REGULATORY ASSESSMENT OF THE HUNGARIAN NUCLEAR FACILITIES AND RADIOACTIVE WASTE REPOSITORIES IN 2017

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 elements 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 detect their safety effect, to reveal the potential causes, and to initiate effective measures to eliminate any deviations.

The assessment 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 licensing experience, 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 the authority assessment 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 2017 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. The operation of the facilities did not mean a health risk increment for the employees of the facilities or the public.

Based on the amendment to the Act CXVI of 1996 (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 155/2014(VI.30.) Korm. entered into force, the HAEA continued the regulatory activities commenced in the second half of 2014. The evaluation main areas, the indicators and attributes of the safety performance indicator system supporting the assessment of radioactive waste repositories had been developed, the data collection is in process. The evaluation criteria system will be established based on the experience gained. In the future, the monitoring of changes and qualification of deviations, analysis of trends and early recognition of tendencies will be further facilitated.

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 regulatory oversight of 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 HAEA are controlled by the 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 assessment is 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 the activities associated with nuclear energy 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 associated with atomic energy entailing such risks.

The safety of 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. The comparison with the relevant results and performance indicators of previous years can be significant for the evaluation of the safety performance of the actual year.

The evaluation of safety performance is made based on the assessment and analysis of the conclusions of regulatory inspections, operational data, licensing experience, and events occurred during operation. In order to reach this goal, the HAEA:

- collects operational data and creates their trends;
- gathers the experience of inspections and licensing;
- 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 to the investigation of human induced and reoccurring events;
- comprehensively evaluates the safety performance with the application of a 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 support the licensees in the enhancement of their safety performance.

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

2. Summary Assessment

2.1 Paks Nuclear Power Plant

In 2017, 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 a health risk increment for both the employees of the nuclear power plant and the public**. The occupational radiation exposure level further improved, the collective dose further decreased, and the maximum individual dose got the value within the magnitude of the recent years. 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 area of "smooth operation" degraded and moved to the range requiring authority intervention, the area of "operational safety" was adequate, while the area of "commitment to safety" improved.

In 2017, **the area of smooth operation** was characterised by 2 green and 4 red indicators. In comparison with the preceding year, the number of red indicators increased by three, the number of yellow indicators decreased by three, while the number of green indicators did not change. Among the 17 safety attributes providing basis of the indicators

12 were green, 1 was yellow and 4 were red. Among the attributes, the qualification of 2 improved, 3 degraded and 12 did not change in comparison with the preceding year.

- In 2016, the *"Maintenance planning"* indicator improved to yellow after seven years of continuous red qualification, but it degraded to red again in 2017. The *"Ratio of performed and planned work orders"* attribute became red, while the "*Ratio of planned and real length of main overhauls"* attribute improved to green.
- The qualification of "Use of load cycles" attribute changed from yellow to red, which caused the red qualification of the *"Material condition"* indicator.
- The *"State of the barriers"* indicator degraded again to red due to the change of "Fuel reliability" attribute from green to red.
- The *"Reportable event"* indicator, as in the last three years, became red again, due to the qualification of the *"Authority ordered event investigations" attribute*.
- The *"Unplanned shutdowns and power reductions"* indicator had not changed from green for four years.
- The "Unsuccessful technical safety inspections" attribute improved from yellow to green, thus the "Repairs" indicator got back its green qualification.

The indicators of the **area of operational safety** showed continuous improvement. There was no red indicator between 2012 and 2014, as well as in 2016. In 2017, with 7 green indicators and 19 green attributes, this area got the best qualification. Among the attributes, 1 improved and 18 did not change in comparison with the preceding year. There was no degrading attribute in this area.

- The *"Actual challenges of safety systems"* has been continuously green since 2006.
- The qualification of the "Availability" indicator has been continuously green, since the yellow qualification of the *"Inoperability revealed during test"* attribute in 2014.
- The *"Operator preparedness"* indicator, following its green qualification between 2012 and 2014, became red in 2015 due to *"Number of failed licensing exams"* attribute. It improved to yellow in 2016, then in 2017 it further improved and obtained green qualification again.
- The *"Emergency preparedness"* indicator has been green since 2006.
- The *"Risk during operation"* indicator obtained green qualification in the last three years.
- The *"Risk in analysis"* indicator has been green since 2011.
- The *"Environmental risk"* indicator was yellow in two years since 2010; otherwise, as in 2017, it obtained green qualification.

The area of commitment to safety, in 2016, was characterised by 3 green, 5 yellow and 1 red indicators. The number of red indicators did not change in comparison with the preceding year, the yellow ones decreased by one, while the number of green indicators increased by one. There were 13 green, 7 yellow and 2 red attributes among those 22 safety attributes that provided basis for the indicators. There was no degrading attribute in this area.

- The *"Deviation from planned state"* indicator, except four years, was red in the last ten years due to the red qualification of the *"Number of modifications of the Operational Limits and Conditions"*. The qualification of the indicator improved to yellow in 2016 and kept this qualification in 2017. The *"Temporary modifications"* and the *"Operational instructions"* attributes obtained yellow qualification.
- 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 and kept this qualification in 2017.
- The *"Deviations in the reporting system"* indicator was red in the 12 years of the period between 2006 and 2017 (as well as in 2017) and yellow in three years. This qualification in 2017 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"* has been green in the last three years, since the reporting requirement was always fulfilled within two hours.
- The *"Radiation protection programme effectiveness"* indicator has been yellow in the last two years as a consequence of the yellow qualification of the *"Significantly radiation hazardous work programmes"* attribute.
- The *"Industrial safety programme effectiveness"* indicator remained yellow in 2017, due to the yellow qualification of the *"Workplace accidents"* attribute.
- The *"Human factor"* indicator became green in 2017 due to the improvement of the *"Inappropriate condition for working*" attribute.
- The *"Self-assessment"* indicator has been 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 and 2017, due to the yellow qualification of *the "Corrective measures of investigations"* attribute.
- The *"Operational experience feedback"* indicator improved form yellow to green, due to the improvement of the *"Reoccurring events*" attribute from yellow to green.

The HAEA identifies the critical safety attributes each year. These are those attributes, which are below the unacceptable level for at least three years. In 2017, the *"Authority ordered event investigations"* reached the critical level.

