

10. Presentation of impacts propagating beyond state borders

10. PRESENTATION OF IMPACTS PROPAGATING BEYOND STATE BORDERS

According to the expectations of Governmental Decree 314/2005. (25 December), referring to the environmental impact assessment (EIA) and Environmental Licensing Procedure, it is a requirement just for the preliminary assessment documentation to examine if any possibility of impacts transgressing the boundaries could arise. Preliminary stage of this actual Environmental Impact Assessment has completed by acceptance of Preliminary Environmental Study compiled on the ground of Governmental Decree No. 20/2001. (14 February). This Study meets all requirements of Governmental Decree No 314/2005 now in effect, referring to the preliminary assessment, thus also the introduction of environmental impacts transgressing the border of Hungary. These impacts are to be estimated and evaluated in the same way as all other ones, with the expression that its character of transgressing the boundaries shall be analysed, and reference shall be made on the probable significance of the impact at the affected area extending over the boundaries.

By considering this expectation, we have described in the Preliminary Environmental Study of Paks NPP life extension those environmental elements and system for which any trans – boundary environmental impact could be brought on at all. We also shortly outlined in the same Study that during normal Plant operation, design basis accidents and events bound to conventional environmental releases all environmental impacts become neutral before the Country's boundary. **Thus, neither during the originally planned operation time, nor later, in the elongation period no significant impact transgressing the boundaries could be expected. This is supported by the fact that no such effect arose so far during the operation of more than 20 years.**

By assessing trans – boundary impacts, one has to consider protection of inhabitants and environmental state of the neighbouring countries. In that we effectuated the principle – lain also by international contracts – that protection of inhabitants and environment of neighbouring countries shall attain at least the same level as prevails in Hungary.

In spite of professional consideration described in Preliminary Environmental Study, Government of Austria reported his interest in the Environmental Impact Assessment procedure. The ground of reference of this reporting compiled first that elongation of operational time increases probability of occurring operational accidents, and in case of beyond design basis accidents Austria could be affected.

Paks NPP and the professional team accomplishing the Environmental Impact Studies revised the report submitted by Austrian party and concluded that statements and assumptions in it partly referring to handling the aging, and on the other hand to the boundary transgressing impacts do not form any part of this actual Environmental Licensing Process. Questions in the Report shall be answered in a further licensing proceeding to be accomplished by the OAH (National Atomic Energy Authority).

Thus, we maintain our statement expressed in the Preliminary Environmental Study that no significant boundary transgressing impact could affect the surrounding countries neither in the period of extended Plant operation, neither in connection with normal operational events nor the design basis accidents. (Measures taken to eliminate accidents exceeding these ones and prevent increase of their probability shall be discussed in a later proceeding). By considering

this, hereinafter we evoke the statements of Preliminary Environmental Study, both in relation of radiological and conventional loads.

The following questions shall be clarified in order to determine the significant impacts propagating beyond the border:

- Is it possible at all, considering our particular activity, that such influencing factors and impact mechanism might prevail that could be associated with the possibility of propagating beyond the border shall be considered? Which are those effective factors at which such possibility would not occur, or would occur only with very slight probability or in very special cases?
- How do certain impacts/ mechanism propagate and how are they accumulated under a possibly load?
- Which are those impacts that will have definitely a dampening tendency as getting away from the place of release or load, and which are those ones that might show an increasing tendency? Which features of the affected area do reduce or increase respectively the propagating potentials of impacts?
- Which sensitivity factors of the impact area located in the neighbouring country do increase the extent of impacts significance? What is that limit above which a detectable change shall be considered as an impact, or even as a significant impact? What might be the notification margin that initiates special procedure?

In addition, in this special case, another question is raised. Whether the phenomenon of propagating beyond the border is a consequence of the operating time extension, or it may occur due to the current operation as well?

Some of these questions are generous, therefore it can be answered independently of the activity and the regional characteristics while the other part of them is activity- and region specific. Notwithstanding, it can be stated that the following three factors have a dominant role with respect to judgement of impacts propagating beyond the borders:

- such effective factors which assume the possibility of propagating over a larger area,
- propagating potentials of impacts, and
- sensitivity of the impact area, and those features of the affected area which facilitate or prevent propagating.

Consequently, in order to evaluate the impacts, information on these three factors shall be acquired.

The significance of the effects of the given activity, spreading beyond the country-border might be, at the level of elaboration of the preliminary environmental impact study and of its authority evaluation judged, based on execution of the following steps:

- a) On the basis of the site, the nature of the activity and the technology to be applied, it shall be judged whether the impact propagating beyond the border can be theoretically assumed or not.
- b) Those ones shall be selected from the effective factors and effect processes of the given activity, in case of which initiation of unfavourable environmental-ecological process(es) spreading beyond the country-border is reasonably predictable.
- c) The way of propagating and possibilities of the effect processes initiated by the effective factors taken into account shall be estimated, and on the basis of this it shall

be judged whether these impacts will get (might get) into the neighbouring country. (That is, the expected impact area shall be approximately defined.)

