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Report to the Austrian Government

EIA procedure for the lifetime extension of Paks NPP

Statement on the Preliminary Impact Assessment Study

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1 Executive Summary

The review of preliminary environmental impact study was done in two phases. (legal and technical perspective)

In the first stage of work legal questions had to be investigated, foremost to what extent the EIA documentation has to deal with accident scenarios, which could affect Austrian territory

Based on a review of international treaties, conventions, EU law and bilateral treaties, the following conclusion about the legal aspects can be summarized:

1. The case of the extension of the operating time of the nuclear power plant Paks is covered by the application scope of the EIA-Directive respectively the ESPOO-Convention.
2. The position of the Hungarian authorities on to the question of whether their neighbouring states are likely to be significantly affected, which only takes into account the probability of the occurrence of accidents while at the same time excluding severe accidents (beyond design basis accidents) is not in line with the ESPOO-Convention and the EIA-Directive.

   Owing to the fact that

   (1) the impact caused by the extension of the operating time of the nuclear power plant Paks is not exclusively of a global nature in the legal sense of Article 1 (viii) of the ESPOO-Convention,

   (2) a number of international conventions and declarations define the obligation to co-operate in the way of consultations in the field of nuclear energy,

   (3) according to the recommendations of the UNECE-Secretary the threshold to determine the significance of negative transboundary effects has to be set at a very low level, i.e. whenever there is a possibility, no matter how uncertain, that an impact may be significant, notification should be transmitted,

   (4) according to ANNEX III of the Council Directive 97/11/EC amending Directive 85/337/EEC and the recommendations published by the ESPOO-Authorities, the possibility of the occurrence of a (severe) accident should only be one criterion amongst others when determining whether or not a transboundary EIA should be accomplished,

   (5) according to the decisions of the European Court, the wording of the EIA-Directive indicates that it has a very wide scope and a broad purpose and therefore a transboundary EIA should be in all cases established unless it can be excluded, on the basis of objective facts, that the neighbouring state will be significantly affected by the project,

   (6) the likelihood of causing significant transboundary effects should only be tentatively analysed before the decision to accomplish a transboundary EIA is taken by asking whether the project may by its nature have significant effects on the environment of the neighbouring state; the detailed analysis, taking into consideration the sensitivity of the flora and fauna of the neighbouring state affected

(this information should be transmitted from the affected country), should be carried out during the EIA-Process,

(7) the precautionary principle should play a dominant role when interpreting the term of "likelihood of having significant transboundary effects",

(8) the specific nature of the risk of operating a nuclear power plant which can be qualified as ultra-hazardous-activity (relatively low probability of occurrence on the one hand but probability of causing disastrous consequences on the other hand),

(9) neither in the ESPOO-Convention and the EIA-Directive nor in the treaty between the Republic of Austria and the Republic of Hungary concerning questions of common interests in the context of nuclear activities, the distance to the border of the neighbouring state constitutes a relevant criterion,

(10) the likelihood of having significant effects must be seen as a product of the probability of occurrence of the impact and its magnitude,

(11) in the last years the practice has been established that a neighbouring state takes part in the decision-making process concerning nuclear activities by accomplishing a transboundary EIA

and

(12) severe accidents (beyond design basis accidents) have to be taken into consideration by determining the likelihood of having significant transboundary effects,

the Republic of Austria takes the position that it is significantly affected by the extension of the operating time of the nuclear power plant Paks and therefore a transboundary EIA should be conducted.

3. The exclusion of severe accidents (beyond design basis accidents) in the preliminary study is neither in line with the ESPOO-Convention nor with the EIA-Directive.

A detailed analysis of beyond design basis accidents and their potential effects should form an essential part in the EIA-Documentation.

As a general conclusion of the technical evaluation of the preliminary environmental study, it must be stated that relevant issues for neighbouring countries are not sufficiently elaborated. In order to permit the assessment whether, or to which extent, additional risk for the Austrian population will arise from the life extension of NPP Paks the detailed elaboration of the following issues in the environmental documentation is requested:

(1) The overall treatment of ageing in an NPP is of importance for the risk of extended plant operation. Of particular importance and safety significance is the ageing of the reactor pressure vessel, the steam generators, and the confinement system.

(2) Reliable data on the original state of the pressure vessel, the composition of the materials, the embrittlement surveillance program, the thermo-shock analyses performed etc. should be presented in the documentation.

(3) Also treated in some detail should be the corrosion of steam generators and the option of steam generator exchange; as well as the connection between steam generator corrosion and fuel element contamination.

(4) The long-term behaviour of the confinement system (steel liner, barbotage system etc.) should be discussed in the documentation.

(5) Furthermore, the ageing of many other systems, structures and components can also be of safety significance. A comprehensive ageing management program is required and should be presented in the documentation.

(6) The effects on the safety margins of the plant related to ageing in connection with power uprating should be presented in the documentation, including the specifications and effects of the new type of fuel to be used.

(7) The issue of seismic hazards (including both site seismicity and seismic design) will have to be presented and discussed in a comprehensive manner in order to permit the assessment to which extent appropriate, state-of-the art data and methods have been applied and which additional analyses might be required.

(8) The issue of terror attacks and sabotage can and should be discussed without disclosing sensitive information.

(9) A comprehensive discussion of DBA and BDBA scenarios and severe accident management measures, including the results of safety analyses concerning BDBA (initiating events, scenarios, source terms) is required to assess the potential risk for the Austrian population in greater detail.