Events

17 reportable events occurred in 2017, including two immediately reportable events. The number of reportable events shows a decreasing trend in the recent years; with a small fluctuation, even in a longer period of time. In 2017, an event with SCRAM I actuation occurred once, in addition to one event with SCRAM III actuation. Human or documentation errors were identified 11 times by investigations. The authority determined eight events as reoccurring events. Real ECCS actuation did not occur in 2017, natural phenomenon did not cause any event, and no 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 needed emphasis. The most frequently (five times) affected system in

2017 was the Diesel generator. Greater attention and the investigation of causes are justified in this area.
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 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 most of the events were insignificant from the viewpoint of the core damage probability increment. Among the events, the Events No. 1972 and No. 1967 were significant from the risk increment point of view, since the associated conditional core damage probability increment exceeded 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 the number of reportable events, events entailing SCRAM-I actuation, and of events entailing the inoperability of two safety systems did not change in comparison with 2016. The number of events associated with the Diesel generator, reoccurring events, and of events entailing SCRAM III actuation decreased. The number of events entailing forced power reductions exceeding 50%, and of events associated with foreign material slightly increased; however, this value was not extraordinary in the view of the last 5-10 years. Every event was classified as INES 0, without safety significance. Events entailing the violation of the Technical Specifications or ECCS operation had not occurred since 2014. SCRAM-I had not occurred during operation since 2015. There was no radiation safety related event in 2017. Both the ratio and the number of events induced by human errors slightly decreased in comparison with the preceding year. The licensee submitted each and every regular report in due time.
It is a continuous expectation of the authority towards the license to strengthen its efforts towards safety commitment 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 258 regulatory decisions in 2017, including 139 resolutions and 119 decisions. Among the decisions, 166 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. 26 on-scene walkdowns were conducted prior to granting 16 licenses for utilisation, where the representatives of the competent authorities and the licensee took part. Among the licensed building activities, the continuation of the renewal and reconstruction of buildings, the building-reinforcements and the improvement of the integrity of fire segments are to be mentioned. Additional 77 resolutions and 71 decisions were made in relation to licensing proceedings connected to practices of civil engineering profession.

The number of decisions related to Paks Nuclear Power Plant increased in comparison with 2016. 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. The delays in the implementation of certain safety improvement measures and modifications in comparison with the original schedule were caused by the changes in the technical concept and the legal background of the public acquisition proceeding.

Inspection

In 2017, 554 inspections were recorded at Paks Nuclear Power Plant. The HAEA conducted one comprehensive inspection at the facility, in accordance with its annual inspection plan. On-site inspections were performed by the HAEA in connection with the periodic test of safety equipment and system (42), monitoring the operating state of the concerned unit and the general technical conditions of the facility (180), specific modifications (26), and activities made during the main overhauls of the units (112). During the inspections, there was no need for any immediate action or intervention to the operation; however, the representatives of the authority several times observed such deviations, which required to implementation of corrective actions.

As a consequence of the licensing proceeding connecting to service life extension of Unit 4, the HAEA conducted more inspections at Unit 4 than in the preceding year. Room inspections were conducted in many cases. During the inspections, the authority reviews a given area from mechanical engineering, electrical, instrumentation and control, civil engineering, radiation protection and administrative viewpoints. The nuclear safety inspectors inspected 212 times the adequacy of the preliminary safety assessment of the planned modifications. The HAEA inspected the documentation of the safety engineering reviews of pressure retaining systems 43 times, including the review of several hundred documents. The documents included the passports of pressure retaining equipment, inspection reports serving as supporting documents of records in the passports, and licenses related to these examinations.

In 2017, Documentations Substantiating the Operation After Modification were approved in 48 cases.

Nuclear Emergency Response

In accordance with the provisions of the Nuclear Safety Code (NSC) issued as the annex to the Govt. decree 118/2011. (VII.11.) Korm. on the nuclear safety requirements for nuclear facilities and on the associated regulatory activities, Paks Nuclear Power Plant shall conduct, at least once a year, a full scale nuclear emergency response exercise with the participation of the entire Emergency Response Organisation and shall provide opportunity for the participation of off-site contributing organisations. This exercise was held in November 2017 by the Paks Nuclear Power Plant. Total electrical power loss caused by collapse of the national electrical power network, together with the break of the main steam collector of Unit 3 was the initiating event of the exercise, which events

together simulated a scenario led to radioactive release. In addition, the scenario assumed the simultaneous leakage of a dangerous chemical. The Emergency Response Organisation of Paks Nuclear Power Plant 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, Paks Nuclear Power Plant is prepared for the management of nuclear emergencies affecting more units on the site simultaneously. During Severe Accident Management exercises, the Emergency Response Organisation demonstrated that it could respond to multi-unit emergencies.
Besides, Paks Nuclear Power Plant conducted three unannounced alerting drills for the duty officers of the Emergency Response Organisation, in order to verify their appropriate readiness. Additionally, it participated in the international "ConvEx-3" exercise organised on June 21-22, 2017 by the International Atomic Energy Agency as the host facility of the postulated event.

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, utilization of external experience, and the review of inspections conducted together with co-authorities. During the regulatory activities in relation to the assessment of human factors, no problem that could fundamentally jeopardise safety 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 2017, the HAEA concluded that the **facility operated in compliance with the legal requirements**. The operation of the facility **did not mean a health risk increment for both the employees of the SFISF and the public**. The low value of occupational radiation exposure further decreased, 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 can be stated that the nuclear safety level of the nuclear facility in 2017, in comparison with 2016, decreased in the area of „Smooth operation", while increased in the areas of „Operation with low risk" and „Operation with a positive safety attitude". The „Adequate planning of the fuel loading period" attribute, due to its red qualification requires enhanced regulatory attention.

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

In 2017, the safety performance indicator system (SPIS) of the SFISF was composed of 1 red and 9 green indicators. Among the attributes, 1 was red and 18 were green.

The **area of smooth operation attributes** was in the unacceptable range due to one attribute. The "State of systems and equipment" indicator is red as a consequence of the red qualification of the *"Adequate planning of fuel loading period"* attribute. The re-definition of the time planned for the management of received containers that affects the value of the attribute resulted in a value that is closer to reality in the last two years. Based

on the qualification in 2017, the indicator requires enhanced regulatory attention. 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.