- d) If the possibility of spreading of the effects beyond the country-borders was earlier confirmed, then the characteristics of the concerned affected area shall be explored, in other words the sensitivity of the given area to the new effect processes shall be determined. Based on this and on the comparison of the effect processes and of the area sensitivity the effects really spreading over the country-borders shall be selected.
- e) Significance of the propagating impacts shall be evaluated.

In the following section, answering this question we want to judge the possibility of propagating beyond the border with respect to the nuclear power plant's activity related to the operating time extension.

a) The plant site and the nature of the activity

As it is known, the nuclear power plant is located in the middle of the country, at a significant distance from the borders. Also its distance from the south border is close to 100 km. This means that, considering location of the plant site, occurrence of impact propagating beyond the border is probable only in very extreme cases. (Generally these impacts are anticipated in the zone of max. 10-20 km from the borders.)

However, generation of nuclear energy as an activity and the pressurized water technology applied in the nuclear power plant involve special releases which are not common at industrial plants, which, even under normal operation conditions, anticipate impacts capable of considerable propagating, primarily with respect to the surface waters.

b) Impact factors

Definition of the impact factors and mechanisms anticipated during current operation of the nuclear power plant is given at the beginning of Chapter 5. The question is whether in case of extended operating time of the nuclear power plant, the impact factors and mechanisms differing from or exceeding those of the current Plant, should be anticipated or not. On the basis of information described in Chapters 3 and 7, that unambiguous answer can be given that neither a new process, nor one significantly differing in respect of its volume, consequently predicting the possibility of propagating beyond the border, shall not be considered. (It is also generally accepted that propagating beyond the border is mostly caused by impacts of larger quantity, larger scale.)

In accordance with the nature of the activity, the impact factors and mechanisms can be classified into two groups: the radiological and the conventional ones. It is practical to separate them also from the point of view of propagating beyond the border. The mechanisms earlier presented are not repeated here, only those ones are highlighted for which, due to their nature and strength, impacts propagating beyond the border are anticipated.

During normal operation impact propagating beyond the borders can be anticipated only in case of releases into the surface waters. (See: Load of the Danube with radioactive materials, its thermal load, conventional pollution by used waters.) In addition to this, in case of a design emergency, atmospheric releases also may occur. Justification of these mechanisms already leads us to the next issue.

c) Effect propagating

The justification is provided by assessment of the way of effect propagating and of the transmitting medium. Both in the air and the surface waters, it is possible that polluting materials and other loads get far distances without demixing or deposition. This is caused by particularity of the media (water, air). They are, in contradiction to for example the soils, not capable of accumulating the pollutions. Consequently, in both media it is frequent that it is possible the impacts to be detected also at a distance of more hundreds, thousands km. For example, in the vicinity of the Paks Nuclear Power Plant, it is possible to detect and separate radioactive contaminants originating from the catastrophe of Chernobyl and from the natural background contamination.

Of course, the detectability and the factual effect do not simultaneously occur. That is, an effect which is detectable with an instrument, not necessarily affects each effect sufferers, see for example the natural background contamination. Even so, investigating only the detectability in the first step, the propagating beyond the border is assumable with respect to both the indicated water loading and the havaria-natured air pollution.

In case of questions included in item **d)** it is not yet possible to perform a more detailed assessment in this phase, since sensitivity of the effect areas beyond the border is not known in detail. Even so, in our opinion, a decision shall be made on the significance of impacts in this special case.

d) Significance of impacts

In our opinion the “significant” effect assumes that the given state change causes not a temporarily, but a final change, or an environmental loading existing for a prolonged time. It means also that it shall be at least a loading one, in accordance with the qualifying category-system. In our opinion, it is not allowed a neutral and acceptable effect to be considered as significant. The significant impacts shall be primarily sought among impacts of the operational activity, and among possible single impacts which can be eliminated. The significant effect shall be related to the most sensitive effect sufferer in accordance with the Hungarian practice.

With respect to the operating time extension of the nuclear power plant, scope of the significance is fundamentally influenced by the fact that further existence of the current state can be essentially considered from the point of view of the environment. **The environmental state expectable during operation of the nuclear power plant beyond its design operating time is identical with the current environmental state** (apart from tendencies not related to the nuclear power plant, for example, increase in the number of sewage purification plants and in the traffic).

