HAEA NSD

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RECENT DEVELOPMENTS IN NUCLEAR SAFETY IN HUNGARY

April 2011.

Spring in the HAEA garden

General

Industrial Standards on the nuclear field in Hungary

The preparation for the life time extension of the Hungarian nuclear power generating units required a discussion between the NPP and Hungarian Atomic Energy Authority in 2006-2007 about the utilization of nuclear plant specific standards. During this early discussion it was necessary to overview the set of Hungarian National Standards. This survey has revealed that although there are a number of technical standards for general industrial purposes including industrial safety, we do not have nuclear plant specific standards for all the necessary technical fields.

The practice followed in the NPP safety upgrades and modifications during the last two decades was that the NPP and the Authority agreed on the utilization of international and national standards practically project-by-project.

In view of the practical demand set first by the lifetime extension of the Hungarian nuclear power generating units, by the aspect of new unit technical specification and competitive bidding needs, the representatives of the nuclear industry, the Authority and the Hungarian

National Standard Committee agreed on the promulgation of a series of international standards specific to nuclear power plants to cover the necessary technical fields on which Hungarian National Standards were not available.

In the framework of this long term agreement the first series of standards are covering the principles of instrumentation, control room and emergency control room design, safety parameter displaying, detection of leakages and loose parts in primary circuit, neutron flux monitoring, radiation monitoring and alarming. These technical fields are represented with 13 IEC standards, which were published as Hungarian National Standards in January 2011. The original technical content of these standards remained in English language.

It is to be noted that the IEC standards follow the IAEA nuclear safety standard requirements and guideline recommendations institutionally.

The next set of published standards will cover the fields of normal and incident condition monitoring, monitoring radioactivity in gaseous effluents, dose rate monitoring, surveillance testing, equipment environmental qualification, software development and verification, hardware design requirements for computer-based systems, data communication in systems performing category “A” functions and electrical interlocks for important functions.

For the purposes of NPP pressure vessel and primary-secondary circuit, operation of passive-active mechanical components, in service inspection, testing, maintenance and qualification, the related ASME Standards and Codes will be published as Hungarian National Standards. The reference will be the year of 2001. The preparation and the negotiation with the affected Standard Bodies and Institutions have already started. As it turned out, the ASME requirements should be published only in Hungarian language. That needs a vast amount of precise translation and the financial contribution of the Industry. The publication is planned by the end of 2012.

HAEA internal

Preparation of a Targeted Safety Reassessment program

Following the Fukushima reactor accident, the Council of EU has asked the Commission and the European Nuclear Safety Regulation Group (ENSREG) to work out the scope and content of a targeted safety reassessment of the European NPPs with the participation of the

member countries. The review will be based on the lessons learnt from the accident and is often referred to as a „stress test”. The Council suggested using the expertise available in the framework of the Western European Nuclear Regulators Association (WENRA). According to the request, the national regulatory bodies will conduct the safety review; share the results including the necessary measures also with the Commission.

Following the Council’s decision the HAEA has initiated the work on the compilation of the required contents of the targeted safety reassessment of the Hungarian Paks NPP. In this work the HAEA was assisted by an expert group recruited from the TSOs of HAEA and lead by the director of the nuclear research centre KFKI AEKI.

The purpose of the Hungarian Targeted Safety Reassessment is to review the safety margins of Paks NPP in the light of lessons learnt from the severe reactor accident in Fukushima. The requirements have been compiled on the basis of the specifications by WENRA to be submitted to ENSREG, of the recommendations by the Hungarian expert group and of the proposals by the expert group set up within the HAEA. It should be mentioned that the WENRA specifications strongly rely on the document compiled by the Finnish nuclear authority STUK, when requesting a report from its licensee.

The report to be compiled by the Paks NPP on the results of the Hungarian targeted reassessment shall include the following main chapters:

- General data
- Key-events – the most severe situations still to be considered and their possible internal causes
- Possible external causes of the key-events
- Possibilities to prevent and/or mitigate the key-events
- Potential consequences of uncontrolled key-events
- Management of the consequences of key-events
- The safety upgrading measures foreseen and the necessary further investigations

The Targeted Safety Reassessment is started by the NPP in mid May and is to be completed by the end of September. HAEA shall review the report and issue its decision on the necessary measures by the end of November 2011.