The **area of operation with low risk** obtained good qualification, all of its attributes were in the green range. The *"Risk"* indicator improved from yellow to green. The other indicator of the area, *"The Environmental risk"* got green qualification for years.

In the **area of operation with a positive safety attitude** the qualification of the *"Violation of requirements"* attribute of the *"Human factor"* indicator improved from yellow to green; each indicator of the area was in the green range. The *"Independent internal audits"* attribute of the *"Striving for improvement, self-assessment"* indicator kept its green qualification in the second year after its red qualification in 2015. 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 2017, reportable event relating to either operation or construction did not occur; in addition, no event occurred under indirect reporting obligation.

Licensing

The HAEA made 7 regulatory decisions related to the SFISF in 2017. Two decisions connected to the approval of the Workplace Radiation Protection Rules (WPRPR), while another decision was a modification license for the replacement of the sliding rail connection of the container transport cart. The other decisions related to the amendment of the construction license and the extension of the facility.

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 operator PURAM, 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 modules of the SFISF was granted, with the involvement of the competent co-authorities, by the decision of the HAEA on June 26, 2015, with a validity until December 31, 2033. This construction license relates to the extension with chambers according to recent technical designs.

The PURAM, in addition to extending the storage facility, assessed whether the SFISF capacity could be further increased at 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 old spent assemblies having relatively low residual thermal power, instead of assemblies spent only for three years. This assumption makes a 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 an 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 denser configuration. This modification requires the modification of the loading board. Its increasing storage capacity will make it 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' service life extension.

Accordingly, the PURAM submitted its license application "Amendment to the construction license of the SFISF in relation to chambers 25-33" on February 8, 2016, based on which the HAEA initiated a licensing proceeding aiming at amending the construction license. The proceeding was completed in 2017 by the amendment to the construction license. After that the authority granted the construction license for the module extension (chambers 25-28) identified as Phase 3 of Step III of the SFISF.

Activities associated with the extension of the SFISF

According to the valid licenses the extension of the SFISF, designed to host 33 chambers, completed 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 were 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.

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 2017 by the issuance of the utilisation and commissioning licenses. The HAEA, during on-site inspections, oversaw the works, then it participated in the active commissioning test of chambers 21-24.

SFISF Periodic Safety Review

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 had to be performed by the licensee of the facility, in 2017, 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. On November 30, 2017, the PURAM submitted the Periodic Safety Review Report to the authority; its review will be performed by the authority in 2018.

Inspection

In 2017, the HAEA conducted 13 inspections at the facility. The more important inspections were connected to the commissioning of the technologies belonging to the actual module identified as Phase 2 of Step 3 of the modular facility; particularly, the commissioning processes completing the modification of the storage tube monitoring and measurement data collection systems and of the chamber temperature measuring system were inspected. The authority performed an on-site inspection during the modifications of the electrical technology extension and of the low voltage systems.
The modification of the path measuring system of the bridge of the SFISF refuelling machine was completed. In addition, the authority performed an inspection in connection with the foreign material found in the front unit of the refuelling machine. One of the last processes of the extension of the storage facility was the extension of the Radiation Protection Monitoring Systems (RPMS) and the modification of the integration of the radiation protection signals into to the RPMS of Paks Nuclear Power Plant, which were also inspected by the authority. During the inspections the authority verified that the licensee performed the extension related modifications by keeping the deadlines, making the necessary documents available and ensuring the appropriate material and human conditions, in compliance with the requirements established in Volume 6 of the NSC.

Other inspections

The annual inspection plan of the authority included other inspections, which supported the verification of the safe operation of the storage facility. The HAEA inspected twice the maintenance activity of the SFISF, once the implementation of the civil engineering ageing management programme and once the appropriate operation of the release and environment monitoring systems. In addition, also in 2017, the authority inspected the loading process of the spent fuel elements to the SFISF.
The PURAM completed the renewal of the access point of the Entrance and Operative Control Building at its Paks site, and the construction works were observed by the authority on the site. The authority performed documentation checks regarding the internal audit process of the licensee, and its trainings and company examinations.
Immediate authority intervention was not justified during the inspections.

Nuclear Emergency Response

In the case of an emergency at the SFISF, the Emergency Response Organisation (ERO) of Paks Nuclear Power Plant performs the necessary tasks. According to the provisions of the NSC, the SFISF shall conduct a nuclear emergency exercise with the involvement of the entire Emergency Response Organisation once in every two years. This exercise was due in 2017. The exercise was conducted in May 2017, its initiating event was a damage to a fuel assembly and loss of its integrity during the loading of the spent fuel as a consequence of an inadequate operator manipulation. The exercise continued with the loss of the electrical power supply of the SFISF and then radioactive release to the environment occurred through open windows. The simulated situation was worsened by a fire affecting the refuelling machine. During the exercise, the emergency response organisation of Paks Nuclear Power Plant properly performed its tasks.

Human Factor

The HAEA inspected the training system based on its annual inspection plan. A representative of the HAEA participated in every authority licensing exam, who recorded his/her experience in inspection reports. It was concluded during the inspections that the organisation, conduct and documentation of the examinations were performed according to the effective provisions. The experience of the examinations were evaluated, and actions were implemented, as required. In line with the internal regulations, the professional areas of the licensee might propose different training topics. The review of the training material was performed in line with the internal regulations. In summary, it can be stated that such an issue was not identified which might jeopardise safety, thus immediate authority intervention was not justified.

2.3 BUTE INT Training Reactor

Based on the evaluation of the safety performance of the BUTE INT TR in 2017, 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 BUTE 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 „operation with low risk" is continuously good for years, the area of "smooth operation" moved to the authority acceptable range, while the "operation with a positive safety attitude" area moved to the range, which requires authority action.

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)

In 2017, the SPIS of the BUTE INT TR consisted of 1 red, 1 yellow and 10 green indicators. Among the safety attributes, 1 was red, 1 was yellow and 22 were green.