This means also that the state parameters appearing in the Danube, and in case of havaria-events in the air, which are instrumentally detectable also at the other side of the border, will remain for further 20 years. It is a decidable question whether persistence of this state is a significant effect or not.

In our opinion, with respect to the water pollution detectable only in normal operation, the foreign partner (our south neighbour) has already answered this question by means of that it has not indicated any problem in this relation towards Hungary. On the basis of this it may possible to come to the conclusion that **the free of change state can not be considered as a significant environmental effect**, in addition to not all changes instrumentally detectable are included in the environmental effect category.

After answering the questions, it shall be investigated that how the significance of impacts remained after narrowing and probably propagating beyond the border can be assess.

Radioactive releases into the air

Under normal operating conditions of the nuclear power plant, radioactive inert-gas activity of a couple of times 10^{11} Bq/day and ^3H (tritium) of app. $1,5 \times 10^{10}$ Bq/day are released into the atmosphere. This, according to the most conservative assumptions, is diluted to its millionth, consequently expected concentrations for inert gases will remain under the value of 1 Bq/m^3 , while for tritium, they are going to lower by ranks of magnitudes. This estimated activity can be detected by currently used instruments, but the increase, i.e. addition arising from Paks could not be differentiated. The health-physics effects for the people and the living world are reduced below evaluation and detection levels as close as 10-12 km from the nuclear power plant. In summary, they have neutral impact on the environment.

The information mentioned above covers tritium ^3H and inert gas releases. Releases of longer half-time isotopes, which accumulate more readily in the environment, can be described by a value of $10^4 - 10^7$ Bq/day. The concentration of these releases at state borders assumed to be in the range of one-tenth mBq/m^3 , which is practically under the detectable limit.

Propagation of releases calculated for the design basis accident at the boundaries results in a detectable noble gas concentration of $10^4 - 10^5 \text{ Bq/m}^3$, but their health physics impacts diminish to neutral level at the vicinity of the Plant, thus within the boundaries of Hungary,. This is confirmed by data of Tables 8.2. and 8.5, as well as by those of 8.8. and 8.11. Note that data applied in Chapter 8 refer to unfavourable meteorological conditions occurring with low probability. In case of normal meteorological conditions, activity concentrations to be expected at the boundaries could be 100 or even 1000 times lower.

On the basis of above mentioned, **the radioactive airborne releases can not be qualified as significant beyond state borders** even in the case of design basis accident.

Radioactive releases into the surface waters

During the normal operation fission and corrosion by-products with less than 1.5 GBq/year activity reach surface waters. Calculating with the minimum water output of the river Danube, this release results in an activity concentration of $50-60 \text{ mBq/m}^3$, which can not be detected by direct instrumental measurements, its detection might be possible only with radio-analytical methods.

Accumulation of components having a longer lifetime on floated or bed sediment is a detected phenomenon (due to this in some cases higher activity-concentration is measured at the Danube section above Paks, than at the section after the nuclear power plant), but this moves together with the sediment and its effect on the people and the living world is minimal already in the vicinity of the nuclear power plant.

App. 20 TBq of ^3H (tritium) is released from the nuclear power plant each year, final receiver is the river Danube. Under low-water conditions, this release can be detected at the border region (app. $300-600 \text{ Bq/m}^3$), but with no health-physics impact.

As an impact of releases into water due to elimination of consequences of the incident related to the rupture of the large-diameter cold leg pipe, fission and corrosion by-product radioactivity concentration of 170-200 mBq/m³ is expected at the border region of the river Danube under low-water conditions, which by its magnitude is very close to release under normal conditions. On the basis of facts mentioned above, **there is no significant radiological impact on water-environment propagating beyond state borders.**

On the basis of facts mentioned above, **there is no significant radiological impact on water-environment propagating beyond state borders**, since the effect of radioactive materials released into the surface waters is already neutral at the border.

Heat release into the Danube

The previous estimations related to the thermal loading assumed that the heat tailing may detectably affect the water temperature even 10-80 km from the inlet. On the basis of this it could be assumed that effect of the heat tailing is detectable at the border which is 94 km from the nuclear power plant, consequently propagating beyond the border would be considered also in this case. (Although the significance would be questionable, since according to estimations, the temperature increment would be below the value of 1 °C at the border.)

During the site monitoring programme, the temperature distribution and mixing of the heat tailing has been investigated using several methods. On the basis of thermo-photographs taken, it appears unambiguous that:

- the heat tailing always travels osculating to the right bank and enters into water areas between shallows, as well;
- mixing of the heat tailing dominantly (approx. in 95%) occurs at the section between 4-5 km after the inlet;
- the heat tailing can be followed approximately up to the line of Gerjen-Bátya, which accurately corresponds to 10 river kilometres calculated from the inlet.