Regulatory Review of the Paks NPP low power and shutdown PSA

Year 2011 is a milestone in HAEA's long-term project of nuclear safety analyses reviews. The main goals of the ongoing SPSA Review Project are to check the compliance of the shutdown PSA with national and international technical and quality requirements and with the guides of HAEA and IAEA; as well as a survey of the potential applicability of the shutdown PSA model for different PSA applications like Risk Monitor, Precursor Analyses and for use in regulatory process.

HAEA, External Expert Team, NUBIKI and Paks NPP representatives on the kick-off meeting

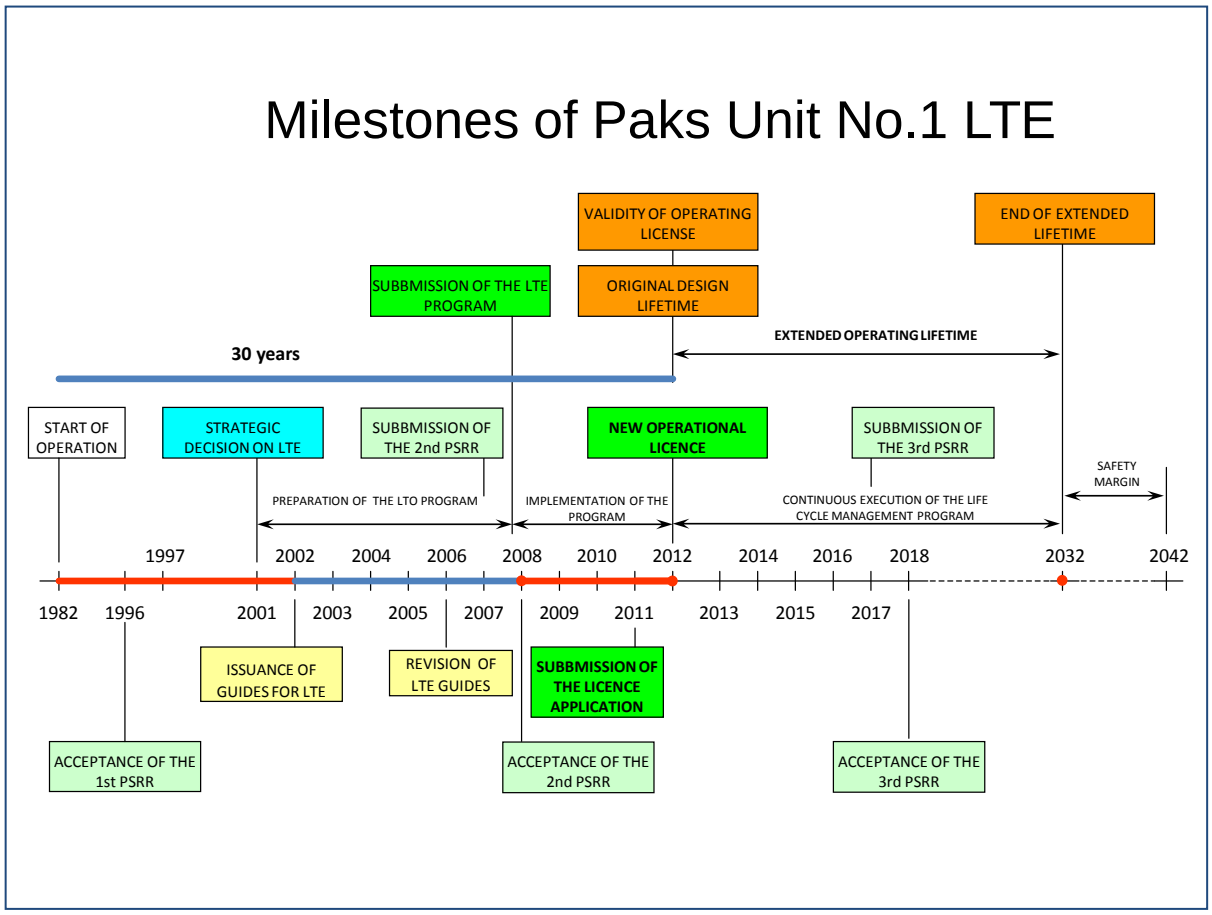
By the end of the 1st quarter of 2011 all planned actions have been completed, the management plan of the regulatory review has been finalized based on comments of all interested counterparts. The SPSA model and its relevant documentation have been updated by the kick-off meeting, a list of questions and/or problem areas related to the SPSA model has been compiled by External Expert Team with the supervision of HAEA staff by the end of March. The PSA specialists of the Paks NPP and its Technical Support Organization (Nuclear Safety Research Institute, NUBIKI) responded to all arisen questions. A meeting will be organized in May 2011 at the headquarters of HAEA for the evaluation of the problems and answers. By the consensually updated time schedule a Final Review Report will be completed by 3rd of June 2011.

