REGULATORY ASSESSMENT OF THE HUNGARIAN NUCLEAR FACILITIES AND RADIOACTIVE WASTE REPOSITORIES IN 2015

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 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 2015 regarding the three safety areas of evaluation that a small change could be experienced in the area of “smooth operation” and “commitment to safety”, while no significant change can be experienced in the area of “operational 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 2015. The safety evaluation of events shows similar results of safety performance than in the preceding year.

The safety performance of the SFISF was similar as in the year of 2014; however, further minor intervention is required by the inadequate attributes in order to reach flawless

performance. The operation of the facility did not mean health risk increment either for the employees of the SFISF or 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 is flawless in two main evaluation areas, while steady and good in one area for years.

It is still necessary for the licensees of the nuclear facilities to strive for eliminating issues, maintaining and enhancing the safety level and specifically the level of safety culture. In order to facilitate their efforts, the regulatory oversight focuses on the respective areas to reach adequate safety performance.

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 is still under development; however, data are available in relation to a few indicators. The future application of the safety performance indicator system will provide the possibility to follow changes, qualify deviations, assess trends, and detect tendencies early. The progress in the collection of the relevant data will allow performing a comprehensive evaluation of the safety performance in the future.

Based on the evaluation of the safety performance of the NRWR in Bátaapáti in 2015, 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 2015, 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 units of the nuclear power plant, the improvement measures determined based on the Targeted Safety Reassessment processing the lessons learned from Fukushima, and the site survey programme of 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 potential impacts 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 summary 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 2015, 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 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 2015**.

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

It can be summarised about the safety performance as reflected by the safety performance indicator system[1] that regarding the three safety areas of evaluation a small change could be experienced in the area of "smooth operation" and "commitment to safety" in comparison with the preceding year, while no significant change can be experienced in the area of "operational safety".

[1]see Annex I, the methodology of regulatory evaluation

*In 2015, **the area of smooth operation** was characterised by 2 green, 1 yellow and 3 red indicators*:

- The *"maintenance planning"* indicator is red due to the *"ratio of performed and planned work orders"*, which assesses the deviations from the maintenance plan. In 2015, the "*ratio of planned and real length of main overhauls*" got also red qualification. The current qualification of the *"ratio of performed and planned work orders"* attribute was caused by the relative large number of work orders planned as supplementary work after the finalisation of the main overhaul plan; while the "*ratio of planned and real length of main overhauls*" attribute became red due to the elongation of the main overhaul on Unit 1 with 17 days.
- The *"state of the barriers"* indicator is red due to the value of *"fuel reliability"* attribute during the year, since three assemblies became inhermetic at Unit 1. These assemblies were removed in the frame of the annual refuelling.
- The *"reportable event"* indicator became red, after the yellow qualification of the last year, due to the increase in the number of *"authority ordered event investigations"*.
- The number of green indicators is stable, it has not changed since 2012. The *"unplanned shutdowns and power reductions"* and *"repairs"* indicators got adequate qualification.

In **the area of operational safety**, there is one red indicator besides the six green ones:

- The *"operator preparedness"* indicator became red after a green period from 2012, due to the degradation of the *"number of failed licensing exams"* attribute (three out of twenty licensing exams were failed).
- In 2014, the number of green indicators decreased from six to four, and then in 2015 it increased back to six. Accordingly, the *"actual challenges of safety systems"*, the *"availability"*, the *"emergency preparedness"*, the *"risk during operation"*, the "*risk in analysis*" and the *"environmental risk"* indicators were all green.

Essentially, **the area of commitment to safety** contains the measurable characteristics of safety culture. In 2015, there were four green, three yellow and two red indicators:

- The *"deviation from planned state"* indicator, except two years, was red in the last ten years, which is caused, in general, by the red qualification of the *"modification of the OLC"* attribute, since the Operational Limits and Conditions were amended 14 times in 2015, in majority, due to modifications or other inevitable changes.
- The *"violations of requirements"* indicator is at most characterised by the *"violations of licensing conditions"* attribute; usually this attribute affects the indicators. This attribute was red in 2015.
- The number of green indicators is stable; it had not changed since 2013. The *"radiation protection programme effectiveness"*, the *"self-assessment"*, and the *"operational experience feedback"* indicators are all green.