The thermo-visional investigations detect only the surface temperature differences of the given water body (Danube). This method does not suitable for investigating and detecting the mixing in the depth, as well as the temperature differences. Therefore, also investigations of changes of (along the gauging vertical) temperature distributions in the depth have been executed. According to these investigations, the temperature distribution investigation along the gauging vertical executed in the section of the new bridge of Szekszárd registered a difference of only slightly more than 1 °C between the left and the right bank. Thus, impact of the hot water plume can be measured at 25 – 30 km distance, but only to minimal extent. **Impact area belonging to surface waters – mainly from heat load aspects – extends to the Sio river mouth.** Here, due to change in flow conditions, mixing, etc. – addition temperature prevailing anyway on the limit of detectability – smooths into the natural background. Consequently, **a significant impact propagating beyond the border due to the thermal load shall not be considered.**

Release of conventional pollutants

Conventional polluting materials may enter the Danube, on one hand, during normal operation, on the other hand, in case of a havaria-event. In our opinion with respect to the

water pollution, the significance can be unambiguously declared generally in the following cases:

- if due to any pollutant material loading, in the border section, the river shall be classified into a category worse than the current one with respect to one or more water quality components;
- if the water quality deterioration (although does not exceed criteria concerning the classification, but) is at least 20-30% in the border section (since it is not possible us to precisely know neither the base load, nor the sensitivity factors and the utilization at the river section of the neighbouring country);
- if more such polluting materials simultaneously get into the water, or it is simultaneously affected by different other loads, at which interactions shall be considered in the border section, that is the accumulation effect of the different pollutions can not be calculated, consequently the risk is high;
- if another load corresponding to the investigated release of the planned activity shall be considered up to the border.

In this case neither the first two phrases, nor the forth one are valid. (This is confirmed by the evaluation of water quality measurements executed for a long time. See appropriate sections of Chapter 4 and 5.) However, it is true for the nuclear power plant that it releases simultaneously different polluting material loads into the Danube. See, radioactive contamination, waste water, industrial waters and thermal loading. Therefore, with respect to these loadings we have to assess whether processes intensifying each other may occur in the border zone.

From those ones, according to derivations in the previous item, no significant heat load promoting summing up of impacts could be expected at the boundaries. Impact of additional communal wastewater released by the Plant could be presented practically only at a very short distance, because of the otherwise very high pollution of the Danube. There are remaining only two components that could be indicated at the boundary: the radioactive and the industrial contamination. Albeit those could be indicated at the river boundary sections, but in themselves, neither of them provides a significant effect. As no accumulation could be expected, their unfavourable features are not worsening each other in such low concentration, thus no impacts above the neutral ones are considered, not even in the case of their adding.

We deem that **in case of conventional water and atmospheric pollution, no impacts transgressing the boundaries should be considered, not even in case of accidents.** Impacts of conventional accidents and estimated impact areas are shown in Table 5.5.17.

Among conventional water pollution, the accident of greatest impact area is the oil contamination of Danube resulted by failure of the Turbine Lubrication System. Its impact area, by considering the options of interventions is estimated to 20 km.

As for the conventional air polluting materials, impact area of a fire occurring at the Plant site has been estimated to 1 – 3 km.

On 24 January 2005 the Environmental Inspectorate and Water Conservation Authority of Lower Danube Valley has got informed that Austria reported himself to be affected and reported himself at the Ministry of Environment into the Impact Assessment Procedure, partly on the ground of Espoo Convention, partly of 97/11 EC Council Directive modifying the 85/337/EU Directive. Environmental Inspectorate and Water Conservation Authority of

Lower Danube Valley ordered the Paks NPP to submit documentation need to inform the Austrian party. On 18 March 2005, all Hungarian and English information materials were delivered to the competent person of Ministry in electronic form, which were forwarded by the Ministry to the Austrian party. Getting acquainted with the delivered materials, the Austrian party noted again that he is willing to take part in the proceeding, and asked for the complete Preliminary Environmental Study together with the Public Summary. Those were delivered in June. On 21 October 2005, Environmental Inspectorate noticed by a letter (Ref. No.: 100562-004-229/05) the Paks NPP that remarks of the Austrian party attached to the letter shall be evaluated and considered by accomplishing the Environmental Impact Study, according to their merit. This actual Study has been compiled by taking this into account, questions of the Austrian party has been responded at the depth defined by the Governmental Decree, in the respective Chapters. Questions related to handling the aging, power increase are dealt with in Chapters 2 and 3, issues of accident impacts in Chapters 5.5 and 8, and the topics of seismicity in Chapters 4 and 6. Questions raised by Austrian party that are beyond the scope of this actual Study are included in Annex 4 attached to the submittance of present Impact Study.