

# THE AUTHORIZATION PROCESS OF THE PLANNED EXTENSION OF THE OPERATING TIME OF THE PAKS NUCLEAR POWER PLANT FROM THE POINT OF VIEW OF ENVIRONMENTAL PROTECTION

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## **Summary**

*One of the stipulations for the extension of the operating time of the Paks Nuclear Power Plant is the environmental license. The results of the industrial monitoring of the environment and radiation protection and the company seat characterization program, carried out between 2000 and 2005, together made it possible to carry out the environmental impact investigation of the extension of the operating time, which formed the basis for getting the environmental license needed for achieving the strategic goal. The two-phase impact investigation, consisting of a preliminary and a comprehensive part guaranteed the full-scale investigation of the environmental effects of the nuclear power station. The procedure also included the controlled involvement of the public (public enquiry). In the presentation we intend to demonstrate the content and the characteristic features of the environmental impact investigation of the extension of the operating time of the Paks Nuclear Power Plant, and the professional values of the establishing program, with particular attention paid to the fact that considering complexity, this is one of the most complicated procedures in today's domestic practice. We are going to delineate the main statements of the environmental impact investigation, the different steps of the domestic and international procedure and the experiences of the process. It is going to be demonstrated to what extent the possibility of public tracking of the procedure affected the activities and attitude of the holder of the nuclear power station's operation permission during the process, and what kind of domestic and international reactions were generated by the authorization process.*

## **1. Introduction**

According to the law, one of the stipulations for the extension of the operating time of the Paks Nuclear Power Plant is the environmental license for the planned activity.

The power station submitted its application for the capacity enhancement tender put out by the Hungarian Electricity Works in 1998. The experiences gained there made it clear that the legislative changes of the time period that has passed since the power station was put in operation determine new expectations of achieving the future strategic goals. The Paks Nuclear Power Plant has realized that a program of high priority is necessary to investigate the company seat and the interactions between the power station and the company seat.

During the compilation process of the issues of the program the proposals and expectations of the authorities involved in the authorization procedure were also taken into consideration, beyond the regulations. The power station's data of the industrial monitoring of the environment and radiation protection and the results of the company seat characterization program, carried out between 2000 and 2005, together made it possible to carry out the environmental impact investigation of the extension of the operating time, which formed the basis for getting the environmental license needed for achieving the strategic goals.

The two-phase impact investigation, consisting of a preliminary and a comprehensive part guaranteed the full-scale investigation of the environmental effects of the nuclear power station. Because of the fact that the effect-investigation had to be applied to a working establishment, some special characteristic features also had to be taken into consideration. This made the tasks of the program makers easier and more difficult at the same time while they were carrying out the studies. During this procedure the results of the company seat characterization and monitoring program and of the industrial monitoring of the environment and radiation protection from the previous years were processed as well.

The impact studies were built on each other, and beyond describing the effects of the extension of the operating time they evaluated the operation period of more than twenty years preceding the establishment of the power station. The laying down of the determining factors was carried out on the basis of the legislative regulations. The procedure also put through the controlled involvement of the public (public enquiry) both in domestic and in international fields.

During the preparations and the impact investigation process the power station relied on the work, the technical and laboratory background and the know-how of the leading experts and institutions of domestic scientific activities as well.

## **2. The company seat characterization program**

The company seat characterization and monitoring program was voluntarily undertaken and started by the power station much before the preparations for the extension of the operating time. When the program was started, the hypothesized future expectations, rather than the operative requirements of those days had to be taken into consideration. That is why, in the interest of technical appropriateness in determining the crucial investigational issues, the opinion of the leading experts and institutions in addition to that of the competent authorities was also asked. The program goes, both in length and depth, far beyond the power station's environment and radiation protection monitoring program required by the law.

