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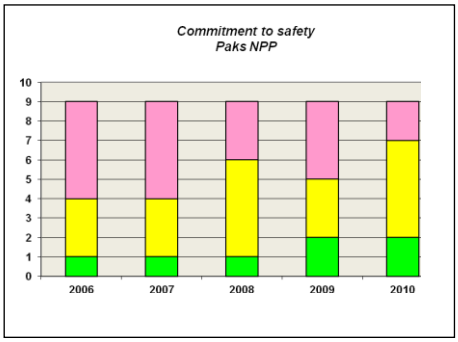
RECENT DEVELOPMENTS IN NUCLEAR SAFETY IN HUNGARY

October 2011.

General

Safety Performance Assessment 2010

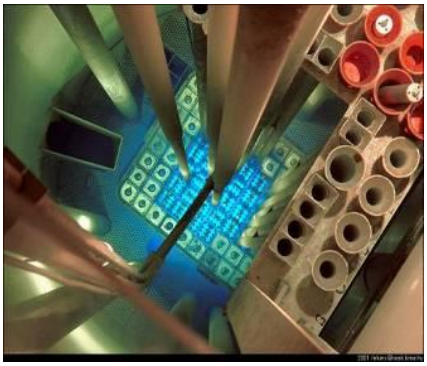
According to the several years regulatory practice the Nuclear Safety Directorate of HAEA has assessed the safety performance of the nuclear facilities in Hungary (Paks NPP, Interim Spent Fuel Storage Facility (ISFSF), Training Reactor of the Budapest University of Technology and Economics (BUTE Training Reactor), and Budapest Research Reactor (BRR)) for the year 2010.



The assessment is based on a system of safety performance indicators, which includes groups characterizing the smooth operation, the operation with low risk and the attitude to safety, respectively. The assessment also takes into account the safety related events and the experiences from regulatory inspections. The most important conclusion is that the nuclear facilities worked according to the respective rules

also in 2010. The safety performance of Paks NPP significantly improved in 2010, particularly in the weakest one of the three major areas (i.e. Commitment to safety). If the licensee remains committed to the elimination of deficiencies, then the trend will not break and the results are expected to improve further.

The level of safety performance of the ISFS facility somewhat decreased in 2010 compared to the high level of previous years, however after evaluation of the degraded indicators it is expected that the former, outstanding level will return.



The safety performance of the BUTE Training Reactor did not change in 2010 compared to 2009, and its nuclear safety level is outstanding.

The safety performance of the Budapest Research Reactor was as favourable in 2010 as in the preceding years, and the nuclear safety level is outstanding.

Legal and Regulatory Framework

Modification of Atomic Energy Act

In 2011, the Hungarian Parliament modified the Act CXVI of 1996 on Atomic Energy. The most important elements of the modifications can be summarized as following:

- The extent of principles determining the use of atomic energy extended. The IAEA Safety Principles published since the last modifications were completely built in the current Atomic Energy Act.
- As the HAEA become a government office, the activities and functions of the regulatory body of the safe use of atomic energy (HAEA) is now written in an act (instead of a Government decree, as formerly).
- The toolkit of the regulatory surveillance formerly covered only licensing, inspection and enforcing. It was significantly extended by the act modification: Further the regulatory assessment is a tool mentioned in the act: assessment of the feedback of the experience gained from operational experience and its effectiveness; assessment of indicators of the technical and organisational processes, technical and event indicators referring to a

safety level, construction of numerical indicators of risk and their data acquisition; assessment of online accessible data, etc.)