The HAEA identifies the critical safety attributes each year. These are those attributes, which have red qualification for at least three years. In the past, the number of

critical safety attributes were 2-5, but thanks to successful actions the number of critical safety attributes was only one in the last five years. The improving trend shows the commitment of the plant to enhance its operation. In the period of 2012-2015, the critical safety attribute is the ***"ratio of performed and planned work orders"***. However, it should be taken into account that the increase of this indicator may also indicate the high level of commitment to safety.

Events

15 reportable events occurred in 2015, including five immediately reportable events. The number of reportable events show a decreasing trend in the last four years; with a small fluctuation, even in a longer period of time.

Events with SCRAM I actuation occurred three times, while an event with SCRAM III actuation occurred once in 2015. Human or documentation errors were identified 12 times by investigations. The authority determined three events as reoccurring event. Real ECCS actuation did not occur either in 2015. Natural phenomenon did not cause any event. In addition, events related to radiation safety did not occur 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 (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. A decreasing trend can be observed from 2013, but the special attention and the investigation of causes are still justified.

The register of the HAEA was extended by 10 such events in 2015, where the non-compliant performance of a supplier contributed to the occurrence of an event. Consequently, the HAEA pays special attention to the assessment and management of issues relating to the activities of the suppliers and their oversight.

The NUBIKI, a technical support organisation of the HAEA, performed the probabilistic based safety analysis of the reportable events of Paks Nuclear Power Plant to identify the impact of all the events and each 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 Event No. 1850 slightly exceeded the threshold value of 1.0E-06 applied for the identification of precursor events; however, based on the assessment, development of corrective actions was not required for decreasing the risk. In the case of event No. 1862, an event persistence period longer than that specified in the analysis performed based on basic assumptions, was designated for sensitivity analysis.

It can be stated based on the safety evaluation of the events that enhancement is 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%. 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 155 decisions in 2015. The number of decisions, besides the increase in their technical complexity and safety impacts, slightly decreased compared to the number of 2014. Among the decisions, 130 decisions were related to Units 1-4 of Paks Nuclear Power Plant, 2 decisions to the newly constructed units of the nuclear power plant, 16 decisions to the SFISD, 1 decision to the BRR, 1 decision to the TUBE INT TR and 4 decisions to the Radioactive Waste Treatment and Disposal Facility (RWTDF). No decision related to the National Radioactive Waste Repository (NRWR) was made by the HAEA. The number of decisions related to Paks Nuclear Power Plant decreased in comparison with 2014. Majority of the decisions were made in connection with the tasks and modifications and completion of the related licensing procedures associated with the 15 month long operating cycle and the introduction of the fuel having 4.7% average enrichment, the service life extension of Units 1 and 2, the completion of putting the severe accident prevention and management procedures into operation, and prorated implementation of safety improvement measures derived from the Periodic Safety Review and the Targeted Safety Re-assessment. The other part of the decisions was required by the elimination of deviations revealed during the inspection of equipment and system components and during maintenance activities, their replacement by more modern and new types, and by refurbishments and equipment modernisations. These also contributed to the enhancement of the safety level. 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 reconstruction of buildings, building reinforcements and the increase of the integrity of fire sections should be mentioned.

Inspections

Besides the 454 inspections recorded at Paks Nuclear Power Plant, two comprehensive inspections were conducted by the HAEA, according to its approved inspection plan. On-site inspections were performed as follows: cyclic tests of safety equipment and systems were inspected 42 times, the operating conditions of the units and the general technical situation at the nuclear power plant were inspected 166 times, 31 inspections targeted the modifications, and the main overhaul activities were inspected 85 times.

There was no need for any immediate action or intervention to the operation. The nuclear safety inspectors inspected 219 times the adequacy of the preliminary safety assessment of the planned modifications.

The MVM Paks NPP Co. conducted 99 qualification procedure at its suppliers; the representatives of the HAEA participated in 41 on-site qualification audit. The HAEA did not identify any severe deviation during the audits.

The most important regulatory inspections in 2015:

Implementation of the safety improvement measures prescribed during the Periodic Safety Review (PSR) performed in 2008:

The implementation of the improvement measures prescribed during the last PSR continued in 2015. The PSR completed on December 15, 2008 resulted in the prescription of implementation of 169 safety improvement measures, which shall be executed in the period of 2009-2018 under strict regulatory oversight. One of the most important task of the safety improvement measures is the provision of the conditions for severe accident management on the units of the nuclear power plant, which task was completed in 2014.