2 Zusammenfassung

Die kritische Durchsicht des vorliegenden UVP-Konzeptes (lt. ungarischem Recht: vorläufige Umweltstudie) erfolgte in zwei Phasen. (juristische und technische Perspektive).

Im ersten Bearbeitungsschritt wurden die juristischen Fragestellungen bearbeitet. Hierbei wurde aus juristischer Sicht die Frage beantwortet, ob die vom Projektwerber vorzulegenden UVP-Dokumente auch Szenarien von Unfällen darzustellen haben, welche negative grenzüberschreitende Folgen auf österreichisches Gebiet haben könnten.

Basierend auf einer eingehendem Studium der internationalen Rechtsliteratur, Konventionstexte, EU-Recht und bestehenden bilateralen Vereinbarungen zwischen Österreich und Ungarn ergeben sich folgende juristische Schlussfolgerungen:

1. Die EU-UVP-Richtlinie und die ESPOO-Konvention sind für die beabsichtigte Betriebsverlängerung des KKW Paks anwendbar.

2. Der Standpunkt der Ungarischen Behörden, wonach bei der Frage der Betroffenheit von Nachbarstaaten lediglich auf die Eintretenswahrscheinlichkeit von Störfällen abzustellen ist mit der Konsequenz, dass schwere, aber nicht sehr wahrscheinliche Störfälle (auslegungsüberschreitende Unfälle mit geringer Wahrscheinlichkeit) keine Berücksichtigung finden, entspricht weder den Anforderungen lt. ESPOO-Konvention noch den Bestimmungen der EU-UVP-Richtlinie.

   Berücksichtigend, dass

   (1) die Auswirkungen der beabsichtigten Betriebsverlängerung des KKW Paks gemäß den Bestimmungen von Artikel 1 (viii) der ESPOO-Konvention keineswegs ausschließlich von globaler Natur sind,

   (2) eine Anzahl von internationalen Konventionen und Erklärungen die Verpflichtung zur Zusammenarbeit auf dem Gebiete nuklearer Sicherheit im Wege von Konsultationen festlegt,

   (3) gemäß den Empfehlungen des UNECE-Sekretariats der Schwellenwert für die Bedeutsamkeit negativer grenzüberschreitender Auswirkungen sehr niedrig anzusetzen ist mit der Folge, dass wenn immer die Möglichkeit des Auftretens von Auswirkungen, egal mit welcher Sicherheit, besteht, dem Ersuchen um Notifikation statt zu geben ist,

   (4) gemäß ANNEX III der EU-Richtlinie 97/11/EC in Ergänzung zur Richtlinie 85/337/EEC und den entsprechenden Empfehlungen, welche von den ESPOO-Stellen veröffentlicht wurden, die Wahrscheinlichkeit des Eintretens eines (schweren) Unfalls als nur eines von mehreren Kriterien anzusehen ist, um über die Notwendigkeit eines grenzüberschreitenden UVP-Verfahrens zu entscheiden,

   (5) gemäß den Entscheidungen des Europäischen Gerichtshofes sich aus dem Wortlaut der UVP-Richtlinie ergibt, dass diese einen weiten An-wendungsbereich und -umfang hat und daher ein grenzüberschreitendes UVP-Verfahren immer durchzuführen ist, außer es kann auf Basis objektiver Fakten ausgeschlossen werden, dass das entsprechende Projekt potentiellen grenzüberschreitenden Gefährdungen mit sich bringen kann,

(6) vor der Entscheidung, ob eine grenzüberschreitende UVP durchgeführt werden soll, die Frage der Wahrscheinlichkeit nur kursorisch geprüft werden sollte, in dem gefragt wird, ob das vorgesehene Projekt seiner Natur nach geeignet ist, grenzüberschreitende Auswirkungen nach sich zu ziehen; die Frage der tatsächlichen Eintretenswahrscheinlichkeit sollte sodann ausführlich im Rahmen der vorzulegenden UVP-Dokumentation (gemäß ungarischen Recht: Umweltstudie) analysiert werden,

(7) die Frage der Wahrscheinlichkeit grenzüberschreitender Auswirkungen im Lichte des Vorsorgegrundsatzes zu beurteilen ist,

(8) die beim Betrieb eines Kernkraftwerks auftretenden Risiken von besonderer Natur sind (einerseits geringe Eintretenswahrscheinlichkeit, andererseits aber besonders weitreichende, desaströse Folgen),

(9) die Entfernung des Standorts des Kernkraftwerks zur Grenze eines Nachbarstaates für sich allein gesehen weder in der ESPOO-Konvention, der EU-UVP-Richtlinie noch im bilateralen Nuklearinformationsabkommen zwischen Ungarn und Österreich ein Ausschließungskriterium bildet,

(10) die Wahrscheinlichkeit erheblich grenzüberschreitender Auswirkungen als Produkt zwischen der Eintretenswahrscheinlichkeit einerseits und des Stärkegrads der Auswirkung andererseits anzusehen ist,

(11) sich in den letzten Jahren die Rechtspraxis etabliert hat, einen Nach-barstaat beim Entscheidungsprozess betreffend nuklearrelevante Projekt-vorhaben im Wege der Durchführung eines grenzüberschreitenden UVP-Verfahrens zu beteiligen,

und

(12) schwere Unfälle (auslegungsüberschreitende Unfälle – beyond design basis accidents) bei der Beantwortung der Frage ob erhebliche grenzüberschreitende Folgen in Zusammenhang mit einem Projektvorhaben vorliegen können, selbstverständlich Beachtung zu finden haben,

vertritt die Republik Österreich den Standpunkt, dass sie vom Projektvorhaben Betriebsverlängerung für das KKW Paks erheblich betroffen ist und daher ein grenzüberschreitendes UVP-Verfahren durchzuführen ist

3. Die Nichtbehandlung von schweren Unfällen in der gegenwärtig vorliegenden Vorstudie als erster Teil des ungarischen UVP-Verfahrens entspricht nicht den Bestimmungen der ESPOO-Konvention bzw der EU-UVP-Richtlinie.