Nuclear Power Plant Paks

Preparations to Lifetime Extension (LTE)

The units of the Paks NPP have been put into operation between 1982 and 1987 with a designed lifetime of 30 years. The management of the power plant has decided on the extension of the units' lifetime by 20 more years in 2001. The lifetime extension was almost unanimously supported by the Hungarian Parliament in December 2005.

Environmental impact analysis was prepared and submitted for public debate in 2006. Public hearings both in Hungary and in the neighboring countries (Austria, Rumania, and Croatia) were organized. Environmental approval was issued, and then challenged by environmentalist organizations. Final court decision reinforced the approval in December 2007.



The nuclear safety regulatory approval process requires a Program to be submitted by the NPP four years before the expiry of the operational license, latest. The Program needs to demonstrate either the suitability of the systems and system components for extended operation or, the process of safely ensuring it.

The Hungarian Atomic Energy Authority (HAEA) reviewed the program of the Paks NPP – submitted on 17 November 2008 – concerning the extension of its designed lifetime. According to the Nuclear Safety Regulations the preparation of the program is the precondition of the licensing of the operation beyond the designed lifetime. The enclosure of the program included several documentation demonstrating either the suitability of the systems and system components for extended operation or the process of ensuring it.

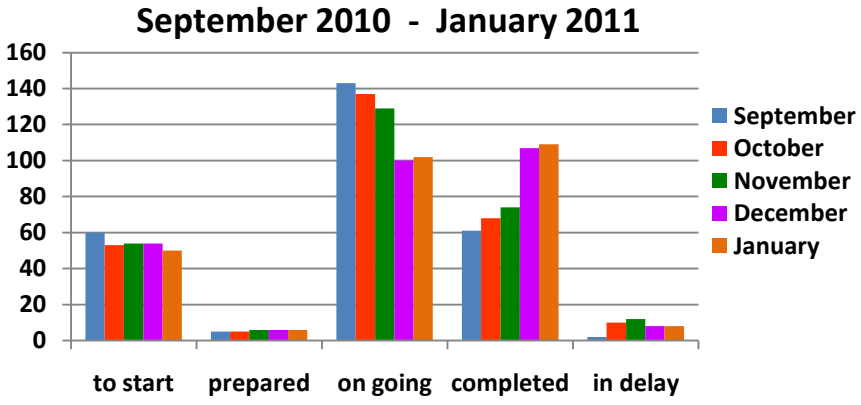
According to the resolution of the HAEA no such deficiency was found which would rule out the possibility of later approval of the life-time-extension. At the same time the HAEA in its

resolution noted 315 findings based on which some corrections should be initiated and 101 further findings which should be taken into account in order to increase the efficiency of the lifetime extension measures.

It is noted that the timetable provided in the documentation makes the timely implementation of the program possible but delays in the implementation of some corrections might risk the entire extension process. Certain deadline corrections are also needed for the successful implementation.

The HAEA will decide on the licensing of the lifetime-extension based on the license application of Paks NPP submitted for each unit separately. The license of unit No.1 will expire at the end of 2012, the application should be submitted before the end of 2011. The application should demonstrate the implementation of the program as approved by the HAEA.

Completion of the program is regularly reported to HAEA. According to the reports most of the activities are being carried out in a timely manner. A statistics on the statuses of the various tasks as of January 2011 (taken from the report on the period of December 201 – January 2011) is given in the diagram below.



Status statistics of the various tasks

Other Nuclear Installations

Certifying BME Institute for Nuclear Technology Training Reactor after ISO standards

In the framework of the recent Periodic Safety Review finished in 2008 the HAEA NSD obliged the operator of the Training Reactor to review its internal procedures regulating the facility's operation from the point of view of meeting the legislative requirements and to

perform the necessary extensions, modifications. To fulfill the obligation the management of the operator NTI fully surveyed and modified the facility's regulation system. The reworked regulation system is put in a frame by the new Quality and Environment Management Manual. The revision of the internal regulation also included the unified operational and emergency response manual documents. The new quality and environment management system of the Training Reactor has suited the requirements of the ISO 9001 and 14001 standards.

