Alarming results on geological risk at the Paks NPP site

Wednesday, 9 June 2021, 3-4:30 pm CEST, via zoom

REPORT on the presentation and discussion

The meeting was attended by 29 people from seven countries, including Members of European Parliament, other politicians, media representatives, NGOs and independent experts. About 13 more people were interested receiving a report later, because they could not take part.

Meeting was chaired by Patricia Lorenz/Friends of the Earth Europe, Joint Project

The recording to the presentations and the discussion and the speaker's presentations are available for download here: http://www.joint-project.org/

Introduction by Dorottya Egres, Energiaklub

Energiaklub Climate Policy Institute and Applied Communications is an organization which has worked almost 30 years on energy efficiency, renewable resources, climate protection, conventional energy resources and energy policy.

In 2009, the Hungarian Parliament gave its provisional acceptance for the possible expansion of the existing nuclear capacities. For several years, preparations for the planned reactors were undertaken. The documentation of these preparations was not made public which resulted in several years of litigation. In 2011, the Parliament passed the National Energy Strategy according to which Hungary will keep using nuclear energy. In 2014, without a tendering procedure, agreements were signed about the Russian state-owned company Rosatom supplying the new reactors and the Russian Federation financing 80% of the investment costs (10 billion euro).

In 2016, the project company submitted its site license application to the competent authority, the Hungarian Atomic Energy Authority. According to the Paks 2 project company's website, acquiring the site license was a two-step process. The first step consisted of the project company setting up the program of the site investigation and evaluation, which was approved by the Hungarian Atomic Energy Authority in 2014. They stated that this program was made with the broad and detailed knowledge of the site.

During the second step the site investigation and evaluation program was implemented. The goal of the site investigation and evaluation was to identify every natural and human circumstance, characterize their effects on the design of the nuclear power plant and verify its safety. The site license application had to prove that the site was fit for the siting of a nuclear power plant.

The key statement of the site investigation and evaluation was that the site is suitable for accommodating new nuclear power plant units. The site features were defined by technical and scientific standards, and as these were taken into account, and by the compliance of the safety regulations the new units could be designed and established. In 2017, the HAEA authorized the site license application.

It was Átlátszó that reported first in 2017 that the site of the NPP and the planned expansion does not comply with the International Atomic Energy Agency's earthquake safety recommendations because an active tectonic fault line passes under nuclear facilities and less than ten thousand years old traces of earthquakes were found on the surface in the immediate vicinity of the site. Despite the

report and the extensive investigative work done by Átlátszó, the state carried on with the project. The construction license has been submitted and is expected to be granted in September 2021.

Dr. Kurt Decker, University of Vienna, Department of Geodynamics and Sedimentology

Kurt Decker presented results from his 2021 study "NPP PAKS II – Paleoseismological assessment of the Siting Report and the Site License with respect to fault capability".

The study reviewed the paleoseismological assessment of the Paks II siting documents and focused on the potential of surface displacement by active geological faults. Such displacements may occur during strong earthquakes ("capable faults"). The key question is: Can a potential occurrence of permanent surface displacements (capable faults) be reliably excluded?

Three documents were examined:

- The Geological Site Report, prepared by a group of experts in 2016
- The Site Safety Report, prepared by MVM Paks II in 2016, which is based on the Geological Site Report
- The Site Permit, issued by the Hungarian Atomic Energy Authority

The authors compared figures from the Geological Site Report and the Site Safety Report and found that some scientific evidence was not transferred to the Site Safety Report, or even changed like in the case of the location of the fault zone – in the Geological Site report it is located under the area where the Paks II reactors are foreseen, in the Site Safety Report it is moved further south.

In his presentation Kurt Decker showed pictures of surface displacements, one of the examples was a displacement very near to the Kashiwazaki Kariwa NPP in Japan. Such displacements could result in a substantial damage of the reactor building.