Die in weiterer Folge des UVP-Verfahrens der Öffentlichkeit vorzulegende UVP-Dokumentation (lt. ungarischem Recht: Umweltstudie) hat daher eine ausführliche Darstellung von Unfallszenarien, insbesondere zu schweren auslegungsüberschreitenden Unfällen, mit zu beinhalten.

Generell ist als Schlussfolgerung aus der technischen Evaluierung der vorläufigen UVP festzuhalten, dass die für Nachbarländer relevanten Themen nicht ausreichend ausgearbeitet wurden. Um eine Bewertung zu ermöglichen, ob und in welchem Ausmaß die Lebensdauerverlängerung des Kernkraftwerks Paks für die österreichische Bevölkerung

zusätzliche Risiken darstellt, wird die detaillierte Ausarbeitung folgender Fragen in der UVP-Dokumentation gefordert:

(1) Generell ist die Behandlung der Alterung eines Atomkraftwerks für die Risikoabschätzung einer Lebensdauerverlängerung wichtig. Von besonderer Bedeutung und Sicherheitsrelevanz ist die Alterung des Reaktordruckbehälters, der Dampfgeneratoren und des Confinement - Systems.

(2) Zuverlässige Daten über den Zustand des Reaktordruckbehälters, die Zusammensetzung des Materials, das Programm des Versprödungsmonitorings, und die durchgeführten Thermoschockanalysen etc. sollten in der Dokumentation präsentiert werden.

(3) Auch detailliert behandelt werden sollten die Korrosion der Dampferzeuger und die Option des Austausches der Dampferzeuger, wie auch der Zusammenhang zwischen Dampferzeugerkorrosion und Brenn-elementverunreinigung.

(4) Das langfristige Verhalten des Confinement-Systems (Stahlauskleidung, Barbotage-System etc.) sollte in der Dokumentation behandelt werden.

(5) Darüber hinaus kann auch die Alterung vieler anderer Systeme, Strukturen und Komponenten sicherheitsrelevant sein. Ein umfassendes Programm für das Alterungsmanagement ist notwendig und sollte in der Dokumentation behandelt werden.

(6) Die Effekte der Sicherheitsreserven des Kraftwerks in bezug auf die Alterung in Verbindung mit einer Leistungserhöhung sollten in der Dokumentation präsentiert werden, einschließlich der Spezifikationen und der Effekte der neuen Brennstoffart, die verwendet werden soll.

(7) Die Frage der Erdbebengefährdung (sowohl Seismizität des Standorts als auch das seismische Design) werden umfassend präsentiert und diskutiert werden müssen, sodass ermittelt werden kann, inwieweit relevante Daten und Methoden gemäß dem Stand der Technik angewendet wurden und welche zusätzlichen Analysen notwendig sein könnten.

(8) Die Frage von Terrorangriffen und Sabotage kann und muss ohne die Veröffentlichung von sensibler Information diskutiert werden.

(9) Eine umfassende Diskussion von Auslegungsstörfällen und von auslegungsüberschreitenden Störfällen sowie Maßnahmen zur Bewältigung schwerer Unfälle, einschließlich der Resultate von Sicherheitsanalysen zu auslegungsüberschreitenden Unfällen (initiierende Störfälle, Unfallszenarien, Quellterme) sind notwendig, um das potentielle Risiko für die österreichische Bevölkerung genauer einschätzen zu können.

3 Introduction

According to Hungarian Law, an Environmental Impact Assessment (EIA) must be performed prior to granting a lifetime extension of an additional 20 years for all four units at the Paks nuclear power plant.

The Hungarian EIA is a two-stage process, with a preliminary and a detailed stage. The EIA consists of a Preliminary Impact Study, followed by a Detailed Environmental Study.

As requested by the Austrian Government, Hungary has submitted documentation for the first stage of the EIA process. The documentation was in large parts translated and made public for comment to the Austrian public by mid-September 2005.

The Federal Ministry of Agriculture and Forestry, Environment and Water Management commissioned the Austrian Environmental Agency to prepare a report to the Austrian Government addressing two aspects of the EIA documentation:

a) he legal aspects regarding the question whether an EIA documentation should include a severe accident analysis. Such analysis would best examine the main risk potentially affecting Austrian territory during a proposed lifetime extension of NPP Paks

b) technical review of the documentation provided by the Hungarian government, including an assessment of aspects which should be included in the elaboration of the environmental assessment documentation (environmental study) by the project sponsor.

The Federal Environmental Agency presents its findings, which are based on contracted works by Sutterlüty Klagian Brändle (Rechtsanwälte – Partnerschaft Dornbirn) and a consortium of experts working for the Austrian Institute of Applied Ecology.

4 Part A Legal Perspective

Transboundary environmental impact assessment Procedure of the nuclear power plant PAKS

Legal Opinion on the Preliminary Study of the Environmental Impact Assessment Regarding the Extension of Operating Time of the Nuclear Power Plant Paks/Hungary

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4.1 Introduction

The nuclear power plant Paks PLC-project applicant is Paks Atomeromu RT, 7031 Paks, Pf. 71 – intends to operate bloc 1 to 4 of the nuclear power plant beyond the previously planned period of 30 years for another period of 20 years, for which Hungarian law requires obtaining a new operating permit.