The safety improvement measures prescribed as the result of the PSR were completed with the exception of 1 measure. The task still in progress is the modification of the motor control of the isolation valves on the pipeline between the reactor pressure vessel and the boron concentration measuring instrument to fully ensure the isolation function in case of fire. The modification was completed on Unit 3 in 2015, it will be performed on the other units during the main overhauls in 2016.

Safety improvement measures prescribed during the Targeted Safety Re-assessment (TSR) in 2011:

Subsequent to the accident at the Fukushima Nuclear Power Plant, the member states of the European Union operating nuclear power plants executed a TSR to improve the safety of their nuclear power plants. As an outcome of the Hungarian safety re-assessment, the nuclear safety authority ordered the implementation of several safety improvement measures, and closely monitors their progress. These measures aimed at increasing the available safety margins of the nuclear power plant, since the re-assessment concluded that the completion of the design basis was not necessary.

Operation of the units of Paks Nuclear Power Plant beyond their design service life:

The regulatory activities associated with the operation of the units beyond their design service life (service life extension) were connected to the compliance with the licensing conditions of the service life extension of Unit 2 and the licensing proceeding of the operation of Unit 3 after its design service life.

Defects appearing on certain parts of the main cooling pumps:

In the frame of international cooperation, the operators of VVER-440 type units provided information on damages to certain parts of the main cooling pumps circulating the coolant of the reactor (hereinafter referred to as MCP) detected during their inspections, on the so-called guide wheel and the head of the pump. In order to utilise the international experience, the HAEA required Paks Nuclear Power Plant to examine the condition of the mentioned parts of each MCP during maintenance activities.

In order to comply with the requirement, the licensee initiated an examination programme in 2013, during which fatigue induced defects were identified on the guide wheels and heads of the MCPs at Paks Nuclear Power Plant. According to an expert opinion, the defects do not mean any safety risk in short term. However, the long term safe operation requires the repair of these parts with the application of the technology developed by the original Russian manufacturer and the Russian material science expert institute or they have to be replaced. The licensee elaborated the schedule of the repairs and replacements in 2014, which was approved by the HAEA. Accordingly, the repairs and replacement started, under the strict regulatory oversight of the HAEA, in 2015 and will be completed in 2020.

Activities associated with the spent fuel pools and their cooling systems:

Due to the leakage occurred at the spent fuel pool of Unit 3 in 2013, the HAEA paid attention to the inspections performed on the cooling circuits of the spent fuel pools of each unit in 2014 and 2015. In December 2014, the HAEA granted approval for the operation of the spent fuel pool of Unit 3 until the end of the planned service life of the unit (December 31, 2016). In its resolution, the HAEA ordered the implementation of certain tasks, which aimed at understanding the details of the corrosion state and ensuring the conditions of the long term safe operation of the pools. In its decision on the service life extension of Unit 2, the HAEA prescribed tasks in connection with the spent fuel pool of Unit 2.

Operation of the units with 15-month operation cycle:

The proceeding aimed at licensing the transition of the units to 15-month operation cycle was one of the major regulatory activities performed in 2015 related to the operating units of Paks Nuclear Power Plant.

Safety culture

The MVM Paks Nuclear Power Plant Co. declared its commitment to the overriding priority of nuclear safety and continuous enhancement of a strong safety culture in high level documents of the management system (i.e. “Vision and Strategy, Safety Policy”). The commitment to safety is continuously overseen by the authority.

2.2 Spent Fuel Interim Storage Facility

Based on the evaluation of the safety performance of the SFISF in 2015, 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).

The performance shown by the safety performance indicator system degraded in one main evaluation area, the adequate level was maintained in another area, and all indicators have adequate value, due to the improvement of one attribute, in the third area.