Reconstruction of polar crane at Training Reactor finished

Polar crane after reconstruction

The hall crane of BME NTI Training Reactor was designed in 1965. As it was pointed out during an authority assessment in 2008, the design and control system of the crane was not suitable anymore to operate in a nuclear facility. The operator determined to perform constructional, control and safety techniques modifications of the equipment in order to make it suitable for further use. The load bearing increased after the reconstruction. With constructional modification, replacement of some components and enhancement of control system the fulfillment of the relevant legislative requirements as well as the carrying out of various lifting actions necessary to operate the facility was ensured. The modification – on the basis of a separate license – made it possible to move the radioactive fuel assemblies in a safe and remote controlled way, whereas the nuclear safety requirements are entirely kept. The crane meets the requirements of single failure criterion. The lifting operations performed with remote control are helped by a camera system.

Crane load test

Inspection of civil engineering works at the Interim Spent Fuel Storage Facility extension

In April 2011 HAEA NSD inspected the civil engineering works at the ISFS facility extension, i.e. the construction of modules 17-20. When the side-wall shuttering was removed, some concreting deficiencies became visible: lack of concrete at the boundaries of concrete layers of varying depth and length, superficial lack of concrete, concrete density deficiencies. The authority ordered to correct the deficiencies and to preclude their recurrence. The licensing documents were completed with instructions and procedures how to correct these deficiencies in the future. All the explored deficiencies were assessed one by one and the correction technology was specified.

Concrete deficiencies in the ISFSF wall

The HAEA NSD ordered that further works cannot continue until the appropriate result of the failure corrections. The authority's inspection protocol draws the attention to strengthen the technology discipline and to increase the supervision of working in compliance with the required technology.

Regular inspections by the HAEA NSD on the storage units manufactured for the Interim Spent Fuel Storage Facility extension

The ISFS facility will be extended with 2100 storage units. Manufacturing of the storage equipments is in progress. HAEA NSD regularly inspects the assembling, pressure testing,

Manufacturing storage tubes

Storage tube leak tightness testing

and leak tightness testing of the spent fuel storage tubes. The charge platform sections, serving to accommodate the storage tubes are ready to be installed.

Visual control of charge platform sections

International co-operation

WENRA

The Western European Nuclear Regulators Association was created in 1999 with the aim to harmonize the safety requirements of the European NPPs at least on the commonly determined base level. Other aim is to promote the permanent improvement of safety in present and future NPPs. The safety of radioactive waste management, decommissioning of NPPs and final disposal of wastes are also included among the aims of WENRA beside safety of NPPs. The harmonization of requirements is going on also in this field.

Hungary has been participating in the work of WENRA since 2003. Hungary is represented by the HAEA in the organization and its working groups.

The WENRA released its statement on the safety goals of new NPPs in November 2010. The *Reactor Harmonization Working Group* actually works on forming a common standpoint (unified requirements) on some issues related to the goals.

Revising the reference levels for waste storage and decommissioning

The HAEA is also participating in the work of the *Working Group on Waste and Decommissioning*; WENRA WGWD.

In the year 2010 WENRA WGWD has finished the review of the safety reference levels for the spent fuel and the radioactive waste storage and has completed the 2nd version of the

report summarizing the harmonized requirements. The document is available on the WENRA website, http://www.wenra.org. During the reference level revision the opinion of the *European Nuclear Installations Safety Standards Initiative*; ENISS, was taken into account and their representatives took part in the final harmonization.

The working group also completed the 2nd version of the report summarizing the decommissioning requirements. After completing the harmonization process, this report will be made public too.

As general evaluation we can say that, both requirement systems became simpler and better arranged after the revision.

Elaboration of final disposal reference levels

In 2010 it has started the elaboration of the safety reference levels for the radioactive waste final disposal, which will be a high priority task for the WENRA WGWD.

National adaptation of WENRA WGWD reference levels

The Hungarian Atomic Energy Authority has taken into account the reference levels for the spent fuel storage and the decommissioning of nuclear facilities for elaboration of the new Nuclear Safety Code volumes.

In 2010 a working group consisting of representatives from the HAEA and the National Public Health and Medical Officer Service started the preparation for the legal adaptation of the radioactive waste reference levels.

Event of Interest

Leak of a Steam Generator drainage pipe and a water purification system pipe

In the early morning of 30th October 2010, a water leak signal appeared from the Paks NPP Unit 4 hermetic area. The primary operator observed an increased amount of floor drainage water, and the shift engineer ordered to search for the leak, according to the PR42 emergency response manual. In the next three days the staff could not identify the source of the leak. Then a decision was made to reduce the power to be able to walk down and find the leak location. The unit was brought to cold shut-down state.