Initially, the legal question for the applicant was whether a preceding environmental impact assessment was a precondition for approval of the extension of operating time, but this question could be clarified in coordination with the Hungarian authorities.

In its statement of December 22, 2004 (Ppsf-348/4/2004), the Hungarian Ministry of Environment was of the opinion that there was no need to introduce a procedure according to the ESPOO-Convention. In the event, however, that any neighbouring country which is a party to the Convention signalizes that it wishes to be informed on or even participate in the procedure, this request must be taken into consideration.

In its notice (AZ K5K3742/05, BZ 100562-004-174/05), the Regional Regulatory Authority on Environmental, Nature and Water Protection of the Lower Danube Valley argues that the radioactive emission of the nuclear power plant Paks in normal operation, including taking into account disturbances with a degree of probability of more than 10^{-5} per year, has no significant harmful transboundary impact, as emissions have already neutralized when at the border. Such activities would thus neither fall into the scope of the Agreement on Transboundary Environmental Impact Assessment, signed in Espoo on February 20, 1991, and announced in Governmental Decree No 148 of 1999 (October 13), nor into the scope of para. 25 of Governmental Decree No 152 of 1995 (December 12).

A crucial factor in this position is in particular the fact that according to the Hungarian legal provisions on nuclear safety (Governmental Decree No 108 of 1997 (June 25), addendum

No. 3, chapter 3.5.), only such incidents are considered significant whose degree of probability exceeds 10^{-5} per year, Disturbances such as the bursting of a reactor tank do not fall under this definition.

The Republic of Austria nevertheless requested notification of the procedure in accordance with Article 7 of Council Directive 97/11/EC amending Directive 85/337/EEC and Article 7 of the ESPOO-Convention. The Republic of Hungary complied with such notification request. The Republic of Austria thus became a participant in the EIA procedure.

From a legal point of view, the following questions arise:

- the question of the need for an environmental impact assessment in the event of an extension of the previously anticipated operating time of a nuclear power plant according to international law;
- the question whether in the present case, there will be significant transboundary impacts or substantial effects on the Republic of Austria;
- the question whether severe incidences, i.e. incidences with a degree of probability less than 10^{-5} per year, have to be considered in the EIA documentation.

As the first question has already been answered by the amendment of the Hungarian Governmental Decree No 47 of 2004 (18th February), this legal opinion shall focus on the answer to the second question. The answer to the third question is mainly a consequence of the answer to the second question.

4.2 The question of the need for an environmental impact assessment in the event of an extension of THE previously anticipated operating time of a nuclear power plant

Hungarian law (see Annex No 1 to Governmental Decree No. 152 of 1995 (December 12) No. 51) as well as Council Directive 97/11/EC amending Directive 85/337/EEC (Annex I Z 2) and the Convention on Environmental Impact Assessment in a Transboundary Context (Appendix I Z 2 b) request an environmental impact assessment (EIA) preceding the start of operation of a nuclear power plant as well as the dismantling or decommissioning of such a power plant or reactor.

The particularity of the present case lies in the fact that rather than the construction of a new nuclear power plant, the operating time of an already operating power plant shall be extended by 20 years.

Section 67 of Act LIII of 1995 on the Hungarian General Rules of Environmental Protection only states that the siting or implementation of a facility or operation, the abandonment and significant enlargement or expansion of an existing facility or operation as well as a change in technologies and products and the significant modification of the above shall be qualified as activities with significant impacts on the environment. Neither Act LIII of 1995 on the General Rules of Environmental Protection, nor Government Decree No 152 of 1995 states any provisions regarding an extension of operating time.

The legal question for the applicant was therefore initially whether the extension of the operating time might be subsumed under the term "significant modification" of section 67 subsection 2 of Act LIII of 1995 on the General Rules of Environmental Protection.

This question was not clarified under Hungarian law until the amendment of the applicable provision of Hungarian law on EIA: Section 26 chapter A of Annex R1 of Governmental Decree No 47 of 2004 (February 18), included the extension of operating time of a nuclear power plant, stating that in case of an extension of operating time of a nuclear power plant, a detailed EIA was requested.

As – according to the legislation of the European Court[1] – member states only have a limited range of discretion with regard to the introduction of an obligation to conduct an EIA, the question of the need of an EIA in case of an extension of operating time of a nuclear power plant has to be examined with regard to the European legal point of view, especially when taking into consideration that decision Grosskrotzenburg of the European Court[2] establishes the direct applicability of Article 2 of the EIA directive which governs the scope of applicability for EIA.

As far as die ESPOO-Convention is concerned – the European Community signed the Convention on Environmental Impact Assessment in a Transboundary Context on 25 February 1991 – the term "proposed activity" is defined as any activity or any major change to an activity subject to a decision of a competent authority in accordance with an applicable national procedure (Article 1 Subsection VI of the ESPOO-Convention).

With regard to European law, Annex II No. 13 of the Council Directive 97/11/EC of March 3, 1997 amending Directive 85/337/EEC (EIA-Directive) concerning the scope of applicability reads as follows:

It includes "any change or extension of projects listed in Annex I or Annex II, already authorized, executed or in the process of being executed, which may have significant adverse effects on the environment."

This means that according to European law an EIA has to be conducted **for any changes or extensions** of projects.

