and the replacement of windows of the Training Reactor had been completed in 2016. In parallel, outside and inside civil engineering works were performed. The above modifications were grouped into 3 modification categories by the professionals of the TUBE INT, which grouping was approved by the HAEA.

Inspection
The HAEA performed 6 on-site inspections to verify the nuclear safety of the facility; two out of them related to the instrumentation and control reconstruction in progress. The HAEA revealed minor deviations in these inspections, which were dealt with by the

Licensee. An inspection focused on the process of management control and the assurance of qualification and competencies at the TUBE INT TR. The HAEA performed an inspection in relation to the building-oversight of the condition of specific civil structures. In addition, a radiation protection inspection was conducted during the renewal works, where the HAEA recorded that the Licensee provided adequate supervision during the building renewal works and provided training to the employees of the suppliers. The Authority observed a minor deviation in relation to the fridge serving for the storage of liquid radioactive sources; the Licensee took the necessary steps to eliminate the revealed deviation. During the manufacture inspection conducted at the Gamma Technical Ltd in connection with the modification of the Radiation Protection Monitoring System (RPMS), the HAEA concluded that additional inspections became necessary in relation to the RPMS, since the technical solutions to be applied were not finalised in each issue.
The observation made during the evaluation in 2015, as the "during the inspection performed in association with the Safety Performance Indicator System, it was concluded that the regulations of the administration processes of the Training Reactor is worth further attention, since minor deviations were experienced in the compliance with licensing requirements" was further emphasised by the evaluation this year, thus the Authority planned further interventions in this area.
During the inspections, the authority did not identify any problem jeopardising the safety of the facility; ordering of regulatory intervention was not justified.

Nuclear emergency response

The TUBE NTI TR shall conduct, biannually, a full scale nuclear emergency response exercise with the participation of the entire Emergency Response Organisation, with the involvement of off-site emergency response organisations. The Training Reactor held its last emergency exercise with the involvement of off-site contributors in 2015.
Two exercises are planned for 2017: one exercise based on the not yet approved Emergency Response Plan (ERP) reviewed and revised according to the training and exercise plan, and another one according to the approved ERP.

Human factors

The HAEA inspected the process and outcomes of the management self-assessments, and the assurance of qualification and competencies. Based on the inspection, the HAEA will pay more attention on the administration procedures in the future.
Minor deviations were revealed by the Authority in relation to the assurance of qualification and competencies; for example, the examinations after trainings and the trainings were not evaluated by the Licensee.
During the inspections, the Authority did not identify any problem jeopardising the basic safety of the facility, thus immediate regulatory action was not justified.

2.4 Budapest Research Reactor

Based on the evaluation of the safety performance of the BRR in 2016, the HAEA judged that **the facility operated in compliance with the legal requirements**. The operation of the facility **did not mean health risk increment for the employees of the BRR and the public.** The occupational radiation exposure was as low as in the recent years. The radioactive release was also very low, much lower than the regulatory limit values. The reactor operated in compliance with the regulations and the Operational Limits and Conditions (OLC).

Based on the qualification of the safety performance indicators, it can be concluded that the warning qualifications in area of "smooth operation" were caused by the ageing of the research reactor. Accordingly, both the Licensee and the Authority shall pay more attention on the ageing management activities. The "operation with low risk" area hold its almost flawless qualification. The Licensee shall improve the compliance with regulatory requirements in the "operation with a positive safety attitude"; the Authority shall pay special attention on the enhancement of the level of safety culture within the organisation of the Licensee.

Figure 2.4-1: Budapest Research Reactor (source: http://www.innoportal.hu/wp-content/uploads/2016/08/budapesti-kutat%C3%B3reaktor.jpg)

On the main evaluation **area of smooth operation**, 2 attributes turned into the warning range and 1 improved. The *"Nuclear measurement chains"* attribute of the *"State of systems and equipment" indicator* improved from yellow to green. Despite the corrective actions decided in 2015 (replacement of critical parts, professional service inspection) the

reconstruction of certain elements of the instrumentation and control system could not be prevented, since a certain part of the used elements (e.g. Z80 microprocessor and its interfaces) represented the technology of the 80'. The investigation experience showed that the system had aged despite the regular maintenance. There was no event in association with the nuclear measuring chain; however, the system was still worth special attention.
The *"Deviations from the planned campaign"* attribute of the *"Operating characteristics"* indicator changed from green to yellow. In 2016, due to the works connected to the replacement of the primary valve seat to be performed due to the event No. 1906, all reactor cycles planned for the second half of the year had to be deleted, thus deviation from the planned schedule occurred five times.
The *"Integrity of the secondary circuit"* attribute of the *"State of safety barriers"* changed from green to yellow, since more defects were identified due to the corrosion degradation of the secondary circuit pipeline system revealed during the investigation of the event No. 1925.
Regarding the other indicator of the area, it can be stated that the only one attribute of the *"Events"* indicator, the *"Reportable events"* attribute continuously green due to its value below the criterion level. Based on the operational experience, these criteria should be reviewed.