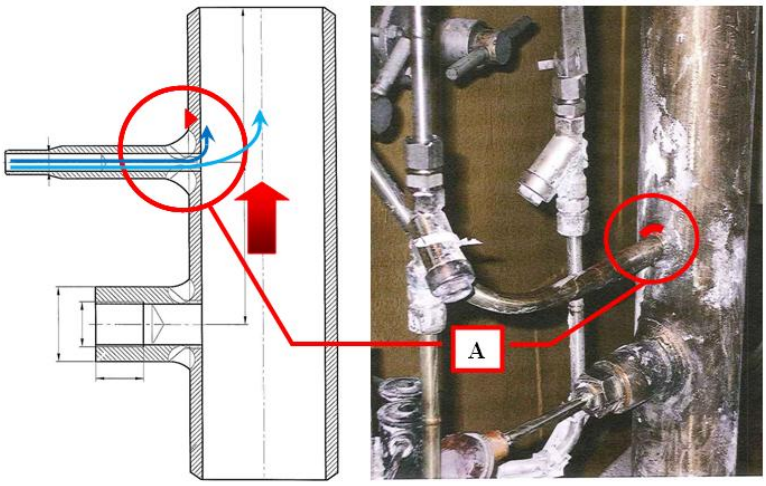
Leaking steam generator drainage nozzle with boric acid marks and some thermal insulation parts

During the walk-down of the hermetic area two leaks were found. One leak was below the steam generator #6, at the drainage nozzle.

The other leak was found on a water purification system pipe near the inlet of a pipe coming from a dosimetry measurement.

The cause of this leak of the steam generator nozzle is yet unknown. One possibility is the electrochemical corrosion at the welding of the components made of different types of steel, i.e. the carbon steel nozzle and the austenitic steel pipe. The other possibility is the thinning of the pipe material by erosion. Because of this failure NPP decided to inspect all the steam generator drainage nozzles during the main overhaul of the NPP units.

The material testing result showed that the water purification system pipe failure



Leaking water purification system pipe

was presumably caused by thermal fatigue. Because of previous similar failures an extensive investigation is in progress on the purification system pipes and the sampling pipe weldings.

The event was rated on the INES scale as level 0. It caused about 9 days loss of energy production

Emergency Preparedness

HAEA's activities in respect to the nuclear accident in Japan

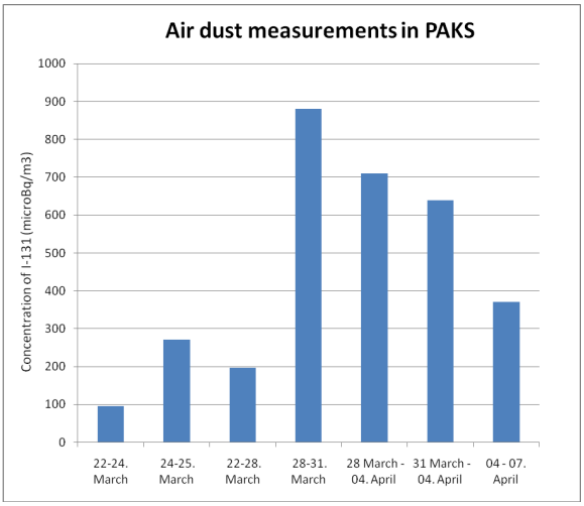
A 9.0-magnitude undersea earthquake occurred off the coast of Japan at 14:46 JST (05:46 UTC) on Friday, 11 March 2011. The event affected the Fukushima I, Fukushima II, Onagawa and Tokai Nuclear Power Stations, the operating units of which automatically shut down after the earthquake, but i n the following days units 1-4 of Fukushima I nuclear power plant had undergone severe accident conditions. After receiving the first official and non-

HAEA leaders reporting about the Fukushima accident to the Hungarian Parliament's Committee of Sustainable Development

official news about the event, the Emergency Response Organization (ERO) of HAEA prepared for activation: the Crisis Manager on duty initiated alert test and the experts began collecting data and information. On March 12 the national decision support organization, the Nuclear Emergency Response Working Committee held an informal meeting, where the Director General of HAEA informed about the situation and decision was made on the government agencies' strategy related to the management and communication of the event in Hungary. The HAEA obtained the task to inform the public through the press and its website. One month after the event, on April 15, the HAEA was still proceeding with this activity. The actual information received about the progress of the situation was published on the website and the summary of the results of air monitoring measurements of the Hungarian laboratories was also regularly updated to keep the Hungarian public informed. The data obtained on ambient dose rates measured by the network of automatic stations did not show any increase.