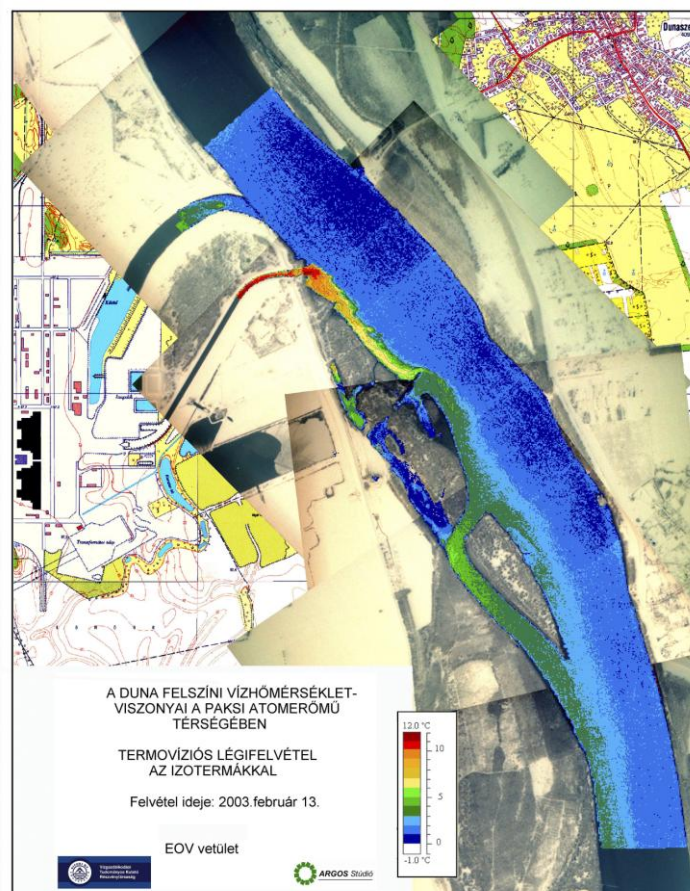
The program covered the following fields, completely utilizing the capacity of the leading experts and institutions of domestic scientific activities:

1. The conditions and changes of surface waters (The Danube)
2. Effect on the utilization of surface waters and ground waters
3. The bed of the Danube and the conditions of the river wall (hydrometric)
4. Examination of the transfusion of the cooling water in the Danube with aerial thermovisional measurements
5. Examination of the tritium content of the water base
6. Local climate in the environment of the nuclear power station
7. Exemplary bio-monitoring examinations

8. Examination of the state of health of the people living in the environment
9. Determining the radiation load of the flora and fauna
10. Characterization of the environment of the power station with aerial and satellite photographs
11. Environmental effects spreading over borders
12. Examination of the environmental radiation
13. Methodical developments connected to the environmental radiological evaluation of emissions
14. Micro-seismic monitoring

Summarizing the results we can say that the power station did not cause any changes in the conditions of the environment; in the case of the thermal loading of the Danube an additional load could be detected. The modeling and estimation carried out show that no changes (deterioration) are to be expected in the effects during the extended operating time, either. The data and investigational results measured within the frames of the program formed the basis of the preliminary environmental study of the extension of the operating time, prepared in the year 2003. The measurement results and the evaluations of the following time period were involved in the detailed environmental impact study in the year 2005.

**Figure 1: Examination of the transfusion of the cooling water in the Danube with aerial thermovision measurements**



The monitoring program is over, but it became clear that even if not continuously, but with a certain periodicity the program needs to be continued. This is supported by the appearance of the ever-changing ecological legislative regulations and the interest of people

as well. Also from the point of view of the enhancement of people's feeling of safety it is expedient to carry out a monitoring activity, applying new investigational methods and modeling, in addition to industrial examinations. This justifies the correctness and adequacy of the industrial measurements as well.

The execution of the company seat monitoring program was supported by: ETV-ERŐTERV Power Engineering and Contracting Co., ÖKO Co. Ltd., NRIRR, VEIKI Power Engineering Division, VITUKI Environmental Protection and Water Management Research Institute Non-profit Company – Institute for Hydraulics, Institute for Water Pollution Control, ARGOS Studio, Hungarian Natural History Museum, Kék Csermely Inc., Florisztika Inc., V-Med Inc., Budapest University of Technology and Economics (they carry out the supplementary investigations of the company seat characterization program that serve operational purposes for the Paks Nuclear Power Plant).

Beyond the professional values it was also important that the people living in the environment of the nuclear power station picked up on this activity, they appreciated it, and took it as a sign of care.