Three indicators of the **area of smooth operation**, namely the *"Operating performance"*, the *"State of systems and equipment"* and the *"Reportable events"* indicators got green qualification for years. The stable green qualification of the *"State of safety barriers"* indicator changed to yellow due to the yellow qualification of the *"primary cooling circuit*

integrity" attribute, as a consequence of an event, occurred in 2017, entailing the decrease of the reactor vessel water level due to the failure of a primary circuit valve.

In the **area of operation with low risk**, the *"Safety systems, equipment"* indicator kept its green qualification, currently for three years since 2015, because the *"Number of safety protection system failures"* attribute became green again based on the data of 2017. The other indicators of the area, the "Releases" and the *"Risk"* has been getting green qualification for years.

In the area of **operation with a positive safety attitude**, the *"Human factor"* indicator is red, because the *"Number of violations of the requirements"* degraded from yellow to red qualification. Out of the authority required actions prescribed in the resolution closing the Periodic Safety Review, 4 were not fulfilled by deadline, which were dealt by the HAEA as violations of the requirements. The indicator continuously has been showing warning qualification or requires authority intervention since 2008. In 2014, the Authority examined, in the frame of a revealing inspection, the situation associated with the violations of requirements, including the records of requirements. The inspection concluded that the area required greater management attention; thus, the licensee established an action plan. The authority inspected the implementation of the action plan in 2017 and concluded that the developed deadline tracking system is administratively capable to manage deviations, but the shortage of human resources might cause problem for dealing with more tasks. The Authority pays greater attention to this area also in the future. The other indicators of the area, the *"Striving for improvement, self-assessment"*, *"Operating experience feedback"*, *"Radiation protection programme effectiveness"* and *"Industrial safety programme effectiveness"* indicators have been continuously green for years.

Events

An event entailing safety system actuation, violation of the OLC or operation under the effect of the OLC, or an event induced by a natural phenomenon, a radiation safety related event or a human induced event did not occur at the BUTE INT TR in 2017. Two reportable events occurred in connection with valve closure failures, thus the second event could be considered as one having reoccurring nature.

Licensing

In 2017, in the course of its nuclear safety related public administration proceedings and regulatory oversight, the HAEA made 8 decisions. In connection with the WPRPR, the authority issued an interlocutory decision, a resolution and two decisions. Among the decisions, the resolution extending the operating license of the BUTE INT TR until June 30, 2027 and the decisions related to the Periodic Safety Review (PSR) (i.e. the decision requesting supplementation, the decision extending the deadline, and the resolution closing the regulatory review of the PSR) might be highlighted.

The PSR of the BUTE INT TR and its operating license:

In September 2016, the BUTE INT TR submitted the Periodic Safety Review Report completing the PSR to the authority, together with the operating license application. The authority involved 20 inspectors in 7 working groups in the review process. Several inspections and discussions were conducted during the regulatory review process between the representatives of the licensee and the authority. The senior management meeting with the rector of the BUTE was worth particular attention, where the management of the status of the Training Reactor within the management system of the University and the assurance of the priority of nuclear safety aspects at university level were discussed. A more important requirement was to review the procedures associated with the condition examination of the spent fuel bundles, and the maintenance and improvement of the civil engineering conditions of the reactor building. The regulatory review was terminated by the authority on August 1, 2017 with a resolution, taking into account the opinions of the three co-authorities (i.e. the Pecs Regional Office acting in the environmental protection and nature conservation scope of authority of the Baranya County Government Office, National Director of Disaster Management of the Ministry of the Interior, South-Buda Disaster Management Office of the Capital Disaster Management Directorate) participating in the evaluation. The HAEA prescribed several safety improvement measures to the licensee, which aimed at further enhancement of the level of nuclear safety. Based on the PSR, the HAEA extended the operating license of the BUTE INT TR with additional ten years, until June 30, 2027.

Inspection

The HAEA performed 10 nuclear safety inspections at the BUTE INT TR in 2017. Majority of the inspections connected to the modifications in progress and the licensing procedures. The HAEA revealed minor deviations during these inspections, which were corrected by the licensee.

The joint inspection performed together with the co-authority of the Department of Environmental Protection and Nature Conservation of the Pecs Regional Office of the Baranya County Government Office was aimed to verify the Quarter III radioactive release and environmental monitoring plan and the accomplishment of the requirements prescribed recently by the HAEA. The joint co-authority inspections revealed two minor deviations in connection with the secure archiving of release monitoring results and the maintenance scheduling of the release monitoring instruments.

During the inspection of the conditions after the renewal completed in 2016, the condition of the roof structure, the condition of the roof cover, the leakage of roof windows, the authority identified a failure at one element of the lightning protection system, which was repaired by the licensee.

During the inspection of the process of experience feedback and assurance of qualifications and competencies, the HAEA revealed that the systematic assessment and utilisation of information from external sources was not solved; in addition, the review of the Training and Qualifications Requirements System was not completed by deadline. During the inspection of the system established to follow deadlines, the HAEA identified

three deviations, in relation to the unclear establishment of responsibilities, the incomplete filling of data and the inappropriate screening of potential human errors.

The HAEA did not reveal any deviation during the inspections connected to the valve replacement on the primary circuit, which were aimed to verify the appropriateness of the applied technology and procedures. Similarly, the HAEA identified no deviation during the inspections connected to the PSR.
As a summary, it can be stated that the authority did not identify any fundamental problem jeopardising safety; ordering of any immediate regulatory actions was not justified.

Nuclear Emergency Response
The BUTE 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. This exercise was due in 2017. The exercise was conducted in December 2017; primary pipeline rupture under full power operation of the reactor was assumed during the exercise.

Human Factor
The HAEA inspected the training system based on its annual inspection plan. A representative of the HAEA participated in every authority licensing exam, who recorded his/her experience in inspection reports. It was concluded during the inspections that the organisation, conduct and documentation of the examinations were performed according to the effective provisions. The experience of the examinations was evaluated, and actions were implemented, as required. In line with the internal regulations, the professional areas of the licensee might propose different training topics. The review of the training material was performed in line with the internal regulations. In summary, it can be stated that such issue was not identified which might jeopardise safety, thus immediate authority intervention was not justified.