All indicators in the area of **operation with low risk**, the *"Releases",* the *"Solid radioactive waste",* "S*afety systems and equipment"* and the *"Risk"* obtained green qualification.

Special attention should be paid to the *"Violations of requirements"* indicator in the area of **operation with a positive safety attitude**, which improved from the red qualification in 2013 to green in 2014 and it held the green qualification in 2015, then it became red again in 2016, due to the two violations of the fulfilment of requirements by deadline. Greater management attention was required, due to the fluctuating performance of the area.
The other indicators of the area, *"Striving for improvement, self-assessment"*, *"Operating experience feedback"*, *"Radiation protection programme effectiveness"* and *"Industrial safety programme effectiveness"* had been continuously green for years.

Events
In 2016, 3 reportable events occurred at the Budapest Research Reactor. The events related to the leakage of the primary main gate valves, smoking of the choking spring of a ceiling armature, and the corrosion caused degradation of the secondary circuit pipeline system.
Event entailing safety protection actuation, OLC violation, or operation under the effect of the OLC, or natural phenomenon induced, radiation protection related or human error induced event did not occur in 2016. There was one reoccurring event.

Licensing

In 2016, among the decisions related to the facility, 3 related to the approval of the new revision of the Workplace Radiation Protection Regulation (WRPR), 1 related to the implementation of the deviations revealed during the comprehensive inspection, while 2 related to the replacement of the primary circuit valve seats.

Due to the change of the legal framework in 2016, a major review and revision of the WRPR became necessary. The regulatory decisions related to the extension of the procedural deadline, the required supplementations and the licensing of the WRPR.

Regarding the replacement of the primary circuit valve seats, a temporary modification license became necessary due to the reactor start-up under conditions differing from those established in the Operational Limits and Conditions, since the primary circuit had to be disassembled for the repair, and the fuel bundles were moved from the active core of the reactor to the wet fuel store. The core verification measurements used for the inspection of the re-movement of the fuel bundles after the repair required automate operation at minimum power level. Consequently, the HAEA approved a one-time reactor start-up besides the inoperability of the main gate valves. In addition, the HAEA approved the modification of the valve seats of the primary circuit main gate valves, and the application of new type, metal-graphite-metal valve seats.

Inspections

The HAEA inspected the nuclear safety of the facility 10 times on the site.

During the inspections, the Authority identified several deviations, and then initiated their elimination.

The inspections covered the on-site inspection of the modification made due to the reduction of the battery capacity of the facility, the maintenance activity, the process and outcomes of the management inspection, and the assurance of qualification and competences.

During the inspection of the safety performance indicator system, the HAEA concluded that the personnel of the Budapest Research Reactor wanted to start the modification of the nuclear measuring chain only after obtaining the lessons learned from the completion of the modification of the nuclear measuring chain of the Training Reactor, and thus the works were rescheduled to 2017. The measuring bench made was an adequate tool to temporarily maintain the status of the spare parts.

The HAEA performed three inspection in connection with the degradation and modification of the valve seats of the primary circuit gate valves, which facilitated, besides monitoring the situation, the clarification of further tasks and licensing issues. In addition, these inspections revealed that the ageing management programme was not actualised by the prescribed deadline. The HAEA identified two deviations during the inspection performed in connection with the corrosion degradation of the secondary circuit pipeline: the degradation of the tube channel and the problem in sharing of responsibilities and communication between the HAS ERI and the service provider on the site.

Nuclear emergency response

The Budapest Research Reactor shall conduct, biannually, a full scale nuclear emergency response exercise with the participation of the entire Emergency Response Organisation,

with the involvement of off-site emergency response organisations. Accordingly, the off-site organisations were involved into the exercise hold in 2016. The initiating event of the exercise was that a foreign material (nylon foil) appeared in the reactor that decreased the coolant flow through four fuel bundles. During the exercise, the Emergency Response Organisation demonstrated its applicability for the management of the event.

Human factors

The HAEA inspected the process and outcomes of the management self-assessments, and the assurance of training and competencies.

In relation to the training and assurance of competencies, the Licensee acted, in general, pursuant to the regulations. The Authority identified as a minor deviation that there was no formal verification of the lessons learned after the completion of a training.

During the inspections, the Authority did not identify any problem jeopardising the basic safety of the facility, thus immediate regulatory action was not justified.