### **3. The environmental impact investigation**

The operator of the nuclear power station submitted the preliminary environmental study (PES) of the extension of the operating time to the competent authorities at the beginning of the year 2004. After the authorities and experts had formulated their opinion and performed the necessary supplementary work, the authorities ordered to prepare a detailed environmental impact study. The detailed environmental impact study (EIS) was created on the basis of the latest reports of the power station, the closing reports of the company seat characterization program and the fully renewed Definite Security Report of the power station at the beginning of the year 2006.

Since the domestic regulations of environmental protection are frame-like, they do not contain any guidelines or descriptive details. At the same time, the unprecedented procedure required the unified interpretation of the task. This was also supported by the fact that the instructions of the regulations applied to new establishments, not to the impact investigation of an establishment that had been in operation for more than twenty years. Taking all these into consideration, the detailed issues of the impact investigation of the extension of the operating time were compiled in the preliminary phase, in 2002.

Arising from the specific situation, in addition to the examination of the conditions preceding the establishment of the power station, the present environmental conditions and the future conditions emerging during the continuing operation had to be put under investigation, too. For example, it was a problem that impact ranking categories existed, so they had to be defined as well.

From the environmental protection and nuclear safety points of view, the main point of the authorization of the extension of the operating time is whether during the extended operating time the operability of the apparatuses of the nuclear power station could change to an extent that would reduce the safety of the nuclear power station, and enhance the risks of operation, or not. During the impact investigation and the environmental authorization it will be necessary to answer the question of whether during the extended operating time of twenty years the environment straining effects – supposing that the nuclear safety requirements are

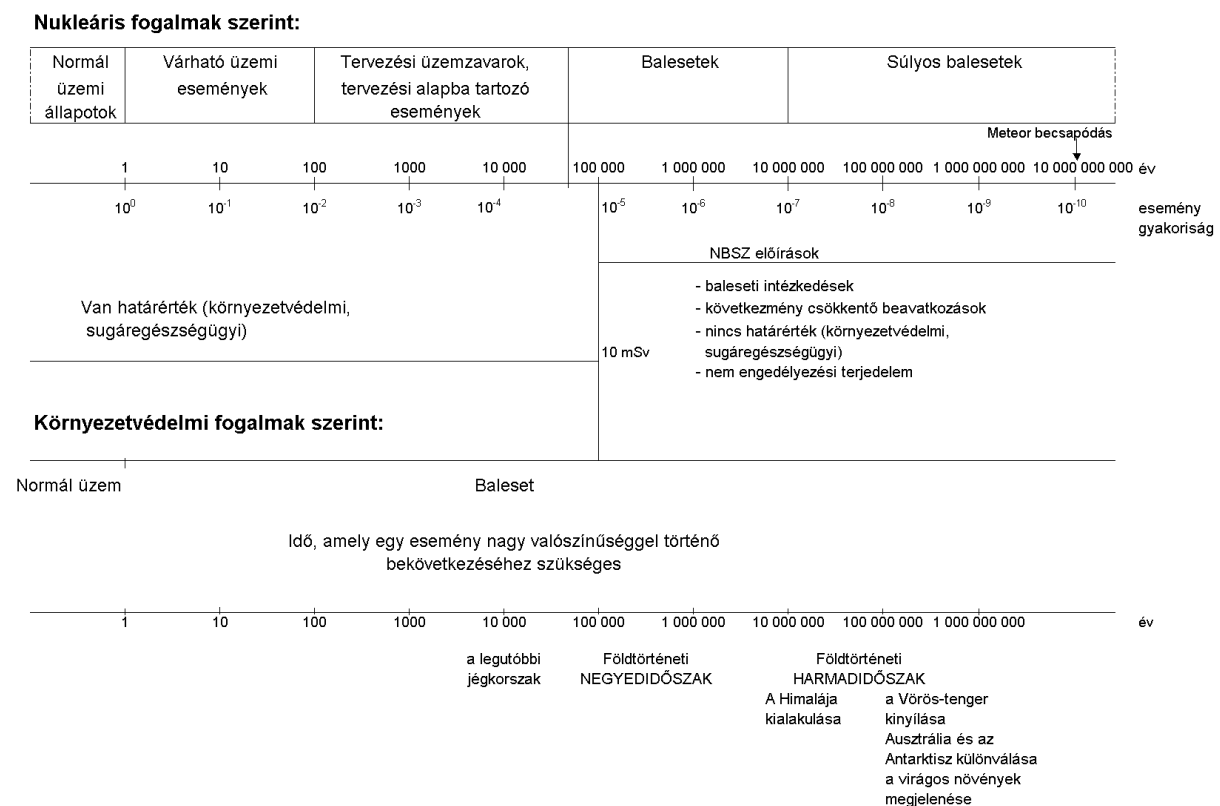
met - could emerge or not. Such an effect could only be expected because of the accumulation time, since the operation permission is limited or withdrawn if the power station does not fulfill the nuclear safety requirements.