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

In the **area of smooth operation**, the qualification of two attributes of the *"state of systems and equipment"* indicator changed from yellow to green. The *"adequate planning of fuel loading period"* had green qualification in the period of 2006-2011, with the exception of 2010, when it slightly exceeded the upper limit value of the green field (10%). In 2012 and 2013, the planned and executed loading period differed more significantly (by 16% and 13%, respectively). The greatest value of the period evaluated so far occurred in 2014 (17.63%). Due to the warning value of the indicator, the HAEA conducted an on-site inspection on March 25, 2015, where the representatives of the HAEA and the PURAM recorded that the licensee had to review the process of loading, the definition of loading

period, its measurement method and target value. The review revealed that the developments executed on the fuel loading machine resulted in shorter loading periods; thus the HAEA modified the definition of the indicator of the planned time for serving containers from the value of 160 hour/container to 130 hour/container. As a test, the new definition was applied during the evaluation in 2015; according to the current evaluation the introduced modification fits the purpose of the review.
Besides, another attribute, the *"adequacy of the gas supply system"* of the *"state of systems and equipment"* indicator showed improvement. Following the enhancing trend of the previous years, the performance of the *"adequacy of the installed radiation protection monitoring system"* is good for years.
The other indicators of the area, the *"storage characteristics"* and *"events"* has been continuously green for years.

The indicators of the **area of operation with low risk** *("environmental risk"* and *"risk"*) continuously had green qualification in the recent years.

In the **area of operation with a positive safety attitude**, the *"independent internal audits"* (C/II/1) attribute of the *"striving for improvement, self-assessment"* indicator changed from green to red. In 2015, no internal audit was performed at the SFISF, and management reviews, as required by the NSC, was neither performed, since the auditor organisation changed the validity of the certificate to April 2016. The date of the internal audit was postponed, in agreement with the above date, to the first quarter of 2016.
The *"violations of requirements"* indicator, after a very high value in 2013, kept its good qualification obtained in 2014. The other indicators, namely the *"collective dose"*, *"striving for improvement, self-assessment"*, *"operating experience feedback"*, *"radiation protection programme effectiveness"* and "*industrial safety programme effectiveness*" showed adequate value and green qualification from the beginning of the reporting period.

Events
Reportable event (event induced by a natural phenomenon, radiation safety related event, etc.) did not occur at the SFISF in 2015.

Licensing
In 2015, as in 2014, the HAEA made 10 regulatory decisions in relation to the SFISF. The most important decisions related to the extension of the facility. According to the modular structure of the SFISF serving for the interim storage of the spent fuel assemblies of Paks Nuclear Power Plant, based on the current licenses, the extension with a module of 4 chambers (chambers No. 21-24) are in progress out of the designed 33 storage chambers. The schedule of the implementation of the extension programme is in harmony with the needs for the storage capacity of Paks Nuclear Power Plant. In 2015, the manufacturing of the major technology components needed for the extension of the SFISF was performed under the regulatory oversight of the HAEA.
The manufacturing and inspection of almost 2100 storage tubes will be completed in 2016. The manufacturing of the leakage monitoring system of the storage tubes and the

rail and power system of the refuelling machine were completed; based on the licenses issued in 2015 by the HAEA, they will be installed in 2016. The commissioning of the extension of the SFISF with chambers 21-24 is expected to start in the end of 2016.

Inspection

In 2015, the HAEA conducted six inspections at the facility. Two inspections were related to fuel loading, three inspections to extension and one inspection to the SPIS. The on-site inspection of the modification of the distance measuring system of the bridge of the SFISF refuelling machine, programmed in the annual inspection plan of the HAEA, was postponed to 2016, due to the rescheduling of the works.

During the inspections, the authority did not identify any problem jeopardising the basic safety of the facility, 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.

2.3 Safety performance of the TUBE INT Training Reactor

Based on the evaluation of the safety performance of the TUBE INT TR in 2015, 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).

As reflected by the Safety Performance Indicator System[2], based on the qualification of the safety attributes and their summing safety indicators, 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 small 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)

The **area of smooth operation** has good qualification for years. All the indicators of the area, namely the *"operating performance"*, the *"state of systems and equipment"*, and the

[2]See Annex I., Methdology of the regulatory evaluation

"state of safety barriers" continuously show good results from safety point of view for years. The number of *"reportable events"* is adequately low.

In the **area of operation with low risk**, the *"safety systems, equipment"* indicator improved to green, because the *"number of safety protection system failures"* attribute became green based on the data in 2015. In 2013 and 2014, 1-1 failure occurred, but there was no such failure in the safety protection system in 2015. The other indicator of the area, *"risk"* did not show any problem. The *"releases"* indicator consisting of *"airborne releases"*, *"liquid radioactive discharges"* and *"solid radioactive wastes"* attributes has a favourably low value 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 year.
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 continuously green for years.