2.5 National Radioactive Waste Repository (NRWR, Bátaapáti)

Figure 2.5-1: Operation hall of the technology building (Source: http://www.rhk.hu/images/sajto/nrht-felszin-technologiai-epulet-uzemcsarnok.jpg)

Regulatory oversight of radioactive waste repositories

In 2016, in line with the Govt. decree 155/2014. Korm., the HAEA continued its regulatory activity over the radioactive waste repositories that started in the second half of 2014. Accordingly, the development of guidance (guidelines) on the method of compliance with the nuclear safety requirements established in the Govt. decree 155/2014. Korm. was completed. Six guidelines entered into force in 2016: "Eventual report of radioactive waste repositories", "Periodic safety review of the Radioactive Waste Treatment and Disposal Facility (RWTDF)", "Guidance on the content and formal requirements for the Safety Report Substantiating the Operation of radioactive waste repositories", "Guidance on the content and formal requirements for the Safety Report Substantiating the Construction of radioactive waste repositories", "Management system of radioactive waste repositories", and "Assessment of the safety culture and utilisation of its results at radioactive waste repositories".

Based on the evaluation of the safety performance of the NRWR in Bátaapáti in 2016, the HAEA determined that **the facility operated in compliance with the legal requirements**. The operation of the facility **did not mean health risk increment either for the employees of the NRWR or the public**. The occupational radiation exposure was

as low as in the recent years. The radioactive release was also very low, much lower than the regulatory limit values.

Events
Reportable event (event induced by a natural phenomenon, radiation safety related event, etc.) did not occur at the NRWR in 2016.

Licensing
In 2016, in relation to the NRWR, based on the submitted documents, the HAEA made the safety review and assessment of five newly planned modification (two in Category 3 and three in Category two), and three licensing proceedings were initiated under the effect of Govt. decree 155/2014. (VI.30.) Korm. in connection with the modification of the 32 t crane moving the new type waste packages, the modification of the 16 t forklift, and the increase of the capacity of the I-K1 chamber.

Inspection
In 2016, the HAEA performed 28 on-site inspections at the NRWR and documented them in inspection records. Out of them 1 inspection related to the realised modification, 5 to the operation of the repository, 12 to the comprehensive inspection, and 10 to the construction of the repository.
In November, the HAEA conducted a 4 day long comprehensive inspection at the facility, which covered the following major areas: inspection of the project aimed to construct a reinforced concrete pool in the I-K2 chamber, emergency response, radiation protection, experience feedback, maintenance, ageing management, modification associated with the new waste disposal technology, and the interface between construction and operation. The HAEA did not observe any deviation requiring immediate intervention.

Nuclear emergency response
According to law, the radioactive waste repositories shall conduct, biannually, a full scale nuclear emergency response exercise with the participation of the entire organisation, with the involvement of off-site emergency response organisations. In 2016, the National Radioactive Waste Repository held two emergency exercises in 2016, and the off-site contributors were involved into one exercise. One of the exercises was a table top exercise, where the initiating event was a fire in the yard, while the other one was a joint table top and execution exercise, where the initiating event was a damage to a barrel during the movement of waste packages.

Organisational factors
During its inspections, the HAEA reviewed the organisational factors, among others, the process and outcomes of management self-assessments, and the assurance of qualification and competencies.
The PURAM Ltd. Had exemptions regarding certain NSC requirements regarding training and assurance of competencies by the end of 2017. The preparation for the compliance with the requirements was made adequately and timely.

The HAEA drew the attention of the Licensee to the elimination of a minor deviation revealed during the inspection.
During the inspections, the Authority did not identify any problem jeopardising the basic safety of the facility, thus immediate regulatory action was not justified.

2.6 Radioactive Waste Treatment and Disposal Facility (RWTDF, Püspökszilágy)

Figure 2.6-1: Bird view of the Radioactive Waste Treatment and Disposal Facility (Source: http://www.rhk.hu/images/sajto/rhft-madartavlat.jpg)

Based on the evaluation of the safety performance of the RWTDF in Püspökszilágy in 2016, the HAEA determined that **the facility operated in compliance with the legal requirements**. The operation of the facility **did not mean health risk increment either for the employees of the RWTDF or the public**. The occupational radiation exposure was as low as in the recent years. The radioactive release was also very low, much lower than the regulatory limit values.

Events
Reportable event (event induced by a natural phenomenon, radiation safety related event, etc.) did not occur at the RWTDF in 2016.

Licensing
In 2016, in relation to the RWTDF, based on the submitted documents, the HAEA approved the categorisation of two newly planned modification (both in Category 3). Two licensing proceedings were initiated under the effect of Govt. decree 155/2014. (VI.30.) Korm. On the request of the PURAM Ltd the proceeding regarding the unified operating license of the RWTDF commenced in the middle of 2016, while in the end of the year, the review of the Periodic Safety Review of the RWTDF submitted according to the provisions of Govt. decree 155/2014. (VI.30.) Korm. started.

Inspection
In 2016, the HAEA performed 11 on-site inspections at the RWTDF in Püspökszilágy and documented them in inspection records. Out of them 5 inspections related to realised modifications, and 6 to the operation of the repository.
Immediate action or intervention to the operation was not necessary during the inspections.