Such a close relationship with the nuclear safety regulations meant the necessary adaptation of a certain system of perspectives, and a certain approach in the fields of impact investigation and environmental authorization, which caused some problems, of course, primarily in the evaluation process of the environmental effects of operation breakdowns.

The judgment of operation breakdowns and accidents differs in the nuclear and environmental regulations, and, moreover, the definitions of operation breakdowns and accidents are not the same, either. In the everyday use of the ideas the confusion is even greater. According to the regulations of environmental protection every event that is different from the normal operation is an “accident”, irrespectively of the probability of the occurrence and the seriousness of the consequences. The nuclear regulations are more specific, they differentiate between normal operation, probable factory events and operation breakdowns, accidents and serious accidents belonging to the contingency planning, and these are linked with incidence rates. The nuclear regulations link the security requirements to these rates. It is obvious that it requires the determination of the probability of dangers and failures, and the quantitative evaluation of risks at the same time.

The demonstration of the different interpretations of the environmental and nuclear regulations is summarized by the below illustration:

**Figure 2: The yearly incidence of the probable events**



One of the basic terms of the nuclear regulations is the contingency planning. It contains the events that occur with a frequency of  $10^{-4}$ /year, the so-called contingent operation breakdowns/accidents that have to be prevented from happening by the security systems of

the power station. In this case only the safe emissions, doses determined by the regulations have to be taken into consideration. Of course, the security analyses of the nuclear power stations that investigate probability cover events with much less incidence as well. The security analyses investigating probability prove that the melting of the active zone of the reactor is an event with a frequency of  $\sim 10^{-5}$ /years. An event where a significant amount of radioactive emission can occur because of the damage of the containment is orders of magnitude less frequent. The latter, less probable events belong not to the planning, but to accident-avoidance, on the basis of considering the risks. This is the worldwide practice of nuclear regulations (moreover, this is the practice in every field, in word or in thought). It is obvious that the correct technical-scientific investigation of events with extremely low probability is a bit difficult, since we have to face the lack of human experience on this scale.

#### **4. The main statements of the environmental impact study**

So in the middle of the environmental impact investigation there are events with a frequency of  $10^{-4}$ /year, determined by the contingency planning, which can be called accidents according to both the terminology of environmental protection and the common language; however, these are called operation breakdowns belonging to the contingency planning according to the nuclear regulations. On the basis of the above conception the main statements of the study of the detailed environmental impact investigation, carried out by taking the events determined by the contingency planning into consideration, are the following:

The operating time of the nuclear power station can be extended with the appropriate procedures that handle aging, and the majority of the activities needed for it has to be carried out because of the planned operation of thirty years as well. The interferences – with only a few exceptions – can be carried out as parts of the planned maintenance and reconstruction activities. So no influencing factors and processes differing from the present ones have to be taken into account, either during the preparations for the extension of the operating time, or during the extended operating time; the probable effects are also the same as the present ones. So we do not have to take significant changes in the environment of the affected area into consideration, either until 2012, or during the extended operating time.