The authors draw the following three conclusions:

- Paleo-seismological data derived from the trench Pa-21-II next to the site confirm the existence of faults leading to permanent ground displacement in the site vicinity of Paks II. But in the Site Safety Report, MVM Paks II stated: "Seismic events occurring in the research area … are not able to significantly displace the surface, i.e., the fault planes cannot be considered capable." This is not in line with the evidence of the Geological Site Report.
- According to Hungarian nuclear safety requirements, the potential of occurrence of a permanent surface displacement on the site has to be reliably excluded by scientific evidence, or the site is considered unsuitable for a NPP. This requirement clearly has not been fulfilled.
- A wealth of geological and geophysical data described in the Geological Site Report proofs that the Dunaszentgyörgy-Harta fault zone is active. Application of Russian nuclear safety requirements would exclude the construction of an NPP at the Paks II site. (requirement 3.1 of GOSATOMNADZOR OF RUSSIA 2002, NP-032-01)

Kurt Decker researches earthquake geology, active tectonics and seismic hazard at the Institute of Geology, University of Vienna. He works as a consultant for IAEA, ENSREG, NAGRA and the Austrian Ministry of the Environment with a focus on nuclear safety and natural hazards. Kurt Decker is member of the EC/ENSREG Stress Tests team and Austrian delegate to several working groups of the Western Nuclear Regulators Association (WENRA).

Dr. Tamás J. Bodoky, Geophysicist, Budapest

Tamás J. Bodoky presented the results from his 2020 study , a report in English on this study was published in April 2021 by the Hungarian magazine Átlátszó.

Kurt Decker reviewed and evaluated the entire research material, which covers a large area. In the following Dr. Bodoky focused only on the site itself.

The Hungarian regulations don't require prove that near-surface or surface-breaking faults are non-existent, it is enough if their possibility can be reliably excluded when selecting a site for a new nuclear power plant.

7.3.1.1100. "If the potential of occurrence of a permanent surface displacement on the site cannot be reliably excluded by scientific evidences, and the displacement may affect the nuclear facility, the site shall be qualified as unsuitable."

The non-existence of displacements can be proved either by trenches or by shallow geophysical measurements. However, the site area was filled up artificially by sandy and mud-like materials which cover the surface in a thickness of 2 to 5 m. Because of this fill trenches couldn't be practically used.

From the point of view of geophysics the area can be regarded as a two-layers structure, under the sandy-gravely Quaternary top layer there are more compact Pannonian beds. The interface between them can be found at a depth of 25 to 35 m under the present surface. From the point of view of seismic hazard here displacements only in the Quaternary layer are of interest and even there the closer they are to the surface the more important they are.

According to the regulations the fundamental question is: can we exclude the possibility of permanent near surface or surface displacements within the site? The surface is to be understood as the original surface, which is now under the fill.

The geophysical report (Tóth et al, 2016) gave the following answer:

"Based on the available data below the site, we can state with absolute certainty that the fault zone crosses the entire preserved Pannonian sequence. However, there is no data that can provide a definite answer to the question of the tectonic involvement of Quaternary sediments."

Conclusion 1: If there is no data providing a definite answer, then permanent surface or near surface displacements cannot be excluded, consequently the site should be qualified as unsuitable.

Up to here the story is a legal issue. But Dr. Bodoky showed that not only that the possibility of surface breaking displacements cannot be excluded, but based on the data published in the reports it can be proven with a relatively high probability that they exist.

Geophysical investigations inside the area of the selected site were carried out by different means. As a first preparatory step electromagnetic (EM) and ground probing radar (GPR) measurements were carried out to see how much that former industrial area had been disturbed and contaminated below the surface by former human activity.

Slide 2/ Specific conductivity map of the uppermost 1 m got from EM survey on the site

The EM measurements indicate a lot of underground artificial objects especially on the Southern and South-Western part of the area, though the Northern and North-Eastern parts seem to be quite undisturbed.

As a second phase of the in-site investigations electrical resistivity and seismic refraction survey were carried out.

As for the two methods mentioned, we had to come to a conclusion that they were unfit to answer the basic question.

The last method used was the seismic S-wave reflection survey.

Slide 4/ Location map of the seismic S wave reflection survey inside the selected site

Though the technical details of the survey is described and the profiles are presented, no results are mentioned in the Final Geological Report, the profiles of the reflection S wave survey were not interpreted or analysed at all. The geophysical report explained this with the underground artificial objects creating highly disturbing noise levels

I think, however, that the underground artificial objects are not so much disturbing for the seismic reflection measurements as it was said. The S-wave reflection profiles, or at least a part of them, are well interpretable.