Nuclear emergency response
According to law, the radioactive waste repositories shall conduct, biannually, a full scale nuclear emergency response exercise with the participation of the entire organisation, with the involvement of off-site emergency response organisations. In 2016, the Radioactive Waste Treatment and Disposal Facility held two emergency exercises in 2016, and the off-site contributors were involved into one exercise. The initiating event of one of the two table top exercises was the falling of barrels in the moving frame, while 4 events deviating from normal operation were managed during the other exercise.

Organisational factors
During its inspections, the HAEA reviewed the organisational factors, among others, the process and outcomes of management self-assessments, and the assurance of qualification and competencies.
The PURAM Ltd. Had exemptions regarding certain NSC requirements regarding training and assurance of competencies by the end of 2017. The preparation for the compliance with the requirements was made adequately and timely.
The HAEA drew the attention of the Licensee to the elimination of a minor deviation revealed during the inspection.
During the inspections, the Authority did not identify any problem jeopardising the basic safety of the facility, thus immediate regulatory action was not justified.

2.7 Project for Sustaining the Capacity of Paks NPP

The MVM Paks II. Nuclear Power Plant Developing Private Limited Company (hereinafter referred to as MVM Paks II Ltd.) is a project company established for the construction of new nuclear power plant units.

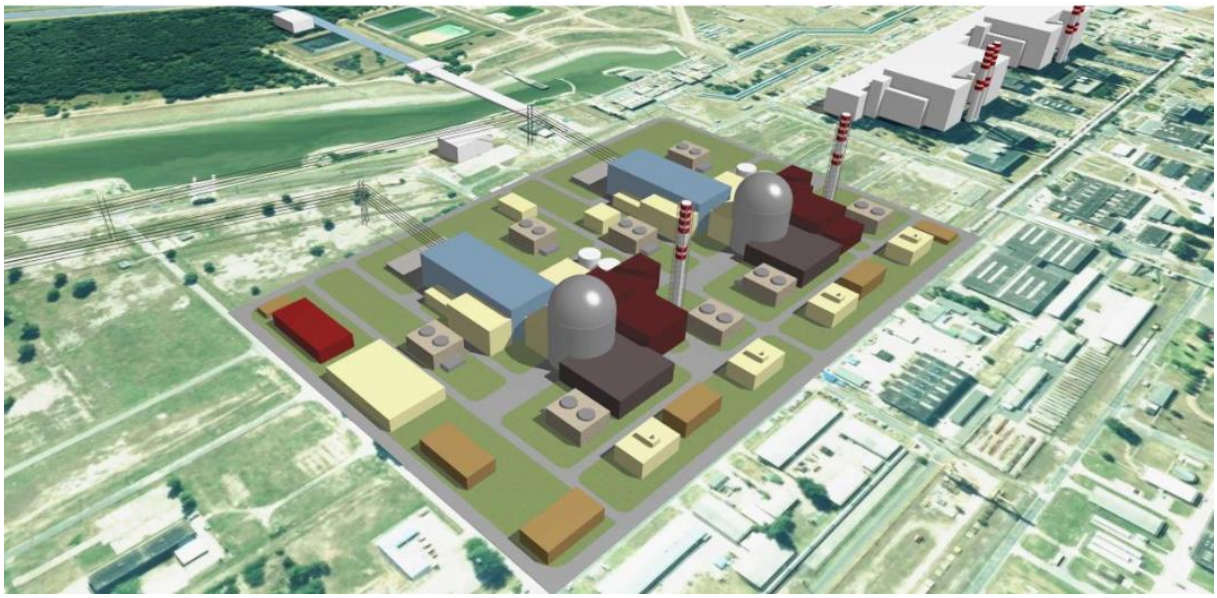

Figure 2.7-1: Design view of the new units (Source: http://www.mvmpaks2.hu/)

Site permit

The HAEA, with its resolution No. HA5919, issued the site survey and assessment license on November 14, 2014. In 2015 and 2016, the MVM Paks II Ltd executed the actions of the Geological Research Programme (hereinafter referred to as GRP) on the planned site that were specified in the frame of the site survey and evaluation programme.

On October 26, 2016 the MVM Paks II Ltd submitted its site permit application for the site of the new nuclear power plant units to the HAEA. The HAEA established a working group for the review and assessment of the license application, and involved the Mining Section of the Technical Licensing and Customer Protection Department of the Baranya County Government Office and the Ministry of the Interior Directorate General for Disaster Management as co-authorities. IN the frame of the proceeding, the HAEA hold a public hearing on December 13, 2016. At the end of the reporting period, the review and assessment process of the site permit application was not completed (the HAEA granted the site permit on March 30, 2017).

Action plan

In 2014, the HAEA, in its resolution No. VE5911, ordered that the MVM Paks II Ltd had to submit, as a supplementation to the license application to obtain the site survey and assessment license, a detailed action plan for the improvement of its management system, which could comprehensively take into account and manage its operating experience, the deficiencies revealed by its internal audit, the regulatory comments and the modifications induced by the change of the owner. The Licensee, in its regular status

reports submitted to the HAEA, provided information on the progress of the execution of the actions plan. The status reports were submitted by the Licensee by deadline according to the preliminary schedule. The implementation of the action plan was continuously monitored by the HAEA.