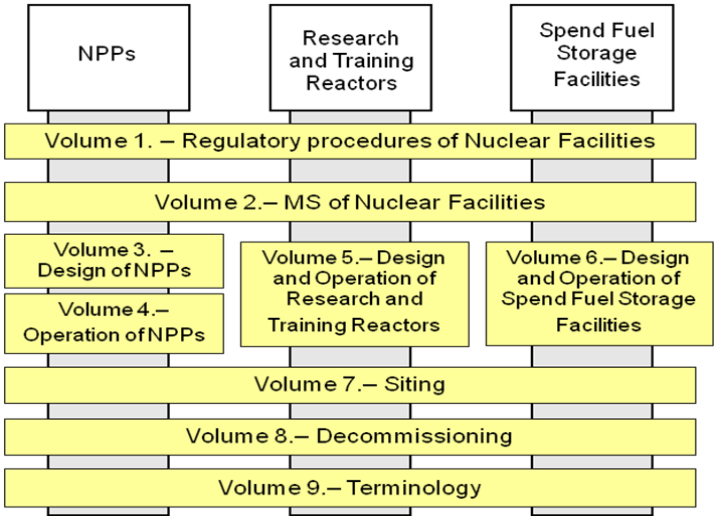
- The licensee of the radioactive waste repository, the spent fuel interim storage and disposal facility is allowed to inform the public via local governments associations aiming to control and inform. The new regulation covers special requirements of the establishing such local government associations, and the regulation on how to join these association.
- The licensing oriented regulatory activity changed in the last years with the implementation of different regulatory methods and it will change further. The modification supports the inspection that completes and partly supplements the licensing of modifications of nuclear facilities and the inspection program tracking the lifecycle of the modification.
- By the modification, the preliminary evaluation of knowledge of the experts, who give expert's opinion being mandatory in field of nuclear safety, and the registration process of these experts were settled on the act level.
- The legislative regulation of the security appears in the Atomic Energy Act due to the modification. The act defines the most important concepts and the main goals of nuclear security and physical protection.
- The Parliament provided a conceptual approval to start the preparatory activities of new unit(s)' construction on Paks NPP site. This process leads to the licensing of new unit's construction. The surveillance fee is paid for the HAEA now only by the operators of operating nuclear facilities. The construction of an installation having already a construction license requires increased regulatory surveillance; therefore the act extended the payment of regulation fee to cover also the nuclear facilities under construction.

New nuclear safety codes

According to rules of the Atomic Energy Act (Act Nr. CXVI of 1996) and its executive decree (Government decree 118/2011), the Hungarian Atomic Energy Authority (HAEA) shall review and improve as necessary the national nuclear requirements at least in each five years taking into account the achievements of science and the national and international experience.

According to this duty, the HAEA reviewed the regulation released in 2005 (Government decree 89/2005). The new set of requirements will step into force on 01.11.2011 subsequent to the review. During the review those reference levels defined by WENRA (Western

European Nuclear Regulators Association) were built in which were not present in the national set of requirements. Beside this the requirements and recommendations of IAEA published since 2005, the suggestions of international reviews and also the experience coming from the use of the requirements were taken into consideration.



The set of requirements was completed by two new volumes (Vol. 7: Site assessment and Vol. 8: Decommissioning) in order to define requirements for all sections of the lifecycle of the nuclear facilities. Also the other six volumes constituting the annexes of the governmental decree were refreshed significantly and modern requirements were added to them. The structure of the published regulation is shown by the figure above.

HAEA internal

New head of the HAEA Nuclear Safety Directorate

Dr. Ivan Lux, former Deputy Director General

Mr. Gyula Fichtinger acting Deputy Director General

At the request of the European Commission Ivan Lux, former Deputy Director General of the Hungarian Atomic Energy Authority will coordinate the organization of the international regulatory reviews in Vienna at the International Atomic Energy Agency. He resigned as

governmental servant and left the HAEA in the end of July. Gyula Fichtinger, Head of NPP Supervision Department has been assigned the position of acting Deputy Director General by József Rónaky, DG of HAEA.

HAEA completed its preliminary report regarding the Targeted Safety Reassessment of Paks NPP

The completion of the Targeted Safety Reassessment was demanded by the Council of the European Union for each and every European nuclear power plant. During the course of the reassessment those responses to extreme situations had to be investigated. The recommendation for the implementation of such remedial actions, which would enable the avoidance of consequences such as in Fukushima, in every reasonably imaginable situation, was expected. The reassessment shall be carried out in accordance using the method accepted by the European Commission and its regulatory working group (ENSREG). Paks Nuclear Power Plant handed over the progress report, regarding the reassessment, to the Hungarian Atomic Energy Authority. The HAEA prepared the preliminary national report for the European Commission based upon this report.

Bird's eye view of Paks NPP site

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

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

Further to the investigation of the problem areas laid out by ENSREG, the reassessment carried out by HAEA also includes the national legislation regarding the requirements of nuclear safety.