As far as the disposal of radioactive waste within the meaning of Article 37 of the EURATOM-Treaty is concerned, the Commission Recommendation of December 6, 1999 on the application of Article 37 of the EURATOM-Treaty (1991/829/EURATOM, OJ L 324, 16.12.1999, p. 25) requests that each member state provide the Commission with general data if a member state envisages modifying a plan for the disposal of radioactive waste (No. 4. of the Commission Recommendation).

The purpose of this provision is that the risk of radioactive contamination must not be excluded even for "mere" modifications to existing sites. The Commission's opinion, which has to be given prior to the time of the permission of the disposal of radioactive waste[3], can give

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1 See e.g. ECJ case C-396/92, Bund Naturschutz in Bayern, ECR 1994, I-3745; ECJ case C-431/92, Grosskrotzenburg, ECR 1995, I-2211; ECJ case C-150/97, Commission/Portugal, ECR 1999, I-0259; et al.

2 ECJ case C-431/92, Grosskrotzenburg, ECR 1995, I-2211, para. 39 et seq.

3 See e.g. Judgement of the European Court of Justice of 22nd September 1988, Land du Saar and others v Ministre de l'Industrie and others, case 187/87, ECR 1988, p. 05013.

a very important indication to the member state, which is in particular due to the Commission's unique overview of developments in the nuclear power industry throughout the Community.

In the decisions Kraaijeveld[4] and World Wildlife Fund[5], the European Court clarified that the wording of the EIA-Directive indicates that it has a wide scope and a very broad purpose. Its purpose would be undermined if "modifications to development projects" were so construed as to enable certain works to escape the requirement of an environment impact assessment although, by reason of their nature, size or location, such works were likely to have significant effects on the environment. The mere fact that Directive 85/337/EEC (before being amended by Council Directive 97/11/EC) did not expressly refer to modifications of projects included in Annex II, as opposed to modifications of projects included in Annex I, does not justify the conclusion that they are not covered by the Directive.

Taking into account these decisions, the sole relevant criterion with regard to the question whether or not an environmental impact assessment is necessary has to **be the probability of the project (in our case the extension of operating time) having significant effects on the environment**.

In a quite recent decision dated September 7, 2004, concerning Directive 92/43/EEC (Conservation of Natural Habitats and of Wild Flora and Fauna, the "Habitats Directive"), the Grand Chamber of the European Court opinioned that the fact that an activity carried out periodically for several years on the site concerned, and that a licence has to be obtained for it every year, each new issuance of which requires an assessment both of the possibility of carrying on that activity and of the site where it may be carried on, does not in itself constitute an obstacle to considering it, at the time of each application, as a distinct plan or project within the meaning of the Habitats Directive.[6]

In his opinion delivered on January 29, 2004[7] Advocate General Kokott argued that the applicability of Article 6 (3) of the Habitats Directive cannot be based solely on the fact that the Netherlands have granted no permanent authorisation but rather renews the authorisation annually. If the need for an appropriate assessment depended exclusively on whether national law provided for permanent authorisation or annually renewable authorisation for the relevant measure, there would be an incentive to grant authorisations relating to special protection areas for an unlimited period in order to circumvent the application of Article 6 (3) of the Habitat Directive. Such circumvention would, however, be incompatible with community law.

Subsequently, the Advocate General argued that the Habitat Directive does not stipulate which activities are to be authorised in which form (limited or unlimited period). It is thus primarily the duty of the Member States to determine the relevant rules. However, temporary authorisations to be reviewed on a regular basis are particularly appropriate where the

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4 ECJ, case C–72/95, ECR 1996, I-5403 especially para. 31 and 39.

5 See Judgement of European Court of Justice of 16th September 1999, World Wilde Life Fund and others v Autonome Provinz Bozen and others, case C-435/97, ECR 1999, p. 05613, especially para. 40.

6 See Judgement of the Court (grand chamber) of 7th September 2004, case C-127/02, ECR 2004, p. 00000 para. 28.

7 See ECR 2004, p. 00000 para. 33 and 34.

possible effect cannot be assessed with sufficient accuracy but depends on variable circumstances at the time of the initial authorisation.

In this context, Article 2 (1) of the Council Directive 97/11/EC of 3rd March 1997 amending Directive 85/337/EEC, reads as follows:

"Member States shall adopt all measures necessary to ensure that, **before consent is given, projects likely to have significant effects on the environment** by virtue, inter alia, of their nature, size or location, are made subject to a requirement for development consent and an assessment with regards to their effects. These projects are defined in Article 4."

Taking into consideration this legal regulation and the decisions of the European Court described above, the following conclusion can be drawn: Whenever a project likely to have significant effects on the environment requires consent from the national authorities under national law, the project has to be subject to an environmental impact assessment.

§ 3 (1) of Governmental Decree 108/1997 of the Hungarian Government Appendices 1 to 5 of the Nuclear Safety Regulations provides for the official means of admission and the exact proceeding of the admission procedure.

Section 2.017 of Volume I Section 2.4 of the Nuclear Safety Regulations now provides that upon expiry of the operating permit, the application for a new operating permit is necessary in order to continue operating a block of a nuclear power plant.

In connection with Article 2 (1) of Council Directive 97/11/EC amending Directive 85/337/EEC, the conclusion can be drawn that in our case – extension of the operating time of the nuclear power plant – an environmental impact assessment is necessary **when this extension will likely have significant effects on the environment**.