Researches on the site

In association with the design, the Russian principal contractor performed a comprehensive technical review on the planned site of the new units, based on a predefined research programme (i.e. "Engineering survey"), in order to collect data necessary for the detailed design and planning of building foundations.

Events

In 2016, the Authority investigated 1 event (No. 1898) that could be connected to the activities performed on the site of the new unit. The event occurred during the execution of the research programme of the Russian principal contractor in connection with the design.

Licensing

The HAEA, with its resolution "Assessment and evaluation of the potential interactions of existing nuclear facilities and nuclear facilities to be constructed on the safety of nuclear facilities" obliged the nuclear facilities operating and the nuclear facilities planned to be constructed on the Paks site to mutually inform each other.

The HAEA, within its competence, initiated an authority proceeding regarding the "Demonstration of the applicability of the principal contractor", and ordered that the MVM Paks II Ltd had to verify, in the frame of a nuclear qualification procedure, prior to commencing any nuclear safety related activities that the Principal Contractor was applicable to perform nuclear safety related activities and could ensure the necessary work conditions.

On the request of the MVM Paks II Ltd, the HAEA granted building license for the construction of the Investment Centre. The Licensee submitted it application to obtain license for the building activities of the Plant Investment Centre (PIC) on October 18, 2016. The IPC consists of a main building providing workplace for 300 persons, a reception building, bicycle and litter store, and parking places. Based on the submitted design documents and blueprints, and the co-authority opinions, the HAEA granted the building license of the PIC in a specific building license, separate from the construction related licenses. The building activities could be started, based on the decision of the Licensee, within the 3 years validity of the building license.

The legal basis for the submission and evaluation of the Preliminary Safety Information Report (PSIR) is established in the Act on Atomic Energy. Accordingly, prior to initiating the construction license proceeding of the nuclear facility, the licensee may inform the atomic energy oversight organisation on the preliminary compliance of the planned nuclear facility with the safety requirement by the submission of the Preliminary Safety Information Report. The preliminary compliance of the unit type with the national requirements and the potential deviations have to be presented in the PSIR based on

information about an operating unit or a unit under construction that has the same type as the planned nuclear power plant.
The evaluation of the PSIR is not considered as a regulatory licensing proceeding. In general, it aims at providing information to the Authority regarding the major technology characteristics and technical solutions of the planned unit type, in order to allow the authority evaluating in advance, whether the unit is in compliance with the national safety requirement system and preparing for the review and assessment of the construction license application.
The MVM Paks II Ltd submitted the Preliminary Safety Information Report to the HAEA on September 1, 2015.
The professionals of the HAEA reviewed and assessed the documentation containing about 10,000 pages in the frame of an 11-month-long work programme.
After the review, the HAEA informed the Licensee in an administrative letter about the results of the review to ensure that the Licensee could elaborate the Preliminary Safety Report to be submitted together with the construction license application in an appropriate quality based on the comments.

Inspection
In 2016, the HAEA performed 1 comprehensive and 2 targeted inspections at the MVM Paks II Ltd. Immediate action, intervention did not become necessary during the inspections.

Comprehensive inspection
In the frame of the comprehensive inspection, which was composed of 7 individual inspections, the HAEA reviewed the modification of the organisation and the management system, the assurance of human resources, the project management, the supervision of the design process by the Licensee, the management of suppliers, the management of regulatory comments and deviations, and the implementation of the action plan required in the decision VE5911.

Taking account of the tasks of the actions plan, the Authority conducted deeper review regarding the following areas:
- priority of safety
- prime responsibility for safety
- management system
- management of deviations from license applications
- configuration management
- design and planning
- scheduling
- language used in licensing documents
- cooperation between the investor and the future operator
- application of standards
- data management issues

Targeted inspections

One of the targeted inspections aimed to review the execution of the programme approved in the site survey and evaluation license.

The representatives of the Authority reviewed three areas during the inspection:

- Construction buildings, replacement of public utilities
- Geological Research Programme
- Geotechnical examination programme performed by the Russian principal contractor

In the case of the first and third topics, the main objective was to gather information. In connection with the construction buildings, the Authority intended to obtain information on the number and schedule of expected license applications.

The HAEA inspected whether the Licensee executed the Geological Research Programme in compliance with the provisions of the resolution HA5919. During the inspection, the representatives of the Licensee informed the Authority that the compliance with the requirements against the MVM Paks Ltd are supervised and verified directly by the professionals of the MVM Paks Ltd, and additional technical inspectors are also employed. The inspection records were randomly reviewed by the Authority.

The inspection revealed that the geotechnical monitoring system was not in operation, since it will be put into operation in a more complex scope in the frame of the investment project.