Preliminary National Report

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

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

Hungarian Atomic Energy Authority
Budapest, September 14th 2011

		Signature	Date
Editor:	dr. Ferenc Adorján HAEA chief adviser		13/09/2011
Controlled by:	Gyula Fichtinger DDG of HAEA		13/09/2011
Approved by:	Dr. József Rónaky DG of HAEA		14/09/2011

Paks Nuclear Power Plant will complete its final report before the 31st of October 2011, which will then be evaluated by the HAEA before the 31st of December 2011. The HAEA will identify the actions that the power plant must take, to achieve the goals of the reassessment, and then shall inform the European Commission. The reports from the European countries will be subject to an international reassessment organized by the European Commission in the first half of 2012.

The preliminary report can be accessed on the website of the HAEA:

http://www.oah.hu/web/v2/portal.nsf/att_files/brochur/$File/CBF_EJ_Eng.pdf?OpenElement

Hungarian Cultural Heritage Days at HAEA

On 17th September 2011 HAEA opened the doors to the public in the framework of the Hungarian Cultural Heritage Days. The organizers prepared a variety of programs to give an impression on the work of HAEA. First, the main fields of the HAEA activities were presented by three short lectures. The program continued at the Centre of Emergency Response, Training and Analysis (CERTA) with the presentation about the role of the HAEA Emergency Response Organization (ERO) in the case of nuclear emergency. The staff of Department of Technical Support showed briefly the work of ERO in a simulated nuclear accident at the Paks NPP. Visitors welcomed the presentation with great interest, and a number of questions were put to the staff. Many people watched the exhibition of posters on the first and second floors, which presented the multifaceted activities of HAEA. In front of each poster a colleague of HAEA was standing to help to obtain information and answer questions raised.

The interest of the participants indicated that many people were taken the information materials and at the end of the visit in large numbers filled the nuclear knowledge questionnaire. Small, symbolic gifts were received for the correctly filled questionnaires.

That the HAEA meeting room was packed more than once shows the big interest in the event, we received 194 visitors. The entries written in the guestbook reflect the visitors are curious about nuclear energy and the HAEA activities.

HAEA entrance walled up

Activists of Greenpeace Hungary walled up the main entrance to the HAEA headquarters on Wednesday, September 21 in protest against the preliminary report on stress tests at the Paks Nuclear Power Plant.

The action aimed to highlight “erroneous and false communication” about Hungary’s sole nuclear facility, Greenpeace told MTI.

The HAEA last week said that the tests, carried out under a European Council directive, had so far produced “positive results”. The final report will be ready on October 31, it said.

Greenpeace accused the HAEA of bias and called on the office to include independent experts from Western Europe in the review of the plant’s safety.

Budapest police started procedures to dismantle the wall and have taken in five protesters for questioning. (By MTI News Agency)

Greenpeace activists wall up entrance to HAEA

Nuclear Power Plant Paks

Severe accident management in Paks NPP

The aim of the introduction of severe accident management measures (including technical modifications) is to fulfil requirements of the nuclear safety regulations and to provide the enhanced safety of operation during the extended service lifetime of the four units of Paks NPP.

The below-mentioned set of technical and procedural modifications is intended to retain and cool the corium in the reactor pressure vessel, provide an additional autonomous electric supply, maintain the structural integrity of the confinement, provide important management measures and provide assistance for their implementation to the operator to stabilize the unit and return it to a controlled, stable state during an accident situation.

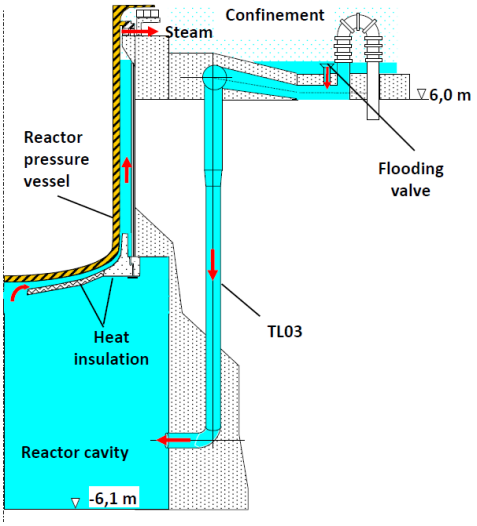
Reactor cavity flooding and external cooling of the reactor pressure vessel

The aim of this modification is to retain the reactor pressure vessel integrity in a severe accident situation with the external cooling of that and this way to avoid the core-concrete interaction and the resulting release of radioactive materials to the environment as a consequence of the reactor damage.