Events
Reportable event (event induced by a natural phenomenon, radiation safety related event, etc.) did not occur at the TUBE INT TR in 2015.

Licensing
The number of decisions in relation to the TUBE INT TR decreased in 2015. The HAEA granted a modification license (HA-6020) for the reconstruction of the nuclear measurement chains of the TUBE INT TR.
Based on the periodic safety review (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.

Inspection
The HAEA performed 4 on-site inspections to verify the nuclear safety of the facility. The HAEA inspected the annual maintenance of the Training Reactor, it inspected twice the modification of the nuclear measurement chains and once the data collection associated with the SPIS. The inspection of the RPMS modification scheduled in the inspection plan, was postponed to 2016 due to the longer time needed for the installation.
During the inspections, the authority did not identify any problem jeopardising the safety of the facility.

Safety improvement measures:

The safety of the Training Reactor was intended to be further improved in 2015, including upgrades of major building technology and high-power systems, the radiation protection monitoring system, the waste water treatment system, the replacement of primary circuit and other valves, and more important civil engineering maintenance activities. However, due to the elongation of the public acquisition procedures, the works are postponed to the next year.

Nuclear emergency response

On May 27, 2015, the TUBE INT TR held a joint emergency management and reactor building evacuation exercise. The first one was a group specific exercise with the participation of the Reactor Safety and Assessment Group, the latter one affected everybody who stayed in the reactor at that time.

The TUBE INT TR held its full-scope emergency response exercise on December 12, 2015. Subsequently, the HAEA ordered the organisation of another emergency response exercise to the TUBE INT.

2.4 Budapest Research Reactor

Based on the evaluation of the safety performance of the BRR in 2015, 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).

As reflected by the Safety Performance Indicator System[3], based on the qualification of the safety attributes and their summing safety indicators, it can be summarised about the safety performance that the area of "smooth operation" is continuously good for years, only one attribute is yellow. The "operation with low risk" area and the "operation with a positive safety attitude", with fluctuations, hold their almost flawless qualification.

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

It should be emphasised on the main evaluation **area of smooth operation** that all attributes obtained a green, i.e. adequate qualification in 2012; however, the values changed in two sub-areas in 2013, then among them, the *"radiation monitoring system"* improved in 2014. In 2015, the *"state of systems and equipment"* changed from green to

[3]See Annex I., Methdology of the regulatory evaluation

yellow due to three failures associated with the nuclear measurement chains. These failures demonstrated that besides regular maintenance, certain elements of the instrumentation and control system had to be reconstructed in longer term. The qualification of the *"operating performance"* indicator improved from yellow to green due to the refurbishment of the compressor of the cold neutron source in 2015. Regarding the other indicators, the *"state of safety barriers"* is adequate, the *"number of events"* is low.

In the area of **operation with low risk**, the qualification of the *"solid radioactive waste"* attribute of the *"releases"* indicator improved from yellow to green. The other indicators, so the *"safety systems and equipment"* and *"risk"* continuously held the green qualification.

All indicators obtained green qualification in the area of **operation with a positive safety attitude**. Special attention should be paid to the "violations of requirements", which improved from the red qualification in 2013 (violation of compliance with requirements by deadline in 4 cases) to green in 2014 (0 case) and it held the green qualification in 2015 (0 case).

Events

In 2015, 3 reportable events occurred at the Budapest Research Reactor. The failure of the automatic power control system was reported twice. The third event was induced by the loss of the external power supply that caused automatic shutdown of the reactor.
Natural phenomenon induced, radiation protection related or human error induced event did not occur in 2015. Two of the three above-mentioned events entailed real safety protection actuation.

The common cause of the events associated with the failure of the automatic power control system demonstrated that the assessment of the ageing processes of the instrumentation and control measurement chains, the identification of the degradation jeopardising safety and the execution of the needed reconstruction require special attention. The implementation of the corrective measures determined in the 2015 report of the BRR is strictly overseen by the authority.