2.4 Budapest Research Reactor

Based on the evaluation of the safety performance of the BRR in 2017, the HAEA judged that **the facility operated in compliance with the legal requirements**. The operation of the facility **did not mean a 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 the area of "smooth operation" indicate an increasing number of technical issues caused by ageing of the research reactor. Accordingly, both the Licensee and the Authority shall pay more attention on the ageing management activities in order to prevent the appearance of failures. The area kept the level of the preceding year with 2 improving and 2 degrading indicators. The "operation with low risk" area held its flawless performance. Due to the warning qualifications in the area of "operation with a positive safety attitude" the Licensee has to improve the compliance with regulatory requirements and decrease the human error induced reportable events, while the Authority has to pay special attention to the enhancement of the level of safety culture within the organisation of the Licensee. The third area kept the level of the preceding year with 1 improving and 1 degrading indicators.

Figure 2.4-1: Budapest Research Reactor (source: http://www.innoportal.hu/wp-content/uploads/2016/08/budapesti-kutatC3B3reaktor.jpg)

In 2017, the SPIS of the BRR consisted of 3 yellow and 9 green indicators. Among the safety attributes, there were 4 yellow and 26 green. Comparing to 2016, the qualification of 3 attributes degraded from green to yellow, while 2 attributes improved from yellow to green and 1 from red to yellow.

In the main evaluation **area of smooth operation**, 2 attributes turned into the warning range and 2 improved. The "Nuclear measurement chains" attribute of the *"State of systems and equipment" indicator* degraded from green to yellow. Between 2010 and 2013, an event affecting the status of the measurement chains occurred every year, out of which two fell under reporting obligations. One failure related to the measurement chains in 2016, which was repaired by card replacement.
Two failures occurred in 2017, a measuring chamber and the connected measuring card were replaced. The failures indicate, despite the maintenance activity, the aged condition of the system. A part of the used elements (e.g. Z80 microprocessor ad its interfaces) represents the technology of the 80's. Despite that, the installed and spare cards were checked by a professional service provider in the frame of the corrective measures decided in 2015, and the critical elements of the CPU card were replaced, the reconstruction of certain elements of the instrumentation and control system is unavoidable in the future.
The qualification of the *"Unplanned shutdowns and power changes due to internal causes"* attribute of the *"Operating characteristics"* indicator degraded from green to yellow; however, the power reductions had no common cause.
The qualification of the *"Deviations from the planned campaign"* attribute of the *"Operating characteristics"* indicator improved from yellow to green. Due to the works connected to the replacement of the primary valve seat performed in 2016, all five reactor cycles planned for the second half of the year had to be deleted. Following the partial replacement of the secondary circuit pipeline, the first cycle of the reactor in 2017 started in May 8; deviation from the campaign did not happen.
The qualification of the *"Integrity of the secondary circuit"* attribute of the *"State of safety barriers"* indicator improved from yellow to green. The pipeline replacements required by the corrosion degradation of the secondary circuit pipeline system were completed in the course of the year.
Regarding the other indicator of the area, it can be stated that the only one attribute of the *"Events"* indicator, namely the *"Reportable events"* attribute is continuously green for years due to its value below the criterion level. However, due to the degrading trends of events, these criteria should be reviewed.

All indicators in the area of **operation with low risk**, namely the *"Releases",* the "S*afety systems and equipment"* and the *"Risk"* has been obtaining green qualification for years.

Special attention should be paid to the *"Violations of requirements"* attribute in the area of **operation with a positive safety attitude**. The attribute got red qualification in 2013, and then green in 2014 and 2015. As a consequence of 2 lately fulfilled requirement in 2016, the attribute became red again in 2016. The qualification of the attribute improved

to yellow in 2017; 1 deadline violation occurred during the fulfilment of legal obligations. The fulfilment of requirements in due time requires greater management attention.
Another attribute of the *"Human factor"* indicator, namely the *"The human induced events"* degraded from green to yellow, because human errors contributed to 2 events out of the five reportable events.
The other indicators of the area, *"Striving for improvement, self-assessment"*, *"Operating experience feedback"*, *"Radiation protection programme effectiveness"* and *"Industrial safety programme effectiveness"* has been green for years.

Events

In 2017, 5 reportable events occurred at the Budapest Research Reactor. During an event, the welds serving for the fixation of the legs of two fuel bundles were damaged. In the case of another event, three pieces of three-fuel-bundles were not in the position identified in the Preliminary Campaign Report. In addition, an event related to operator failure, and two others related to power loss of external power supply. Neither events had impact on nuclear safety.
No event entailing OLC violation, or operation under the effect of the OLC, or natural phenomenon induced, radiation protection related and no reoccurring event occurred in 2016. Based on the current evaluation, the reportable events did not exceed the warning level, but the degrading tendency of the recent years requires greater attention from the authority.

Licensing

The HAEA concluded one regulatory decision in association with the facility in 2017, which licensed the temporary modification of the OLC of the BRR, in order to allow the reactor start-up needed for reactor physics measurements during the inoperability due to the repair works on the secondary circuit.

<u>Main overhaul at the Budapest Research Reactor due to modifications</u>

The BRR did not operate between June 26, 2016 and March 8, 2017 due to two major modification works. In order to prevent radiation induced degradation of the plastic valve seats in the primary circuits, the facility started to use new type, metal-graphite-metal valve seats. The modification was authorised and continuously monitored by the HAEA. The replacement of the entire underground pipeline became necessary due to the corrosion induced degradation of the secondary circuit pipeline, which was performed under the authorisation and oversight of the HAEA. Both modifications were required by the implementation of corrective actions decided during event investigations.

Inspections

In 2017, the HAEA conducted 9 inspections at the facility. The authority inspected the maintenance works, the implementation of the obligations prescribed as an outcome of the comprehensive inspection performed in 2015, the process of Topical Peer Review, the replacement of the valve seats of primary circuit main closing valves, the examination of the capacity of the battery pack, the instrumentation and control system, and the assurance of qualifications and competencies.

During the building oversight inspection of specific civil structures, as identified by the NSC, the HAEA stated that the building was endangered by collapse; fallen cover elements and reinforced concrete corrosion traces could be observed. The locations endangered by collapse were cordoned at the scene. Following the inspection, the HAEA requested the licensee to develop a long term action plan aiming at refurbishing the building. The condition of the building is monitored closely by the authority.