In a severe accident situation the reactor vessel and its cavity can be cooled with natural circulation using the water accumulated in the confinement. The flooding of the reactor cavity can be executed through the air duct pipelines TL03 of reactor cavity cooling.

To implement the flooding and cooling by natural circulation gauges, bobbers (level switches), filters, valves are needed to install and furthermore drill several holes in the biological shield.

In Unit 1 the installation work has been finished in 2011, and will be finished during the outages in years 2012÷2014 in Units 2÷4.



External cooling of the reactor pressure vessel

Establishment of the autonomous accident electric supply possibility

Autonomous accident electric supply

The function of the autonomous accident electric supply is to provide electric supply in case of a complete station blackout, when no safety power supply is available. The system provides electrical power supply for the depressurisation of the primary circuit, for the components needed for external cooling the reactor pressure vessel, and for the severe accident monitoring system.

To ensure autonomous accident electric supply four new mobile diesel aggregators and their new electrical connections to the safety power supply system have been provided. Practical realisation of the autonomous accident electric supply had been finished for all the units in 2011.

Installation of additional accident hydrogen recombiners

The aim of this modification is to prevent the buildup of the combustion concentration of hydrogen and this way keeping the confinement pressure under 3.35 bars to avoid the damage of its integrity in an accident situation.

For this purpose in the confinement of each unit sixty accident hydrogen recombiners had been installed beside the formerly installed sixteen design basis hydrogen recombiners to passively eliminate the produced hydrogen by catalytic combustion during a severe accident situation.

In 2011 the installation of the accident hydrogen recombiners had been finished at all four units.

Accident hydrogen recombiners in the confinement at Paks NPP

Severe accident monitoring system

The severe accident monitoring system provides important information for the using of severe accident management guidelines and to support decision-making during a severe accident situation.

The severe accident monitoring system remains operable during a severe accident situation and provides several important measurements as: reactor pressure, confinement water level, core exit temperature, reactor cavity water level, steam generator levels, confinement pressure, confinement temperature, confinement hydrogen concentration, spent fuel pool water level, reactor hall dose rate, and severe accident gamma dose measurement in the confinement to evaluate potential release of radioactive materials.

The implementation of the severe accident monitoring system is completed in Unit 1, and will be finished in 2012 in Unit 2 and in 2013 in Units 3 and 4.

Introduction of the severe accident management guidelines

The introduction of the severe accident management guidelines provide assistance to the operator to stabilize the unit and to return it to a controlled, stable state after such events which have led to major damage of the core. These consequence-mitigating guidelines can be deployed for the cooling of corium, the reduction of radioactive releases, and to maintain the structural integrity of the confinement.

The severe accident management guidelines had been developed according to the WESTINGHOUSE OWNERS GROUP SEVERE ACCIDENT MANAGEMENT GUIDANCE documentation with the super-control of the Westinghouse's professional staff.

Beforehand, level 2 PSA analyses had been carried out and the frequency of events leading to severe accidents and also the processes which could cause the damage of the confinement had been identified.

The introduction of the severe accident management guidelines will be finished by the end of 2011 in Unit 1 and between 2012 and 2014 in Units 2, 3 and 4.

Safety back fitting is finished to cope with Primary-to-Secondary leak (PRISE) Initiating Events

One of the mounted and later demounted blow-down gate

A very comprehensive safety upgrade process was defined and approved as part of the first Periodic Safety Review of Paks NPP Units 1÷4. Along the years all but the last technical measures were designed, approved and implemented. The only remaining issue was to preclude the consequences of two-phase or water phase blow down through the SG safety valves and/or of a water hammer in the main steam-lines resulted from a PRISE event. The technical solution accepted by HAEA NSD contained a separate gate valve group and a diffuser attached to the water part of each SG allowing blowing down the secondary side of the leaking SG before having two phase or water flow through the safety valves or a water hammer.

The modification, which is necessary to implement the above mentioned technical solution, was postponed in 2009 and in 2010 because the gate valves were not able to ensure tight closure. About the implementation of the modification and the problems encountered during implementation we informed earlier in the Bulletin (see the April 2010 bulletin).