Licensing

The number of decisions made in relation to the BRR decreased in 2015, since the implementation of safety improvement measures ordered as an outcome of the PSR successfully completed.
The HAEA issued only one license in 2015, which was related to the modification and modernisation of the radiation protection system of the BRR. In the frame of the modernisation of the BRR Radiation Protection Measurement and Monitoring System (RPMMS), the licensee replaced the detectors by more modern instruments. In the frame of the modification, the licensee established an integrated display and evaluation interface with the involvement of the measurement data of the airborne release monitoring system (ARMS) and the radiation protection measurement system of the Outside Spent Fuel Store (OSFS), which operated as standalone sub-systems in the past.

Inspections

In 2015, the HAEA performed a comprehensive inspection at the BRR, with the aim to inspect the nuclear safety, management and certain operating processes of the BRR. During the comprehensive inspection, the professionals of the HAEA conducted examinations in 10 sub-areas, verified the operation of the ageing management programme, the management of the radioactive wastes, the operation of the maintenance programme, the operation of the safety protection system, the process of authentication of measurement instruments, the examination programme of pressure retaining tanks, the process of preparation of regular reports, the management of the interface between nuclear safety and security, and the utilisation of the experience gained from the expert walk-down of the EURASC regional meeting.

The on-site phase of the comprehensive inspection did not reveal any such nuclear safety issue, which would have required urgent regulatory action. The authority requested the licensee to prepare an action plan to the management of the revealed deviations.

In addition, the HAEA inspected 6 times the nuclear safety of the facility on the site. The inspections were planned. The HAEA inspected the modification of the discharge monitoring system, the summer maintenance activity, the status of the reserve control rod modification, the practice of complying with regulations, and the execution of the corrective measures induced by two events (No. 1790 and 1792) occurred in 2014. The inspection of the administration processes of the BRR concluded that the internal regulation of the administration processes of the BRR should have been re-inspected after 2 years as minor deviations were found in the practice of complying regulations.

In the frame of the corrective action decided in response to the leakage of the sealing of the Tuflin main closing valves, reported as event No. 1792 in 2014, a pre-irradiated sample series of the material of the installed sealing was used on the primary circuit pipelines. The assessment of the sample series was completed in the summer maintenance period in 2015. The assessment revealed damages to the samples, thus the valve seats have to be replaced probably in a year. The professionals of the BRR commenced the preparation for this work.

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

Safety improvement measures:

In 2014, six out of the seven cases of unplanned power changes of the reactor were caused by the failure of the cold neutron source (CNS). In 2014 and 2015, the compressors and other subparts of the CNS were renewed in several steps, and thanks to that power change occurred only once in 2015 due to the failure of the CNS.

The electronics of the automatic rod control worked well after the maintenance and renewal; however, the replacement of the control to a more modern instrument is unavoidable in a longer period of time.

Nuclear emergency response

The BRR held an INES classification exercise on May 18, 2015 for the operators of the reactor.

The BRR held an exercise on December 7, 2015 with the aim to verify the visual information transfer through the modern, wireless communication channel about an accident potentially occurring on the site, and the relocation of the protected command post due to increasing radiation level.

Both exercises were conducted without any significant issue, thus immediate regulatory action was not necessary.

The full scope exercise with the involvement of the entire emergency response organisation of the BRR and the off-site emergency response organisation is due in 2016.

In the frame of the regulatory oversight of the nuclear emergency response activities, the HAEA observed the conduct of the above mentioned nuclear emergency response exercises.

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 2015, 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 continued. The first two published guidelines, the *"Regulatory inspection of radioactive waste repositories"* and the *"Regular reports of radioactive waste repositories"* entered into force in 2015.

The development of the safety performance indicator system of radioactive waste repositories for supporting their evaluation is still in progress; however, data are available for a few indicators. The future application of the safety performance indicator system will make it possible to monitor changes and qualify deviations, analyse trends, and detect potential changes in an early phase. The comprehensive evaluation of the safety performance will be possible as more data will be collected.

Based on the evaluation of the safety performance of the NRWR in Bátaapáti in 2015, 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 2015.

Licensing

In 2015, in connection with the NRWR, the HAEA categorised 5 newly planned modification based on the submitted documents. The HAEA approved the categorisation of 3 modifications to category 3 and 1 modification to category 2, but disapproved the categorisation of 2 modifications to category 3. A regulatory licensing procedure, falling under the scope of the Govt. decree 155/2014. Korm was initiated in 2015, in relation to deepening of the survey drills in the subsurface controlled zone of the NRWR.