In line with the annual plan, the HAEA performed also radiation protection inspection at the facility, together with the Department of Environmental Protection and Nature Conservation of the Pecs Regional Office of the Baranya County Government Office, and the Laboratory Section of the Public Health Department of the Baranya County Government Office performing the regulatory radiological assessment of environmental elements. The joint authority inspection was aimed to inspect the adequacy of the documentation associated with discharge monitoring, maintenance of instruments and their calibration. Due to the deviation revealed during the inspection in relation to the radiation protection logbook, the HAEA requested the licensee to take the necessary measures.

In summary, it can be stated that such an issue was not identified which might jeopardise safety, thus immediate authority intervention was not justified.

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. The next of such exercises will be organised in 2018. In November 2017, the HAS ERI conducted a table-top exercise for its Disaster Prevention Organisation.

Human Factor

The HAEA inspected the training system based on its annual inspection plan. A representative of the HAEA participated in every authority licensing exam, who recorded his/her experience in inspection reports. It was concluded during the inspections that the organisation, conduct and documentation of the examinations were performed according to the effective provisions. The experience of the examinations was evaluated, and actions were implemented, as required. In line with the internal regulations, the professional areas of the licensee might propose different training topics. The review of the training material was performed in line with the internal regulations. In summary, it can be stated that such issue was not identified which might jeopardise safety, thus immediate authority intervention 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 2017, 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: "Event reporting 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". In 2017, the HAEA published a new guideline "Safety classification of systems, structures and components of Hungarian radioactive waste repositories". In general, the guidelines provide regulatory recommendations for the fulfilment of the legal requirements for radioactive waste repositories.

Based on the evaluation of the safety performance of the NRWR in Bátaapáti in 2017, the HAEA determined that **the facility operated in compliance with the legal requirements**. The operation of the facility **did not mean a 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.

The evaluation main areas, the indicators and attributes of the safety performance indicator system supporting the assessment of radioactive waste repositories had been developed, the data collection is in process. The evaluation criteria system will be established based on the experience gained.

Events

In 2017, 3 reportable events occurred during the operation of the NRWR. Two of these events related to painting loosening and one to the failure of an electric fuse.

Licensing

In 2017, in connection with the NRWR, based on the submitted documents, the HAEA commenced the safety review of eight planned modifications, and three regulatory licensing proceedings were initiated under the effect of the relevant Govt. decree. The licensing proceedings related to the construction of the I-K3 chamber reinforced concrete basin, and the documentation modification of the NRWR WPRPR and OLC. In addition, the operating license proceeding of the NRWR completed in 2017, which became necessary due to the expiration of the operating license and the extension of the operating part of the underground storage unit.

Inspections

In 2017, the HAEA performed 20 on-site inspections at the NRWR and documented them in inspection records. Out of them 6 inspections were related to realised modifications, 4 to the operation of the repository, and 10 to the construction of the repository. A complex regulatory inspection was conducted in the construction phase of the repository, where 3 authorities (i.e. the HAEA, Labour Affairs and Labour Safety Section of the Employment, Family Support and Social Security Department of the Szekszard Regional Office of the Tolna County Government Office, and the Mining Section of the Regulatory Department of the Baranya County Government Office) jointly performed inspections. Immediate action, intervention affecting the operation or the construction had not to be ordered during the inspections.

Nuclear Emergency Response

According to the law, the radioactive waste repositories shall conduct, at least biannually, a nuclear emergency response exercise with the participation of the entire organisation,

with the involvement of off-site emergency response organisations. The last of such exercises was organised by the NRWR in 2016, thus it will be due in 2018. A table top exercise was organised in 2017 at the facility.

Human Factor

During an inspection, the HAEA reviewed the qualification and labour safety conditions at the facility. The PURAM had exemptions regarding certain NSC and RSC requirements by the end of 2017. The preparation for the compliance with the requirements was made adequately and timely. The HAEA did not reveal any deviation during the inspection.

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)

Regulatory Oversight of Radioactive Waste Repositories

In 2017, the HAEA continued its regulatory activities regarding the radioactive waste repositories, which commenced in the second half of 2014, after the Govt. decree 155/2014 (VI.30.) Korm. entered into force. Accordingly, the development of guidelines describing the method of fulfilling the requirements falling under the scope of authority of the HAEA that were established in the Govt. decree 155/2014 (VI.30.) Korm. Six guidelines entered into force in 2016: "Event reporting 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". In 2017, the HAEA published a new guideline "Safety classification of systems, structures and components of Hungarian radioactive waste repositories". In general, the guidelines provide regulatory recommendations for the fulfilment of the legal requirements for radioactive waste repositories.

Based on the evaluation of the safety performance of the RWTDF in 2017, the HAEA determined that **the facility operated in compliance with the legal requirements**. The operation of the facility **did not mean a 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.

The evaluation main areas, the indicators and attributes of the safety performance indicator system supporting the assessment of radioactive waste repositories had been developed, the data collection is in process. The evaluation criteria system will be established based on the experience gained.

Events

Reportable event (event induced by a natural phenomenon, radiation safety related event, etc.) did not occur at the RWTDF in 2017.

Licensing

In 2017, in connection with the RWTDF, based on the submitted documents, three regulatory licensing proceedings were initiated under the effect of the Govt. decree 155/2014. (VI.30.) Korm. The licensing proceedings related to the review of the defined safety zone of the RWTDF, the installation of the new waste management technology aiming at the volume reduction of the worn waste packages on the site of the RWTDF, and the modification of the hot cell crane in the operating building of the RWTDF. An authority proceeding was initiated under the effect of the Govt. decree 487/2015. (XII.30.) Korm. on the protection against ionising radiation and the associated licensing, reporting and inspection system, which is aimed at the approval of the WPRPR of the RWTDF. In addition, the licensing proceeding regarding the operating license of the RWTDF, initiated upon the request of the PURAM Ltd was completed in 2017, as well as the review of the Periodic Safety Review Report of the RWTDF submitted in the end of 2016 in line with the provisions of the Govt. decree 155/2014. (VI.30.) Korm.