The great number of interviews made by the media with the HAEA management and the references by the Hungarian portals to our website show that our activity has been demanded and acknowledged by the public. HAEA management has been invited to a special hearing by the Parliamentary Committee on Sustainable Development dedicated to the Fukushima accident and its consequences.

The European Commission contracted the HAEA to support its activity during radiological emergencies (RESPEC contract). This arrangement has also been activated during the first few days after the accident in Japan and the Commission several times requested the HAEA emergency services in the assessment of the nuclear emergency. The HAEA ERO responded to technical questions and provided meteorological forecasts and trajectories to assist the Commission in its emergency activity.



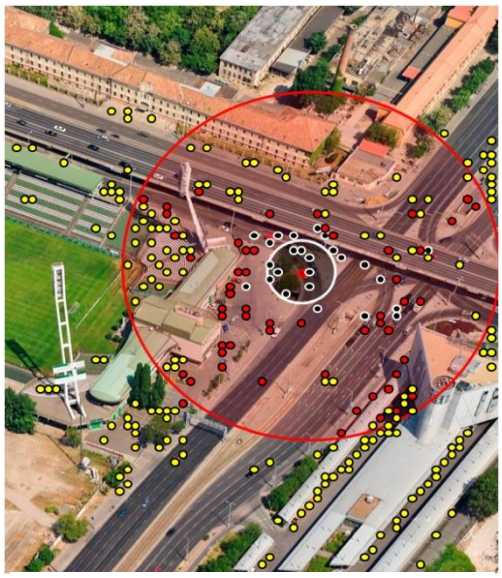
Paks NPP Iodine measurements after the Fukushima accident

Response to the consequences of a dirty bomb attack: INEX-4 international emergency response exercise in Budapest

The OECD Nuclear Energy Agency's basic concept for the fourth series of the INEX exercise (INEX-4) was to prepare an issue-driven table-top exercise for the member states without any on-scene movement addressing the post-crisis consequence management and the transition to recovery arising from a malicious act involving a radiological dispersion device. As in the case of past INEX exercises Hungary

INEX-4 exercise in the Fire Department of Budapest

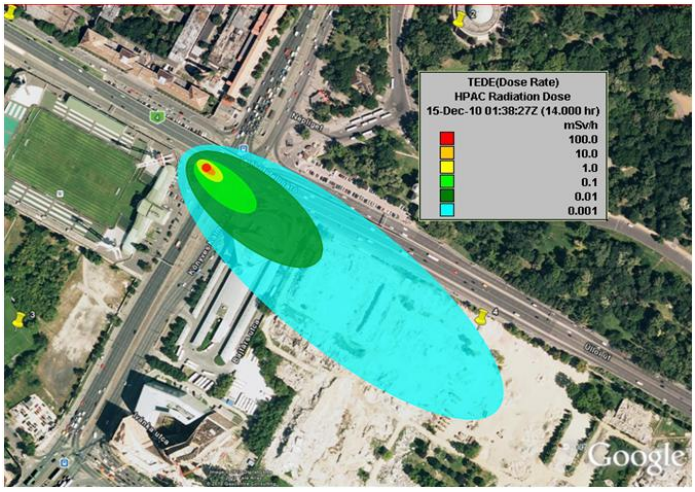
decided to participate and a committee lead by HAEA was established to prepare the exercise.



Simulated effect of the dirty bomb: deaths (black circles) and injuries (red circles)

According to the assumptions terrorists exploded a bomb containing radioactive Cs-137 isotope in the rush hour at a major crossing of Budapest meanwhile a soccer match was going on in the nearby stadium with 8000 spectators. The players had to make the decision inter alia on the treatment of the injuries, the accommodation of the evacuees, co-ordination of the offered international assistance, the long-term security of the scene, the solution of the traffic problems, the decontamination of the area affected and waste management. Development of the strategy on providing information for the public and on international level was also an important task.

The exercise itself took place in the Fire Department of Budapest on 23-24 February 2011 with the participation of various organizations of the Hungarian Nuclear Emergency Response System with the involvement of more than 100 professionals.



Simulated dose rate levels

Up to this case no exercise was based on such a scenario in Hungary, thus it was a preparatory type by nature. In conclusion, the successful implementation has proven that Hungary principally could cope with this unpredictable and, according to our hope, never occurring emergency. However there is place for improvement to face the new challenges, to which the INEX-4 could give a significant boost.