Inspection

In 2015, the HAEA conducted 22 on-site regulatory inspections and documented them in records at the NRWR in Bátaapáti; 1 was related to an executed modification and 21 were related to the operation of the repository. 4 out of the latter 21 aimed at inspecting the waste acceptance process.

Immediate action or intervention to the operation was not necessary during the inspections.

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 2015, 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 2015.

Licensing

In 2015, in connection with the RWTDF, the HAEA categorised 8 newly planned modification based on the submitted documents. The HAEA approved the categorisation of 5 modifications to category 3 and 3 modifications to category 2. Three regulatory licensing procedures, falling under the scope of the Govt. decree 155/2014. Korm, were initiated in 2015. In addition to the issuance of the relevant modification licenses for the reconstruction of the venting system of the operation building and the execution of safety improvement measures after the closure of the RWTDF, building licenses were also granted in these cases. Additionally, a modification license was issued, after meeting the specified conditions, for the restoration of the operating state of the RWTDF in Püspökszilágy, in order to terminate the suspension of the waste treatment activity ordered in the end of 2013. This license authorizes for, after their acceptance, the treatment of wastes on the site (e.g. selection, conditioning, and packaging) and their appropriate preparation for interim storage or final disposal.

Inspection

In 2015, the HAEA conducted 5 on-site regulatory inspections and documented them in records at the RWTDF in Püspökszilágy, and it conducted a two-day-long comprehensive inspection, which focused on the following main topics: ageing management, waste treatment procedures, management of suppliers, transportation, emergency response, maintenance, management of safety, organisational and administrative factors.
Immediate action or intervention to the operation was not necessary during the inspections.

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.

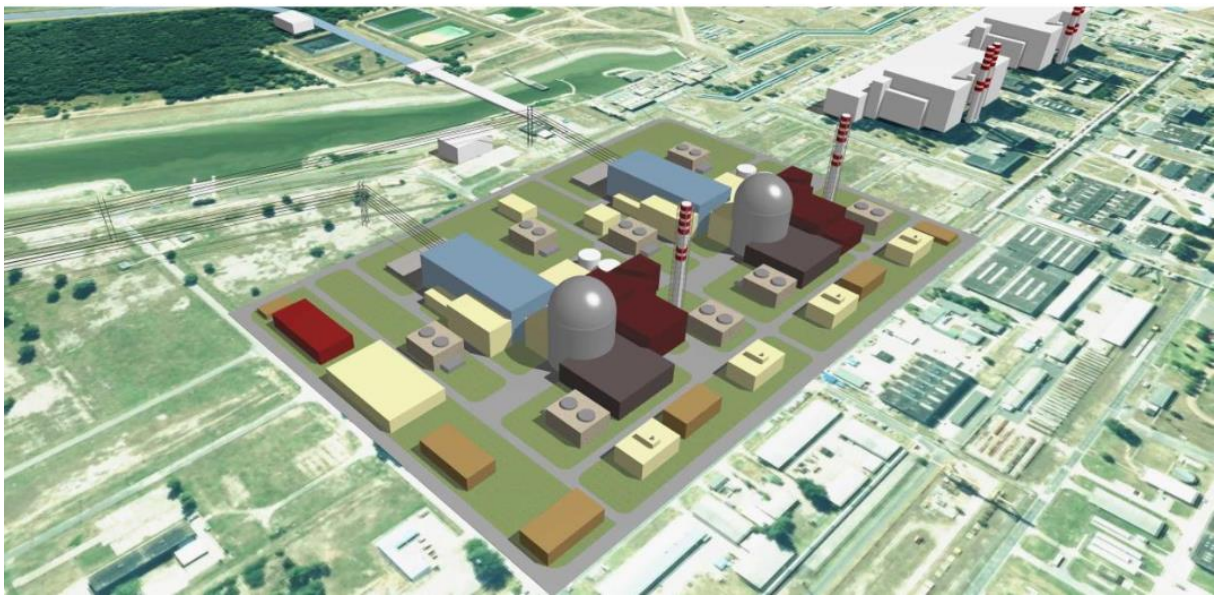

Figure 2.7-1: Design view of the new units (Source: http://www.mvmpaks2.hu/)

Site survey and evaluation

The goal of the site survey and assessment is to identify those site characteristics that potentially prevent construction, to assess and evaluate the site-specific hazard factors, and to determine the site specific and nuclear facility relevant data to be taken into account during the design.