Inspection

In 2017, the HAEA performed 12 on-site inspections at the RWTDF and documented them in inspection records. Out of them 5 inspections related to realised modifications, and 7 to the operation of the repository. Immediate action or intervention to the operation was not necessary during the inspections.

Nuclear Emergency Response

According to the law, the radioactive waste repositories shall conduct, at least biannually, a nuclear emergency response exercise with the participation of the entire organisation, with the involvement of off-site emergency response organisations. In 2017, the RWTDF organised two table top exercises. The initiating event of the exercises in 2017 June was dispersion of the radioactive powder within the building, during compression of waste, due to splitting of a barrel.

Human Factor

During 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 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

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

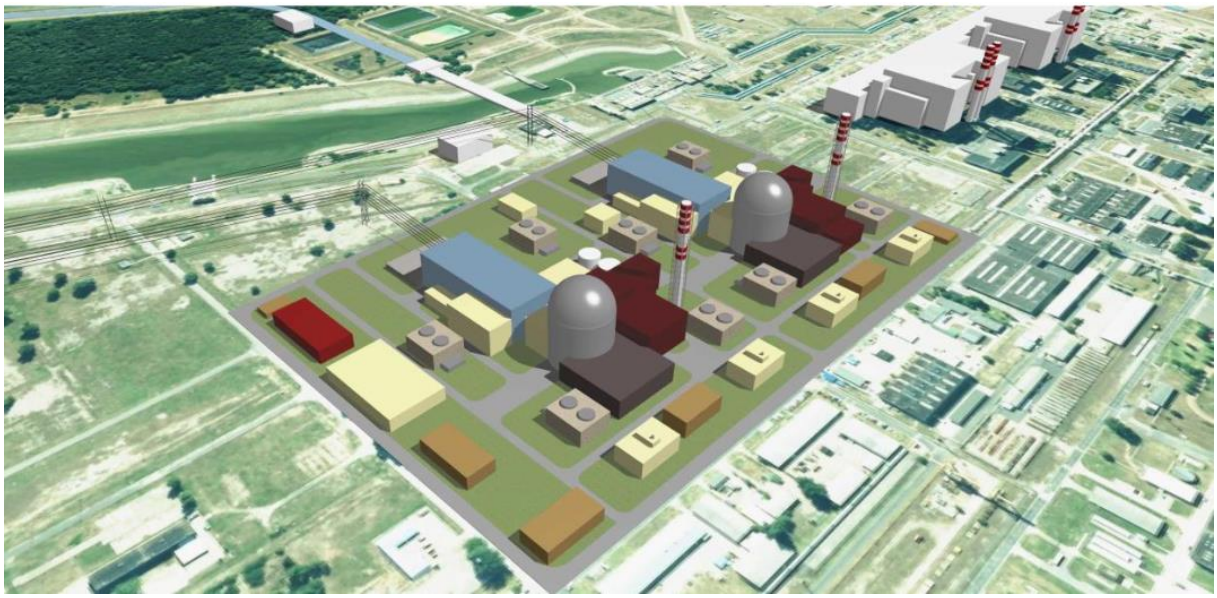

Figure 2.7-1: Design view of the new units (Source: http://www.mvmpaks2.hu/)

Events

Reportable event did not occur at the Pak II Ltd in 2017.

Licensing

Site permit

The HAEA, with its resolution No. HA5919, issued the site survey and assessment license on November 14, 2014. In 2015 and 2016, 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 Paks II Ltd submitted its site permit application for the site of the new nuclear power plant units to the HAEA, which included the Site Safety Report (hereinafter referred to as SSR) and the completion report of the GRP. 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 National Directorate General for Disaster Management as co-authorities. The Scientific Council of the HAEA was involved in the review of the SSR. In the frame of the proceeding, the HAEA hold a public hearing on December 13, 2016.

The HAEA granted the site permit on March 30, 2017 in its resolution P2-HA0008. The obligations prescribed in the site permit are fulfilled by the Paks II Ltd by the defined deadlines.

Other licences

Besides the site permit, the HAEA issued 6 resolutions in 2 topics.

The HAEA, in its own scope of competence, initiated a proceeding regarding "action plan to be developed for the regulatory evaluation of the comprehensive inspection"; the HAEA ordered Paks II Ltd to develop an action for each regulatory comment appearing under a unique identifier in the evaluation report of the comprehensive inspection, and establish an action plan taking into account the executive summary of the evaluation report. The HAEA, with its resolution P2-HA0024, ordered the implementation of the action plan established by Paks II Ltd.

In 2017, Paks II Ltd submitted two building license applications for the complex of hydraulic assembly companies and for the complex of management and service buildings. The review of the license applications was commenced by the HAEA, but Paks II Ltd withdrew the applications before the administrative deadline, thus the HAEA terminated the proceedings in both cases.

Inspection

The HAEA performed two targeted inspections in 2017. During the inspections, immediate actions, intervention to the activities did not become necessary.

During one of the targeted inspections, the HAEA verified the status of the fulfilment of the conditions of the P2-HA0008 resolution and checked whether the licensee provided all the site survey data needed for the design to the main contractor. The inspection revealed that the fulfilment of the obligations of the P2-HA0008 was in progress, the licensee could keep the deadlines. The transfer of the information needed for the design was continuously performed.

The other targeted inspection examined the awareness of NSC requirements. Paks II Ltd presented the documents of its two-day training on "Introduction to the requirement system of the NSC". The training was completed by an examination for each participant. In the case of contractors, if they perform work having effect on nuclear security, the nuclear qualification is a precondition. The nuclear qualification process is performed based on a pre-defined question list, which always includes questions regarding knowledge of the NSC and its training.

Audits

In 2017, in connection with contractor oversight, Paks II Ltd primarily performed the nuclear qualification procedures of the main contractor and its major designer sub-contractors, and of other organisations having role in design related works of the new units. Out of the 18 procedures, 11 were performed with on-site audits, while 7 without on-site audits, via documentation review. The HAEA participated, as observer, in 10 on-

site audits. Following the audits, the licensee granted the qualification to the indicated contractor activities to all but one contractor.