To carry out the interpretation some preliminary steps or decisions were necessary. At first one had to select the profiles of the least disturbed part of the area. The next step was defining criteria to separate surface noise from events indicating geological changes since their appearances are very similar. Finally one had to answer the question of resolution which proved to be large enough to show the phenomenon significant from the point of view of seismic hazard.

Since no real seismic data and rather images of the profiles were available in the reports the interpretation had to be carried out manually. It resulted in fragmented and quiet segments on them.

Slide 5/ Profile SRef-9 (W-E) as it is given by the Final Geological Report (Ács et al, 2016) and its interpreted version

If one indicates the locations of fragmented segments on the location map of the survey then a zone is outlined which can be interpreted as a neo-tectonic fault zone penetrating into the Quaternary upper layer. In that zone at some places the displacements reach the surface and the direction of the fault zone correspond well to that of the side-faults on the southern part of the main Dunaszentgyörgy-Harta zone.

Slide 7/ The location map of the seismic S wave survey with interpretation (red: fragmented zone, orange: convex seismic horizons, blue: horizons rising westward, light blue: horizons rising eastward, hatched part-assumed neo-tectonic zone)

Conclusion 2: The seismic S wave reflection survey cannot be considered as a closed one, the measurements have yet to be continued to get sure results on the selected and licensed site of Paks-II NPP.

Closing word: I am very much afraid that once we have confirmed data then the final results will contradict the statements of the site license.

Tamás J. Bodoky is a geophysicist, an expert in applied geophysics, seismic exploration, processing and interpretation. He is the retired director of the late Eötvös Loránd Geophysical Institute of Hungary, private associate professor at the University of Miskolc, editor-in-chief of Magyar Geofizika, honorary member of the Association of European Geoscientists and Engineers (EAGE).

Questions & Answers:

Question Can we estimate what is the strongest earthquake we can expect in the Paks area ? And do we know what is the strongest earthquake Paks I and II could stand?!

Answer Bodoky: More than 6.5 M in the Report, which is very high; Paks-1 was reinforced to withstand a 6.4 M earthquake, nobody can tell when the next earthquake might take place. The earthquakes were researched back only to a few hundred years, but here we speak about 10,000s of years

Answer Decker: 0.34g is the design basis for ground motion parameters; but they did not check this type of hazard in their assessment. Around 20 strong earthquakes exceeding 6M were recorded in paleoseismic studies, and Mr Decker cannot confirm that all of those were included in the seismic hazard assessment.

Question: The Site License stipulates that the geological survey has to continue, what happened in the last years? If the site license says that the geological survey has to be continued but this has not been done, their duties are not fulfilled; therefore the license is violated.

Answer: Almost nothing has happened.

Question: What about soil liquefaction?

Answer Decker: Soil liquefaction is another type of hazard and continued research has been recommended for this type of hazard.

Question: In autumn 2021 the construction license might be issued. Could digging/trenching take place until then?

Answer Decker: Dr Bodoky talked about how deep the soil was disrupted in the ground surface (seismic analysis), but making a 10m deep tranche is very difficult.

Comment: An international audience for trenching would make sense because this is a risk not only for people in Hungary.

Question: MVM said that the fault line is not capable to move the surface. What is your opinion?

Answer: Decker: We see no safe exclusion of fault capability.

Discussion: What can be done?

The Austrian side wants to enter into a discussion with the Hungarian side (on a technical basis) and the authors of the geological site report.

What could IAEA or ENSREG could contribute, with e.g. expert missions? Who makes seismic reviews? Decker: The IAEA undertakes reviews upon a member state's request.

What is the impact on licensing? Could the site licence be reviewed? Could the regulator be asked to review it?

Who could challenge the site license - who was a party to this procedure

Basically, if a site permit is issued against the law, the prosecution office could issue a legal procedure.

Other options: construction permit is still not issued, expected in Sept 2021, but nobody is accepted as party, and the construction license does not directly deal with the seismic risk

How much ground acceleration value should the building withstand? This value was calculated by a few people, 0.34 g was the result; this should also be peer-reviewed in a similar way than the paleoseimic review was made. A list should be made of issues for peer review.

The European Commission should be contacted, and possibly also the Aarhus Convention.

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