The environmental effects of operation breakdowns are rather complex; they strongly depend on the environmental spreading conditions. The evaluation of this is contained in the Definite Security Report, where we can find the probable emissions in the case of operation breakdowns belonging to the contingency planning, their incidence rates and the estimated radiation doses that can occur in the plant buildings and in the environment. In the case of operation breakdowns a certain amount of the radioactivity of the primary circle spreads into the rooms of the main building of the plant, and maybe into the atmosphere, as well. In the Definite Security Report we can find the calculations of the isotope-constitution, radioactivity of radioactive materials potentially spreading into the environment of the power station, as well as the calculations of the radiation load coming from these. It has been proved that we do not have to reckon with negative effects on the environment, even in the most serious case, either under normal, or unfavorable weather conditions. The effects considered to be tolerable stay within a range of 20-24 km, even under extremely unfavorable circumstances, as far as the attenuation is concerned. As a result of a security enhancement alteration, which is going to take effect during the preparations for the extension of the operating time, the emission rates of the operation breakdowns are going to be reduced by an order of magnitude, so the

area affected by the operation breakdowns belonging to the contingency planning is going to be covered by a circle with a radius of 6,3 km.

All in all, considering the affected areas the following can be stated:

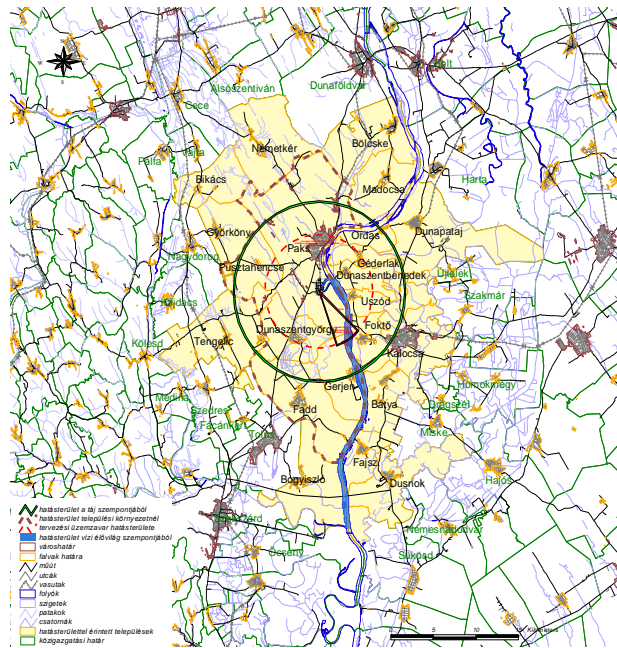
Affected areas from a radiological point of view:

- During normal operation the nuclear power station does not affect the neutral conditions, according to the criteria of gas and liquid emissions and the dose criteria of human health care depending on them.
- In the case of events belonging to the contingency planning the affected area can be a maximum range of 6,3 km.

Affected areas from a non-radiological point of view:

- Air: the affected area is the environment of the slip roads of the motorway No.6 within 25ms, as far as traffic is concerned; from the point of view of industrial sources it is the company seat, and in the case of testing the diesel generators it is a circle of 590m, surrounding the machines.
- In the case of surface waters the affected area can spread to the mouth of the river Sió, primarily considering the thermal loading. All in all, based on the water quality, the outflow and the temperature conditions of the Danube, the planned extension of the operating time can be carried out without coming up against barriers that serve the protection of the water quality of the river, and without opposing the criteria determined by The Water Framework Directive.
- Considering the soil and the ground waters, the effects of the probable special pollutions stay within the company seat.
- Noise: the company seat, the slip roads and their immediate environment could be considered as effected areas; the effects stay within the company seat.
- Settlement environment – the affected area is primarily the township of Paks. However, the positive effects considering the establishment of workplaces among others expand to the neighboring settlements of Paks and the Fadd-Dombori backwater of the Danube as well.
- Terrestrial flora and fauna – our investigations recovered no direct area of affection.
- Aquatic flora and fauna - the cold water channel and the few kilometer-long part of the river below the point where the warm water channel pours in has to be evaluated as areas of affection.
- Usage of the land – the 3 km long security zone of the power station is considered the area of affection. From the point of view of the landscape the area of affection is larger than that; from certain directions, an area of 8-10 km can be marked.

**Figure 3: The area of affection**



Because of the fact that we are talking about a power station that has been in operation for more than twenty years, the effects of normal operation are supported by factual data as well (including the data of the company seat characterization and monitoring systems). It can also be proved that in normal operation there are no effects spreading over borders as results of the extension of the operating time. Taking the potential effects of operation breakdowns into consideration we can state that extremely elaborate investigations (probably we are talking about the type examined in most cases) support the fact that there are no harmful, or new effects that can spread over borders, even in the case of contingent operation breakdowns, as a result of the extension of the operating time.