The other targeted inspection related to the execution of the site survey; it aimed to inspect the execution of the engineering survey, and the relation between the MVM Paks Ltd and the MVM Paks II Ltd, paying special attention on the event No. 1898. The examiners performing the geological and hydrogeological research activities attended a training in advance. The examinations were performed based on a Russian and English action plan.

Audits

The MVM Paks II Ltd elaborated its internal procedure regulating the process of the selection of its suppliers. The audits of the suppliers contributing to the substantiation and compilation of the site permit application were performed in 2016. Audits were performed at four suppliers on five activities: MECSEKÉRC Ltd (2), ÁKMI Ltd (1), GeoRisk Ltd (1) and SOM System Ltd (1). The HAEA participated in all five on-site audits. As a result of the audits, the Licensee granted the qualification for all five activities.

Evaluation of regular reports

The MVM Paks II Ltd submits a status report on the implementation of the action plan and the GRP in the middle of every second month to the HAEA. The status reports provide information on the changes occurred in the tasks of the action plan in the recent period, and reports the completed tasks. The HAEA received 6 status reports in 2016, which were continuously reviewed. The information provided in the status reports was verified by the Authority based on the examination of the samples and during inspections.

I. Annex: Methodology of the regulatory evaluation

Safety has overriding priority above all other aspects during the operation of nuclear facilities. The Hungarian Atomic Energy Authority (HAEA) annually evaluates the safety performance of the nuclear facilities falling under its regulatory competence.

The safety performance of operation can be determined as a result of an evaluation that takes many aspects into account, including the application of the tools of engineering and safety judgement, in addition to attributes that can be qualified with numeric values.

The safety performance is evaluated based on the conclusions of regulatory inspections, operational data, and investigation and analysis of event occurred during operation. Accordingly, the HAEA:

- collects the operational data and creates their trends;
- reviews and evaluates the events occurred during the year;
- performs the safety evaluation of events;
- performs the probabilistic based analysis of events,
- pays special attention on the investigation of human induced and reoccurring events;
- comprehensively evaluates the safety performance with the application of the safety performance indicator system.

The HAEA takes into consideration the degree of potential risks during the evaluation of the safety performance of nuclear facilities being under its regulatory oversight.

The evaluation criteria of safety attributes are determined by the HAEA in a way to take into account the level of safety performance reached by the nuclear facilities, the national and international experience on the safety of the application of atomic energy, and to facilitate the licensees in the enhancement of their safety performance.

The safety of the operation is evaluated by systematic numerically quantified characteristics taking account of many aspects, so-called safety performance indicators. In addition to these indicators, the Authority continuously applies the engineering, safety evaluation, since the safety performance of the facility can be determined only as a result of a comprehensive evaluation. In many cases, only the comparison with the relevant results and performance indicators of previous years can provide an outcome.

I.1. Safety Performance Indicator System (SPIS)

The safety performance indicator system, at the request of the HAEA NSD, was developed by the VEIKI based on the guidance of the International Atomic Energy Agency contained in IAEA TECDOC-1141. In the case of the most important nuclear facility, namely the MVM Paks Nuclear Power Plant (PAE), the system was introduced in 2001.
Based on the lessons learned from its application at the nuclear power plant, safety performance indicator systems were developed for the other facilities being under the regulatory oversight of the HAEA, namely for the Spent Fuel Interim Storage Facility (SFISF), the Training Reactor of the Institute of Nuclear Techniques of the Budapest University of Technology and Economics (BUTE INT TR), and the Budapest Research Reactor (BRR), which systems are in use as of 2005. Consequently, the evaluation is supported, in the case of all facilities, by the results of the safety performance indicator system.

The appropriate selection of indicators allows continued monitoring of the nuclear facility, assessing changes, and detecting degrading tendencies early. If deviations are detected early, then the Authority may initiate appropriate actions to prevent the degradation of safety below the acceptable level.

The evaluation criteria of safe operation are determined by the Authority by taking account of the level of safety performance reached in recent years and the national and international experience, in order to facilitate the licensees in early detection of safety problems.

The following sources provide data to the safety performance indicator system:

- Regular reports (quarterly report, annual report, campaign report, main overhaul report)
- Event reports on safety related events and their investigations
- Conclusions of regulatory inspections
- Information from regulatory licensing activity

The HAEA continuously oversees the operation of the nuclear power plant. This oversight includes various types of regulatory licensing procedures, inspections, and review and evaluation of the regular and event reports of the operator.

The collection, calculation and management of data necessary for the operation of the SPIS is performed in line with a procedure, based on predetermined distribution of tasks and responsibilities. The tasks and responsibilities cover the collection of safety attributes, trend development, calculation of safety performance indicators, and the preparation of the summary evaluation.

I.2. Structure of the SPIS

The SPIS consists of four levels; it has a hierarchic structure (see Figure 1). Three main evaluation areas are on the top of the system. Each area is divided to sub-areas of safety performance indicators. The safety performance indicators are built from safety attributes, which have measurable ad predefined evaluation criteria. The safety performance indicators and the sub-areas are evaluated based on the results of the safety attributes.