The HAEA, with its resolution No. HA5919, issued the site survey and assessment license on November 14, 2014. In 2015, 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.

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, provides information on the progress of the execution of the actions plan, which is continuously monitored by the HAEA.

Laws and guidelines

The Act VII of 2015 on the investment regarding the sustention of the capacity of Paks Nuclear Power Plant and on the amendments to certain acts was promulgated in the beginning of 2015, including amendments to the Atomic Act.

The HAEA published 21 regulatory guidelines relating to the new units in 2015, in order to facilitate the project in meeting the legal requirements.

Events

Reportable event did not occur in 2015 in relation to the MVM Paks II Ltd.

Licensing

The HAEA did not receive any license application from the MVM Paks II Ltd in 2015.

Preliminary Safety Information Report - PSIR

The legal basis for the submission and evaluation of the 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.

Inspection

In 2015, the HAEA performed a comprehensive inspection at the MVM Paks II Ltd. Additionally, the HAEA performed six regulatory inspections at MVM Paks II Ltd.

Immediate measures or intervention to the operation were not required.

The MVM Paks II Ltd started the preparation for its tasks falling under its responsibilities.

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 2015, which were continuously reviewed. The first status report of 2015 contained 23 open tasks, out of which 9 tasks were completed in 2015 and 13 tasks were modified. In August, the MVM Paks II Ltd proposed the supplementation of the action plan with additional 12 tasks.
The information provided in the status reports was inspected by the authority.

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 tendencies in due time. 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. 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 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.

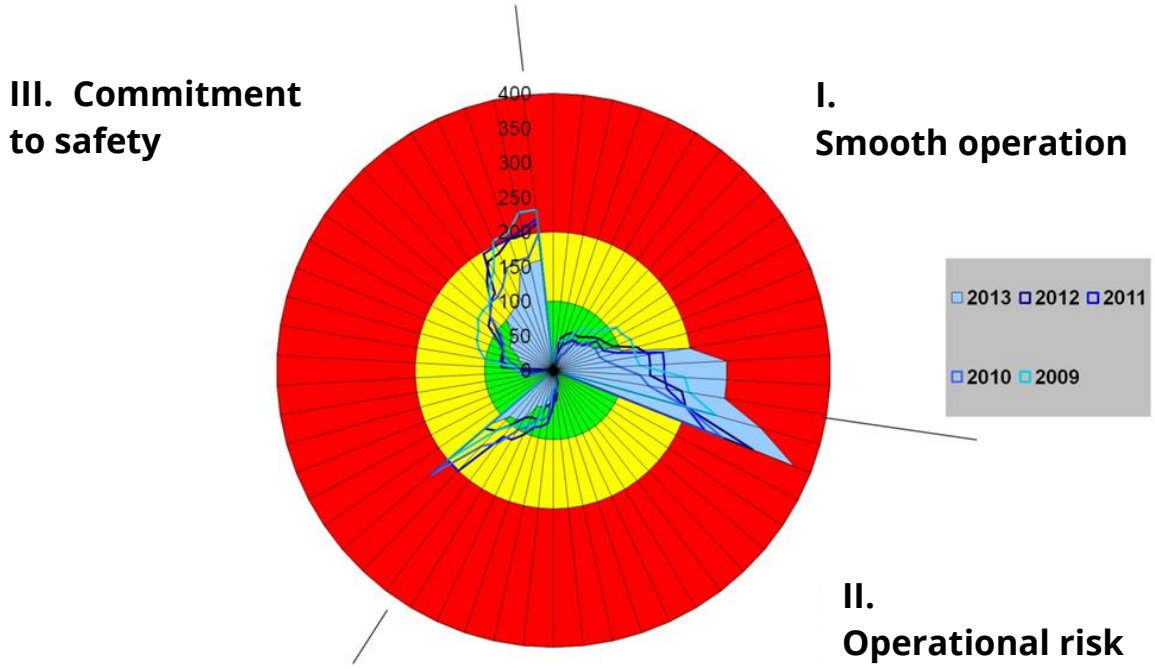

Figure I.1-2: SPI circle diagram

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	Start of operation	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	Start of operation	Site	Internet site
Shallow land disposal	5040 m^3	1976	2166 Püspökszilágy 043/20 Land No.	http://www.rhk.hu/letesitmenyeink/rhft/