Assembled part of the blow down system in the workshop before the tightness test of the valves

The operator considered to change the non-conforming components on gate valves of other construction (and manufacturer) or plug valves, finally choosing the last. Finally in 2011 during the overhauls the systems with the plug valves were built in on all the 4 units.

Other Nuclear Installations

Regulatory oversight of SFISF extension

The extension of the modular type Spent Fuel Interim Storage Facility is going on with the third phase to eastern direction. The vaults 17-20 being set up in the first section of extension are realized by the extension and modernisation of technological systems.

Lifting-in of a section of charging face structure

Air cooling channel before closure

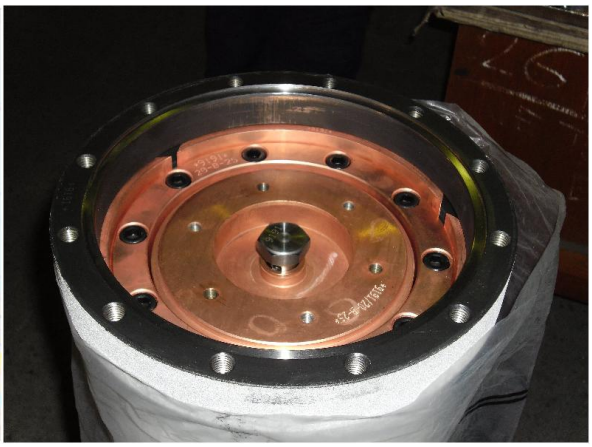
Majority of the modifications had been classified as being required to be submitted for regulatory approval and their effects on safety must be categorised in a preliminary safety evaluation.

On the base of documentation submitted the HAEA NSD approved the safety classification and licensed the following modifications:

Extension and modification of charging machine's odometer system in order to supply vaults 17-20; extension of storage tube monitoring and data acquisition system in order to supply vaults 17-20; fire alarm system extension; extension of electricity supply; extension of radiation monitoring system; integration of radiation protection measurements of the new vault into the NPP's radiation surveillance system; extension of air sampling system of charge hall; modification of the copper fillers of the storage tubes (modification of an earlier manufacturing licence).

In addition to the works of vaults 17-20 being carried out in first section of SFISF third phase, the regulatory body licensed the modification of nitrogen-monitoring system of vaults 1-11 in order of their modernization. The HAEA surveys the safe realization of extension with regular on-site inspections.

Insertion of storage tubes

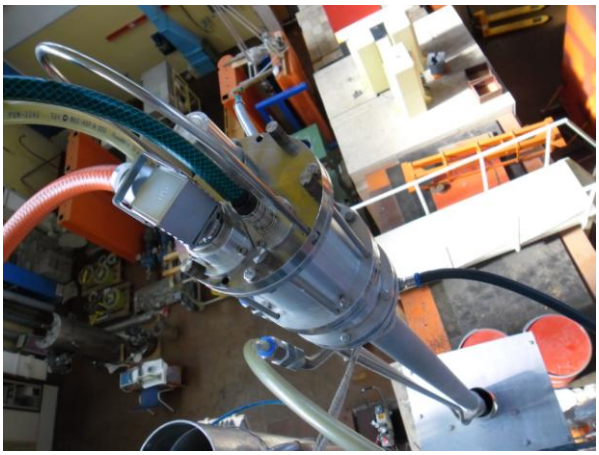


Storage tube head

New irradiation tool for material testing under development in Budapest Research Reactor

Irradiation probes are used in the Budapest Research Reactor since 1999 for examination of metal damage under irradiation. The metal specimen temperature can be controlled by heating for modeling the stress conditions.

The reactor technology of the future requires the application of structural materials more irradiation-resistant on the higher temperatures, so there is an increased demand for the experimental research of their behavior. Technical equipments of Budapest Research Reactor can be made capable for investigation of new materials with the enhancement of the present irradiation tools.



BAGIRA 3 irradiation probe

The new probe developed under the HAEA license was designed to modify the previous irradiation tool according to the demands for altered parameters. The new design has a significantly wider operational temperature range (150-650 Centigrade, contrary to the earlier 200-350 Centigrade), and due to the simplified sample manipulation while loading and unloading the irradiation doses of the personnel considerably decreases, the operational temperature adjustment essentially improves.