The checking and handling of the aging and the technical and security conditions of the apparatuses is a continuous activity. During the extended operating time the security of the power station does not decrease; moreover, it increases because of the development of the scientific and technical knowledge and the available experiences.

## **5. The social acceptance of the extension of the operating time**

### ***5.1. The domestic social estimation and taking part in the procedure of environmental protection***

The social acceptance of the power station and the extension of the operating time are closely related.

The establishment of the Paks Nuclear Power Plant was carried out without the enquiry of the people. This aroused repugnance to the project, even though it did not cause acute problems. The changing in opinions about the nuclear power station, and the nuclear energy in general was a long process. Today, and for years permanently, 75% of the people questioned agrees and has agreed, respectively, with the operation of a nuclear power station in the country.



In the political position of the Parliament on 21 November 2005, 96,6% of the members of Parliament supported the extension of the operating time of the Paks Nuclear Power Plant. This fact influenced the public opinion as well, since the politically independent support, almost without precedent demonstrated the importance of the cause towards the population.

For the social acceptance of the extension of the operating time the power station did the most not during the procedure of environmental protection, but much before it. The operator of the power station initiated informative meetings; arranged visits for every settlement concerned much before the procedure was started, and in all forms and circles was ready to answer the questions.

The extension of the operating time was accepted by the settlements concerned. On the right side of the Danube it could easily be explained by the fact that this region is the immediate beneficiary of the existence of the nuclear power station. However, the people living on the left side of the Danube do not get immediate benefits from the power station, either in the form of tax income of the local government, or in the form of workplaces. The benefits of the consciously cultivated decades-long relationships and partnerships testify themselves in their pure form. The dominating factor here is that there is an information centre on the left side of the Danube as well, and the neighboring settlements have their own measuring stations that provide them with exact, up to date information, precluding every incorrect rumor. This experience of the population authenticated the information about the operating time and the impact study that formed the subject of the public enquiry as well. Most probably this and not the passivity of people was the reason why no written remarks arrived as far as the effects of the extension of the operating time of the nuclear power station was concerned.

In respect of authorizing the extension of the operating time from the environmental protection point of view, the preparations for the public enquiry were carried out according to the regulations. The public enquiry organized by the authorities took place in Paks, on 28 April 2006.

**Figure 4: The pictures of the public enquiry of Paks**



During the public enquiry the price of the electricity produced in the nuclear power station, the financing of the extension of the operating time and the expenses that the consumers, tax-payers were going to be burdened with stood in the focus of people's interest. The facts tipped the scales in favour of extending the operating time, and the answer could adequately be made up on the level of everyday economy as well, so that it satisfied the questioners.

On the left side of the Danube the local government of Kalocsa took a separate initiative, and during the public enquiry organized by the local government the issue of extending the operating time of the Paks Nuclear Power Plant was brought up in the first place, preceding all other issues concerning the town. The external and internal experts of the power station and the representatives of the different authorities invited by the local government also took part in this public enquiry.

During the public enquiry, after the professional information had been provided by the power station, the questions asked were basically the same as those heard during the public enquiry of Paks, but some new ones also appeared, concerning the health impairing effects caused by the power station and the environmental measurements.

Of the domestic civil and green organizations the Energy Club Environmental Association and the organization Greenpeace kept track of the procedure. The Energy Club registered as a client in the authorization process, so that it was given the whole documentation by the competent authority of environmental protection. Their experts evaluated both studies (PES and EES) in writing, and their written opinion was made accessible on their website as well. Their representatives took part and had the floor in both public enquiries. Before the arrangement of the public enquiry organized by the authorities they turned to the minister of environmental protection in an open letter, in connection with the choice of place and time and the ensuring of possibilities of further public enquiries. This initiative was supported by some social and civil organizations, too. They appealed against the order allowing the issue of the environmental license; the appeal can be found on their website. After the operation breakdown the Greenpeace organized a demonstration during the procedure in Paks, in front of the power station in June 2003, protesting against the extension of the operating time. In February 2005 they started a protesting campaign against the extension of the operating time, together with the Energy Club, and in the same year the Energy Club and the Protect the Future Society organized a protest with the signatures of eighty personalities of public life in a paid advertisement in a daily newspaper. In 2005-2006 the Greenpeace organized informational exhibitions in the neighboring settlements of the power station to protest against the use of nuclear energy and the nuclear power stations, and to popularize the use of revolving energy.