The HAEA groups the indicators under three major evaluation areas for each facility as follows:

PAKS NUCLEAR POWER PLANT
- smooth operation,
- operation without risk,
- commitment to safety;

SFISF
- smooth operation,
- operation with low risk,
- operation with a positive safety attitude;

BUTE INT TR
- smooth operation,
- operation with low risk,
- operation with a positive safety attitude;

BRR
- smooth operation,
- operation with low risk,
- operation with a positive safety attitude;

RWTDF
- smooth operation,
- operation with low risk,
- operation with a positive safety attitude;

NRWR
- smooth operation,
- operation with low risk,
- operation with a positive safety attitude.

The safety attributes are evaluated by the Authority based on individually specified criteria and they are colour-coded as follows:

„green": If a safety attribute is in the green field, then it is within the limit values defined as adequate by the Authority. The values in the green field are judged as acceptable by the Authority, additional measures or strengthened attention are not considered as necessary. In the case of a degrading trend or if a value gets closer to the yellow field, the licensee, recognising the issue, may implement preventive measures.

„yellow": The boundaries of the warning, yellow field warns of deviation from the adequate value, however the performance is within the range accepted by the Authority. The attributes within the yellow field require strengthened attention; the licensee shall prepare an action plan for the elimination of the inadequate qualification. The Authority enforces the implementation of the action plan in writing; the realization of the plan is verified during the review of the regular reports as well as during targeted inspections.

„red": The safety attribute is non-acceptable, the lowest boundary of the red field is either the value approved by the Authority or (if it is a lack of a specified value) an individually specified criterion. The licensee shall prepare an action plan, the implementation of which, if appropriate, with additional tasks considered to be important is ordered by the Authority. The realization of the tasks listed in the action plan shall be reported by the licensee in regular reports; additionally the Authority verifies the progress of the implementation of these tasks during targeted inspections.

„white": The safety attribute is unknown. It may have various reasons: one of them is when such a modification occurred in the organization or in the informatics systems of the licensee, which temporarily hinders or makes impossible the data collection regarding the attribute. The reporting system shall be reviewed in this case to determine whether the information can be obtained from other sources or it shall be agreed with the licensee how it can ensure the data provision again.

The safety performance indicators include correlating safety attributes that are non-replaceable by each other; therefore the colour coding of a safety performance indicator is determined based on the colour of the weakest qualified attributes included thereby.

The evaluation shall be made according to other aspects in addition to the qualification colours, in order to take into account the information obtained by the Authority from other sources besides the numerically assessable safety attributes.

The Authority plays a special role during the operation of the SPIS, since it cannot influence the values of the attributes, it does not have direct role in their evolution.
The information gained from the safety attributes facilitates the Authority in the identification of problematic areas and in determination of the necessary regulatory steps. The results of the SPIS show the areas, where the capabilities shall be enhanced,

and the measures, which are required for the improvement of the performance in the future (in the area of human resources, system and equipment, or procedures).

The Authority informs the management of the nuclear power plant about the results of the evaluation, and draws the attention to those phenomena, which requires further investigation and measures; or if needed, the Authority conducts investigation and initiates actions.

The safety performance indicators are composed of associated, but not replaceable safety attributes; thus, the colour qualification of the safety indicators is made on the basis of the worst colour qualification of its composing safety attributes.

The change of the safety performance level is shown in a circle diagram (see Figure I.2-1). The diagram shows the numeric values of safety attributes in a relative scale, where the values of the attributes are represented in increasing order, in percentage of the criteria specified in the different fields. The three sectors represent the three safety areas, the three levels of evaluation range are represented by the green circle, and the yellow and red rings. The area contained by the values represents the general summary of the safety performance for a given period of time. It provides an overview of the problematic sub-areas identified by the SPIS and the timely evolution of safety performance. The change of each area in time can be well followed based on the envelope of the values of the safety attributes.