There is no doubt that – apart from the question whether the extension of the operation period is accompanied by a significant adverse transboundary impact – the continuation of the operation beyond the period specified will have significant effects on the environment:

- As further explained in the technical part of this opinion, the symptoms of age alone (e.g. the brittleness of the reactor tank) provide for a higher risk of accidents.
- The planned increase of capacity to 500 MW within the coming 5 to 6 years might increase the risk of accidents due to the reduction of the margin.
- Finally, the extension of the operating time from 30 to the planned 50 years inevitably causes an increase of radioactive waste (burned rods in the amount of 65 to 70 percent, which *per se* is to be qualified as a major modification according to Article 2 of the Governmental Decree No 12 of 1995 of the Hungarian Government (expressly stated in chapter 7 of the preliminary study)).
- In finding an answer to the question as to the extent of significant effects on the environment the extension of the operation time is likely to have, taking into consideration modifications in the nuclear power plant is not enough: Rather, it ought to be taken into account that the environment itself is subject to permanent changes leading to an entirely new view of possible effects of the nuclear power plant. New threats such as terrorist attacks, which were not an issue some time ago, increase the risk of accidents.
- As stated in the report by the UNECE-Secretariat with the title "Specific Methodologies and Criteria to Determine the Significance of Adversary Transboundary Impact", Annex I,

one possible significant impact concerning human health and safety that has to be taken into account is the change of well-being and quality of life[8]: There is no question that living with the risk of a possible nuclear incident for 20 years longer may have a major impact on the well-being and quality of life of people living close to Paks.

All this results in the conclusion that – notwithstanding the recent amendment to the Hungarian law (Governmental Decree No. 47/2004 (February 18) Annex R1, chapter A.26) – **the obligation to conduct a detailed EIA in case of an extension of the operating time of a nuclear power plant already results out of Council Directive 97/11/EC of March 3, 1997 amending Directive 85/337/EEC** (which applies directly in case the member states do not implement it in their national law).

4.3 The question whether significant TRANSBOUNDARY effects on the environment or substantial Effects on the Republic of Austria exist (Article 7 directive 85/337/EEC as amended by directive 97/11/EC; Article 1 para (ili) and (VIII) Espoo-Convention) by taking into consideration the international conventions and their interpretation

4.3.1 Legal Basis

As mentioned above, a notice of the regional Regulatory Authority on Environmental, Nature and Water Protection of the Lower Danube Valley (AZ K5K3742/05, BZ 100562-004-174/05) takes the position that radioactive emissions of the nuclear power plant Paks in normal operation, including taking into account disturbances with a degree of probability of more than 10^{-5} per year, have no significant harmful transboundary impact. Such activities would thus neither fall into the scope of the Agreement on the Transboundary Environmental Impact Assessment, signed in Espoo on February 20, 1991 and announced in Governmental Decree No. 148 of 1999 (October 13) nor into the scope of para. 25 of Governmental Decree No 152 of 1995 (December 12).

In its statement of December 22, 2004 (Ppsf-348/4/2004) the Hungarian Ministry of Environment was thus of the opinion that there was no necessity to introduce a procedure according to the ESPOO-Convention.

From the Austrian point of view, the question as to the exact scope of the ESPOO-Convention and Article 7 of the EIA-Directive thus arose, i.e. the question as to what extent the Republic of Austria is significantly affected by the extension of the operating time of the nuclear power plant Paks according to the ESPOO-Convention and the EU-Directive.

8 See http://www.unece.org/env/eia/cepwg3r6.htm.

In this context, the following legal provisions are to be mentioned:

Art 1 of the Convention on Environmental Impact Assessment in Transboundary Context – ratified in Austria (27.07.1994) and Hungary (11.07.1997) – defines its scope as follows:

(iii) "Affected Party" means the Contracting Party or Parties to this Convention likely to be affected by the transboundary impact of a proposed activity;

(viii) "Transboundary impact" means any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party.

Based on this provision, the following obligation is laid down in Article 2 (2):

Each Party shall take the necessary legal, administrative or other measures to implement the provisions of this Convention, including, with respect to proposed activities listed in Appendix I that are likely to cause significant adverse transboundary impact, the establishment of an environmental impact assessment procedure that permits public participation and preparation of the environmental impact assessment documentation described in Appendix II.

Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment defines its scope regarding the question of a mandatory conduction of an transboundary EIA in Article 7 (1) as follows:

"Where a Member State is aware that a project is likely to have significant effects on the environment in another Member State or where a Member State likely to be significantly affected so requests, the Member State in whose territory the project is intended to be carried out shall send to the affected Member State as soon as possible and no later than when informing its own public, inter alia:

(a) a description of the project, together with any available information on its possible transboundary impact;

(b) information on the nature of the decision which may be taken,

and shall give the other Member State a reasonable time in which to indicate whether it wishes to participate in the Environmental Impact Assessment procedure, and may include the information referred to in paragraph 2."

There is no explicit definition of the term "transboundary impact" in the EIA-Directive. In the ESPOO-Convention, the term "transboundary impact" is only defined negatively, stating that it has to be an impact that is **not solely of global nature**, in other words an impact that can by whatever means be geographically limited.[9] As a result, the danger exerted by a power plant must affect one specific state more than all the other states.

The above mentioned legal provisions leave the question unanswered whether severe accidents (beyond design basis accident, BDBA) – such cases are not taken into consideration in the notice of the Hungarian authority – are relevant or not when assessing

[9] See hereunto *Günther Handl*, Grenzüberschreitendes nukleares Risiko und völkerrechtlicher Schutzanspruch, Berlin 1992, p. 81.

the question whether the project is likely to have significant effects on the environment in another member state.