Of course we not only have had attackers, but also supporters in recent years; for example the Hungarian Nuclear Forum took its position beside the extension of the operating time in March 2004.

During the time period of the environmental impact investigation the occurrence of the operation breakdown of the second block and the 20th anniversary of the disaster of Chernobyl resulted in several demonstrations protesting against the extension of the operating time, organized by social and civil organizations. These were echoed in the press as well. So in that situation the support by the public opinion, the acceptance of the use of nuclear energy and the emerged trust towards the power station were of high importance for the nuclear power station.

## ***5.2. The international social estimation and taking part in the procedure of environmental protection***

In the preliminary and the detailed phase of the impact investigation both the holder of the permission and the authorities stated that the extension of the operating time does not

result in a remarkable amount of harmful effects spreading over borders, that is why, there were no preliminary international notifications. Despite this fact, during the procedure of the impact investigation international interest was raised and registrations were made on the basis of the Espoo Agreement; Austria, Croatia and Romania took part in the process. In accordance with the regulations of the Agreement the Hungarian party accepted the enquiring registration, provided the necessary information, and ensured the information provision and the possibility of making remarks publicly for party “bearing the effects”.

With the three countries taking part in the procedure consultations and public enquiries were arranged, and they got complementary written responses to their suggestions and questions.

The governments of Austria and Croatia employed experts, while Romania did not take this chance. Before the arrangement of the public dispute and consultation the questions and remarks of the social and civil organizations of Romania were forwarded to the Ministry of Environment and Water.

In the public enquiry for Austria private individuals, some social and civil organizations, the representatives of the Austrian provinces and the experts hired by the government of Austria took part. The public enquiry was characterized by the antinuclear feelings of the Austrian public opinion, the preparedness of the experts and the choice of subject matter, connected to security and technical resolutions. In spite of the negative public opinion the experts took notice of the technically supported answers and arguments. This made it possible to close the procedure with the minutes.

In the public enquiry for Croatia some private individuals, the experts hired by the government, the Greens of Eszék, another civil organization and some green newspapers and daily papers appeared. They were primarily interested in the effects of the power station on the Danube, and they also asked whether the monitoring was ensured or not, and whether the results were publicly available. The mood was accepting towards the extension of the operating time; the closure of the procedure was recorded in the minutes in this case as well.

In the public dispute for Romania some private individuals and several social and civil organizations appeared. Partially they were the same organizations that made written remarks and asked questions before the public dispute was arranged. In the public dispute the majority of the questions were connected to the investigation of ecosystems in general, the expansion of the examinations and the investigation of the effects of the power station on the Danube. The mood was refusing, but this was caused not by the opposition against the extension of the operating time, but by the opposition of the Hungarian party against another ongoing impact investigation initiated by the Roman party. The process was closed by the minutes in this case as well.

**Figure 5: The pictures of the international public enquiries**



## **6. The experiences of the procedure**

The extension of the operating time of the Paks Nuclear Power Plant has got strict stipulations from the point of view of nuclear security and environmental protection, the fulfillment of which might and must be checked and enforced in the authorization procedures. During these it cannot be left unsaid that in the case of the nuclear power station, just like in the case of every other human activity, the principle of zero risk cannot be achieved, but the risks that can be identified from a quantitative point of view have to be known and accepted by the society.

The extension of the operating time of the Paks Nuclear Power Plant has to be considered a professional question, and treated on the present level of the technical-scientific knowledge, and we should deal with it with the involvement of the Hungarian society. These are going to become reality during the preparations for and the implementation of the extension of the operating time and during the authorization process from the point of view of nuclear security and environmental protection. We could experience the positive results of the open communication with the population in the social estimation of the extension of the operating time and during the environmental process.

The Paks Nuclear Power Plant has to be kept in operation for a long time, fulfilling the security requirements, so that it is going to serve the development and prosperity of our homeland as an economical and environment-protecting facility.