International co-operation

EU Training Course on Nuclear Emergency Management

The European Commission signed an agreement with the Hungarian Atomic Energy Authority to provide one-week training courses in nuclear emergency management during the period of 2010-2012. The second TRANEM course (TRAining courses on Nuclear Emergency Management) was held during 12-16 September 2011 with 28 participants from 16 countries. The aim of the course was to give the authorities in each EU Member State and candidate countries an opportunity to send members of their staff for training in order to improve knowledge of basic radiological and nuclear emergency management and the European arrangements in this field.

The participants were introduced to the basic concept of emergency planning, to the application of decision aiding and support techniques, to the selection criteria of the countermeasures during the different phases of the accident, to the communication techniques used during emergency situations and to the mitigation of longer term psychological and economical consequences of nuclear or radiological emergencies.

Besides the EU, the training course was supported by the International Atomic Energy Agency with the hardcopy and CD versions of different emergency preparedness documents; moreover an IAEA expert had given presentation about the international cooperation in radiological emergency management.

At the end of the course the participants had the opportunity to extend their knowledge at a nuclear emergency response exercise held at the CERTA emergency centre of the HAEA. The next course will be held during 10-14 September 2012 in Budapest, Hungary (more information: *www.haea.gov.hu/tranem*).

Events of Interest

Failure of an auxiliary feedwater pump during Paks NPP Unit 4 restart

Following the annual outage the restart procedures were carried out on the Paks NPP Unit 4. In course of the test of the auxiliary feedwater system test it was noted that the position indication of a shut-off valve did not work. The personnel began to fix the failure, but did not stop the restart process. After the shift-changing the new personnel interrupted the restart process for the time of repair. By this means the conditions suitable for the procedures were recovered.

The event assessment has pointed out that though the discover of failure of shut-off valve the personnel did not classify the valve being out of order and the unit restart was continued while the repair was carried out.

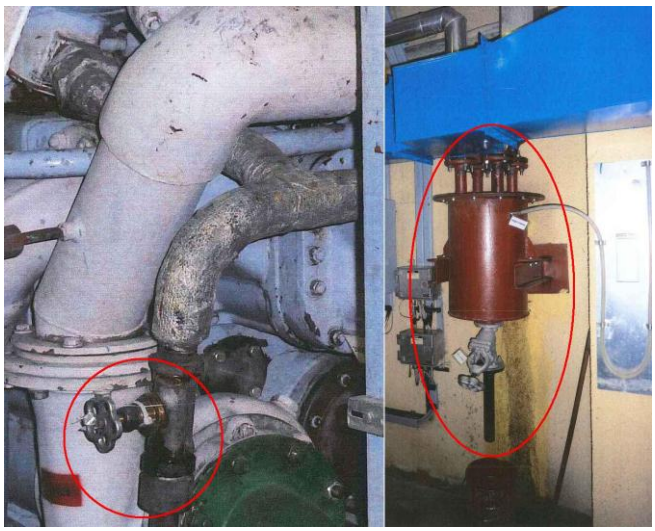
In consequence of the assessment the operator has to establish corrective actions, to avoid such events in the future. The most important corrective actions are the revision of the documents and making them more accurate and to disseminate the lessons learnt from the event among the employees working in the affected positions.

Auxiliary feedwater pump

Fire on a diesel generator causing it unavailable

On May 31, Paks NPP Unit 2, in-service testing of the ’Y’ safety system’s load sequencer program was in progress. When diesel generator was undergoing its coastdown, the paint and oil sludge on outer surface of the exhaust system discharge line ignited and caused open burning fire that was successfully extinguished by the senior field operator on the spot.

After a few minutes, the load sequencer program was completed successfully. Three hours later the diesel generator was declared unavailable to allow the necessary repairs.



Manual valve and dirt catcher

Before the fire a section of the exhaust gas condensate discharge line and the manual isolating valve heated to a dark cherry-red matching a metal temperature of 700÷900 °C. This temperature level caused ignition of the combustible materials deposited on outer surface of the uninsulated pipe section, as well as destruction of the valve in question. The bronze valve plug melted and fractured, the valve seat was destructed, making replacement of the valve necessary.

Fractured valve plug

The discharge valve was replaced with a same type spare from the stores, and the discharge line was checked to ensure the absence of blockage. During this time period Unit 2 was operated under a limiting condition of Technical Specification. After the completion of repairs, the diesel generator has been successfully tested and declared available. The event was rated on the INES scale as level 0.