There is no doubt that the fact that the project in question, the nuclear power plant, as mentioned in Annex I of the ESPOO-Convention and the EIA-Directive, *per se* does not trigger the obligation to conduct a transboundary EIA. Besides the reference in Annex I, the question whether the project has material negative transboundary impact on the environment or not is the additional relevant criterion.[10] As there is no explicit definition of the scope of the ESPOO-Convention and of Article 7 of the EU-Directive, the criterion of "likeliness of having significant effects on the environment in another Member State" has to be interpreted on the basis of international and national provisions and decisions.

4.3.2 The Prohibition of Material Transboundary Environmental Impact and its Preventive Character According to Public International Law

Particularly since the catastrophe in Chernobyl, the question has arisen within the framework of international law as to the conditions under which a state potentially endangered by a nuclear power plant of another state may have an enforceable right to prevent such harmful consequences for its country and its people according to international law.

The United Nations General Assembly declared in Resolution 1629 (XVI) dated 1961:

"The fundamental principles of international law impose a responsibility on all states concerning actions which might have harmful biological consequences for the existing and future generations of peoples of other states, by increasing the levels of radioactive fall-out."[11]

Principle 21 of the Stockholm-Declaration of 16.06.1972 reads as follows:

"States have … the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or areas beyond limits of national jurisdiction."[12]

In the famous Trail-Smelter-Case, which can be seen as the leading case and a precedent on transboundary pollution, the tribunal came to the following conclusion:

"Under the principles of international law, as well as of the law of the United States, no state has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the property or persons therein when the case is of serious consequence and the injury is established by clear and convincing evidence."[13]

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[10] See *Ute Stiegel*, Das Übereinkommen über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen, Frankfurt am Main, Lang 2001, pp. 33 and 100; *A. Nollkaemper*, The Legal Regime for Transboundary Water Pollution: Between Discretion and Constraint (1993), Dordrecht, Boston 1993, pp. 185-186.

[11] See UN GAOR (1043 plenary meeting), UN Doc. A/PV. 1043 (1961).

[12] See text in: 11 ILM (1972), p. 1416.

[13] See RIAA, vol. III, pp. 1905 et seqq, especially 1965.

Taking into account the cited provisions and the numerous declarations, conventions and decisions, the unanimous opinion prevails in today's literature[14] that the prohibition of material transboundary pollution is existing international common law.

In this context, literature is of the opinion that the prohibition of transboundary pollution does not merely refer to activities which actually cause significant harm but also implies an obligation to **prevent** the occurrence of significant harm.[15]

In this respect, the prohibition of transboundary pollution also has a preventive effect.[16]

The EIA provision of the ESPOO-Convention as well as the EIA-Directive can therefore be interpreted as instruments by which the prohibition of potential transboundary pollution according to international common law is transformed.[17]

Therefore, the provisions of international law and decisions have to be taken into account for the interpretation of the term "likelihood of having significant impacts on the environment of another state".

4.3.3 The Obligation of Transboundary Co-operation as a Consequence of this Prohibition

The obligation to avoid material transboundary impacts on the environment inevitably implies the examination of impacts on the environment of planned projects with potential material impact on the environment. The obligation to use due diligence for these examinations furthermore implies that potentially affected states are loyally involved in the planning so that their attention is drawn to the potential impacts on the environment on their territory and that in such case necessary changes can be made.[18]

International and European law regulating such formation and consultation obligations provide various instruments to meet these obligations:

- Article 192 EA provides for a general duty of loyal co-operation between the Member States, analogous to that contained in Article 10 EC: "Member States shall take all appropriate measures, whether general or particular, to ensure fulfilment of the obligations

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[14] See *A. Kiss/D. Shelton*, International Environmental Law (1991), pp. 106 et seqq; *A. Randelzhofer/B. Simma*, Kernkraftwerk an der Grenze in: Festschrift für F. Berber, Munich 1973, p. 408; *Ute Stiegel*, Das Übereinkommen über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (2001) p. 45 with further references in footnote 91; et al.

[15] See *Cf. P. W. Birnie/A. E. Boyle,* International Law and the Environment (Oxford University Press, Oxford 1993), at p. 89.

[16] See *A. Verdross/B. Simma*, Universelles Völkerrecht (1984), § 1029.

[17] See *Ute Stiegel*, Das Übereinkommen über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (2001) pp. 45 and 53.

[18] See *Ute Stiegel*, Das Übereinkommen über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (2001), p. 55; *P. W. Birnie/A. E. Boyle*, International Law and the Environment, Oxford 1993, pp. 102 et seqq.

arising out of this Treaty or resulting from action taken by the institutions of the Community. They shall facilitate the achievement of the Community's tasks. They shall abstain from any measure which could jeopardize the attainment of the objectives of this Treaty."

Based on this duty of loyal co-operation in the area of nuclear energy, a Member State is, according to Article 37 EA, requested to produce a timely and comprehensive report to the Commission on the plans to release radioactive substances which might lead to a radioactive contamination of water, soil, or air of another Member State – notwithstanding the existence of national security interests.[19]

- Article 10 (a) Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme[20] provides that member states shall develop for the realisation of the aims of environmental programmes improved mechanisms and general rules and principles of good governance within which stakeholders are widely and extensively consulted at all stages to facilitate the most effective choices for the best results for the environment and sustainable development with regard to the measures to be proposed.

  The preamble of the Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation provides that each Member State should be prepared for the likelihood of potential radiological emergencies on their territory and should co-operate with other Member States and with third countries in order to facilitate the preparations and management of those situations.