Evaluation of Regular Reports

The conditions of the site permit obliged the licensee to submit, by the 10th day of each month, a summary about the design related activities and the on-site works associated with the construction of the facility, with the content as follows:

a. Activities in progress, postulated activities;
b. Activities performed by the licensee serving for the justification of the adequacy of the design;
c. Supplier qualification and evaluation activities planned, in progress and completed;
d. Revealed non-conformances occurred, safety related events, their evaluation and the corrective actions decided;
e. Changes in the organisation of the licensee;
f. Changes in the number of personnel of the licensee, with particular attention to the changes in management positions;
g. Construction related regulatory proceedings in progress.

The HAEA received 8 status reports in 2017 (counted from May, according to the resolution), which were continuously reviewed and evaluated.

I. Annex: Methodology of the regulatory assessment

Safety has overriding priority above all other aspects during the operation of nuclear facilities. The HAEA annually assesses and evaluates the safety performance of the nuclear facilities and radioactive waste repositories falling under its regulatory competence.

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

- collects the operational data and creates their trends;
- gains inspection and licensing experience;
- 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 and radioactive waste repositories 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 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 safety of the operation of the nuclear facilities and radioactive waste repositories 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. The comparison with the results and performance indicators of previous years can be relevant for the evaluation of the safety performance in the actual year.

I.1. Safety Performance Indicator System (SPIS)

The safety performance indicator system, at the request of the HAEA, 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 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 SFISF, the BUTE INT TR, and the 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. In connection with the oversight of the radioactive waste repositories, the HAEA started its regulatory activity in the second half of 2014. The evaluation main areas, the indicators and attributes of the safety performance indicator system supporting the assessment of radioactive waste repositories had been developed, the data collection is in process. The evaluation criteria system will be established based on the experience gained.

The appropriate selection of indicators allows continued monitoring, 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, semi-annual report, annual report, campaign preliminary report, campaign report, campaign closure report, main overhaul report, maintenance report, repair 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 and the radioactive waste repositories. 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 the data of

safety attributes, trend development, calculation of safety performance indicators, and the preparation of the summary assessment and the sections describing the evaluation of events, inspections, licensing, organisational aspects and nuclear emergency response.

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,
- operational safety,
- 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.

Due to the differences between the facilities, the evaluation of the safety performance is based on different attributes. The number of attributes and indicators are shown in the below table:

	Paks NPP	**SFISF**	**BUTE INT TR**	**BRR**	**RWTDF**	**NRWR**
Number of main evaluation areas	3	3	3	3	3	3
Number of evaluation areas	9	-	-	-	-	-
Number of indicators	22	10	12	12	10	10
Number of attributes	58	19	24	30	19	19

Table I.1-1: Number of attributes and indicators for each facility

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 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 facility or radioactive waste repository about the results of the assessment, 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 substitutable safety attributes; thus, the colour qualification of a safety indicators is made on the basis of the weakest colour qualification of its composing safety attributes.

The change of the safety performance level is shown in a circle diagram (see Figure I.1-2). 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.

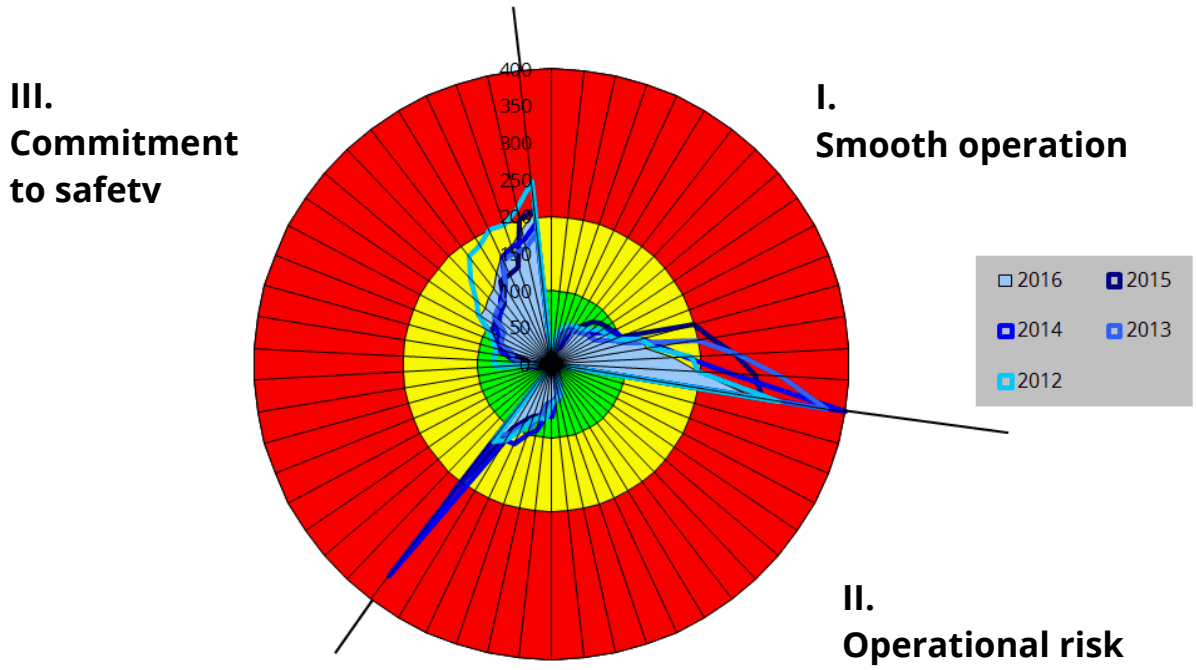

Figure I.2-1: SPI circle diagram

I.3. Safety assessment of events

The HAEA introduced a complementary method for the safety assessment of events. The evaluation activity is based on the so called IRS codes developed and implemented by the International Atomic Energy Agency, which are incorporated into the authority investigation and record keeping system. The evaluation methods categorise 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.

The safety assessment of events aims at better indicating the order of importance among the reportable events (typically INES-0, so below scale events having no safety significance).

II. Annex: Hungarian nuclear facilities and radioactive waste repositories

II.1. Paks Nuclear Power Plant

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

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. BUTE INT 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://www.aeki.kfki.hu/

II.5. National Radioactive Waste Repository

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 (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/