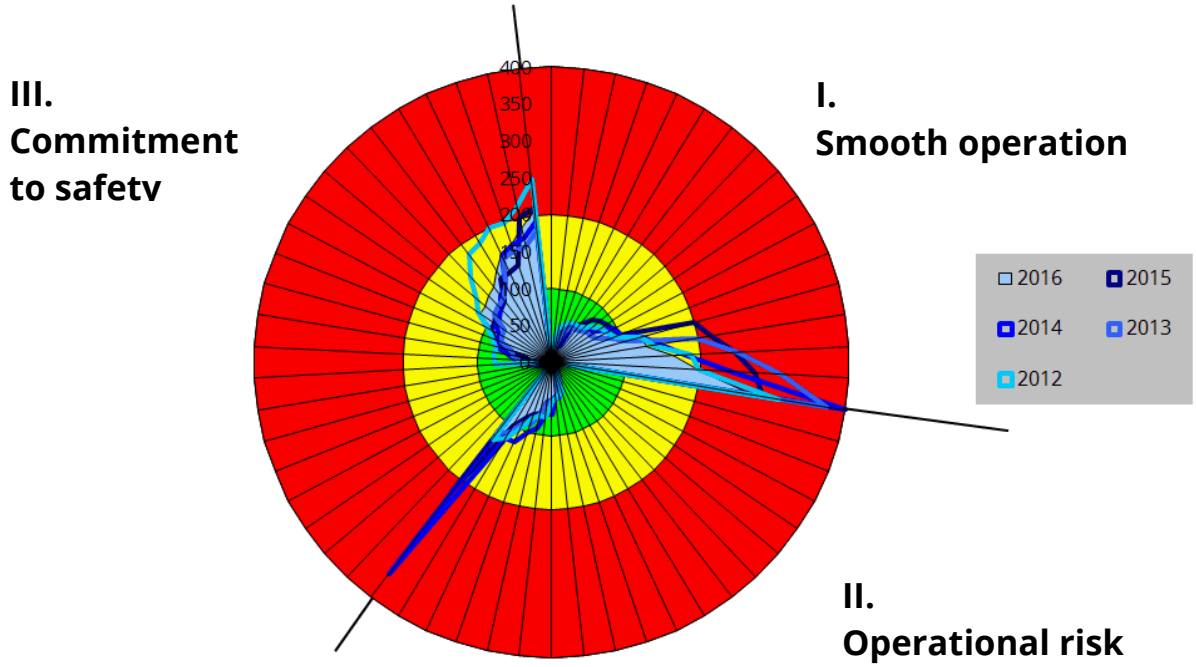

Figure I.2-1: SPI circle diagram

I.3. Safety evaluation of events

The HAEA introduced a complementary method for the safety evaluation of events. The evaluation methods categorises the events based on their safety impact in a way that it provides points to the safety importance of various deviations. The sum of the points given to each attribute, as determined during the evaluation, characterises the events. The assessment provides a relative scale, which represents the safety relevance of the events in comparison with each other. The point value associated with a specific event cannot be used as an absolute indicator; however, the event having greater point shows more safety related deviation. The evaluation system pays emphasised attention to events associated with various types of human errors. The results of the evaluation facilitate the judgement on the safety relevance of the events and the elaboration of the regulatory inspection strategy aiming at the elimination of the causes of the events.

The method is built on data that can be gained from investigations. The aspects determining the evaluation are as follows:

- initiating event,
- protection actuation,
- operation under the effect of the OLC or violation of the OLC,
- activity of the personnel,
- value of core melt probability during the event,
- cause of the event,
- other contributing factors of the occurrence of the event,
- safety class of the affected systems and components,
- radiation exposure to the personnel,
- extent of radioactive release/contamination.

After concluding the investigation, the listed event attributes are valued according to the relevant procedure, and the sum of the points characterises the event.

II. Annex: Hungarian nuclear facilities and radioactive waste repositories

II.1. Paks Nuclear Power Plant

MVM Paks Nuclear Power Plant (Source: www.atomeromu.hu)

Unit	Power	Start of operation	Type	Site	Internet site
Unit 1 PAE1	500 MW	1983	VVER-440/213	Paks	www.atomeromu.hu
Unit 2 PAE2	500 MW	1984	VVER-440/213		
Unit 3 PAE3	500 MW	1986	VVER-440/213		
Unit 4 PAE4	500 MW	1987	VVER-440/213		

II.2. Spent Fuel Interim Storage Facility (SFISF)

Spent Fuel Interim Storage Facility (Source: http://www.rhk.hu/letesitmenyeink/kkat/)

Type	Year of construction	Site	Internet site
Modular, chamber, dry store	1997-	Paks	http://www.rhk.hu/letesitmenyeink/kkat/

II.3. Budapest University of Technology and Economics Training Reactor

Training Reactor (Source: www.reak.bme.hu)

Type	Power	Start of operation	Site	Internet site
Pool type	100kW	1971	Budapest District XI. Műegyetem quay	www.reak.bme.hu

II.4. Budapest Research Reactor

Budapest Research Reactor (Source: www.bnc.hu)

Type	Power	Start of operation	Site	Internet site
Tank type	10 MW	1959	Budapest, District XII	http://energia.mta.hu/hu

II.5. National Radioactive Waste Repository (NRWR)

NRWR (Source: www.nrht.hu)

Type	Capacity	Commissioned in	Site	Internet site
Underground disposal	21500 m^3	2012	7164 Bátaapáti Mórágy Valley 4.	http://www.rhk.hu/letesitmenyeink/nrht/

II.6. Radioactive Waste Treatment and Disposal Facility (RWTDF)

RWTDF (Source: www.rhft.hu)

Type	Capacity	Commissioned in	Site	Internet site
Shallow land disposal	5040 m^3	1976	2166 Püspökszilágy 043/20 Land No.	http://www.rhk.hu/letesitmenyeink/rhft/