- Article 5 d Amended Proposal for a Council Directive (Euratom) Laying Down Basic Obligations and General Principles on the Safety of Nuclear Installations (KOM (2004) 526 final) provides for the obligation that each Member State shall take all appropriate steps to ensure effective information to and, where appropriate, consultation of their population, as well as the competent authorities of the states in the vicinity of nuclear installations under the jurisdiction of the Member State concerned, insofar as they are likely to be affected in the event of a radiological emergency at that installation, on issues related to safety of such nuclear installations.

- The Treaty Between the Government of Austria and the Government of Hungary on Rules on Questions of Common Interest with Regard to Nuclear Plants, which was signed April 29, 1987, provides – apart from extensive information duties – in Article 10 (2), that one party to the treaty has to provide the other party with important (according to its discretion) observations and comments in case of the construction of a nuclear power plant. Such observations and comments are to be transmitted to the competent authorities of the other party for consideration.

- On the national level, Section 11 of the Hungarian Act LIII of 1995 on the General Rules of Environmental Protection provides that the Republic of Hungary shall encourage the enforcement of environmental interests through bilateral or multilateral international

[19] See case C-61/03 Commission of the European Communities v United Kingdom of Great Britain and Northern Ireland, OJ C 132, 28.05.2005, p. 3.

[20] OJ L 242 , 10/09/2002, p. 0001 – 0015.

agreements on environmental protection and other agreements on cooperation and on the provision of information and assistance related to environmental protection, in particular in its relationship with neighbouring countries. Even in the absence of international agreements, the environmental interests of other countries, the abatement of the transboundary loading of, or posing hazard to, the environment and the prevention of polluting and damaging the environment shall be taken into consideration.

Apart from the ESPOO-Convention there are a number of treaties which transform the duty of transboundary co-operation to prevent material transboundary impacts on the environment by the obligation to conduct a transboundary EIA, e.g. Article 20 (3) (a) of the ASEAN-Treaty of July 9, 1985, and the Madrid Protocol to the Antarctic Treaty of October 4, 1991, which has been in force since January 14, 1998.

Whether or not the duty of consultation of a potentially threatened state with regards to the avoidance of transboundary impacts on the environment basically required by international law exists in practice ultimately depends on the interpretation of the term "significant risk" and "significant transboundary harm" according to international law.

4.3.4 The Term "Significant Transboundary Harm" According to Public International Law

As the obligation to conduct a transboundary EIA based on the EIA-Directive and the ESPOO-Convention ultimately is nothing else but the transformation of the obligation already imposed by international law, other provisions of international law should for obvious reasons be consulted for the interpretation of the term "significant effects" of the EIA-Directive.

Also according to international law, it is controversial how to establish the difference between harm that is significant and harm that is less than significant.

In the famous Trail-Smelter-Case, which has been mentioned above, the term "**serious consequence**" is used for differentiation, which implies a rather high level of tolerance.

Since the 1930's, the standards of an acceptable level have of course changed dramatically. However, a number of definitions of international conventions to exactly determine the importance of negative impacts can be applied:

Principle 17 of the Rio-Declaration provides the following: "Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are **likely to have a significant adverse impact on the environment...."**

Article 14 sub-section 1 ASEAN-Treaty provides the following: "The Contracting Parties undertake that proposals for any activity, which **may significantly affect the natural environment, shall as far as possible be subjected to an assessment of their consequences before they are adopted, and they shall take into consideration the results of this assessment in their decision-making process"**.

Article 206 of the UN-Convention on the Law of Sea provides the following: "When states have **reasonable grounds for believing that planned activities** under their jurisdiction or control may cause substantial pollution of or **significant and harmful changes to the marine environment ... ."**

The WCED Elements for a Draft Convention on Environmental Protection and Sustainable Development Article 10 provides the following:[21] "States shall prevent or abate any transboundary environmental interference or **a significant risk thereof which causes substantial harm ...."**

Principle 4 of the 1978 UNEP-principles, which refer to element of risk, reads as follows: "States should make environmental assessments before engaging in any activity with respect to a shared natural resource, which may create a risk of **significantly affecting the environment** of another State or States sharing that resource."[22]

Summing up, it may be said that most of the conventions and declarations only require the obligation to avoid transboundary harm to the environment by conducting an EIA when the transboundary impact on the environment is "**significant**".

As an exception, some documents of international law do not include the necessity of taking into account thresholds of importance, as for example Principle 21 of the Stockholm-Declaration or Article 8 of the Protocol on Pollution Control of the Antarctic-Treaty of October 4, 1991.[23]

In this context, it is noteworthy that the treaty between the Government of Austria and the Government of Hungary on rules for questions of common interest with regard to nuclear plants, signed April 29, 1987, provides in Article 1 (b) with regard to the definition of an emergency (accident in an nuclear plant) for a **very low threshold of importance**:

According to this agreement, an emergency which triggers the obligation to inform other states immediately is defined as a case in which a threat for the population in a neighbouring country as a result of the emergency **cannot be excluded with certainty**.

Summing up, it may be said that the term "significant" means more than just "detectable" but does not have to reach the level of "serious" or "substantial".[24]

4.3.5 Annex III of the ESPOO-Convention and of the EIA-Directive and other publications as interpretation aids for the judgement whether transboundary impacts exist:

According to Article 2 (5), concerned Parties shall, at the initiative of any such Party, enter into discussions on whether one or more proposed activities not listed in Appendix I are likely to cause a significant adverse transboundary impact and thus should be treated as if it or they were so listed.

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[21] WCED Experts Group on Environmental Law – Environmental Protection and Sustainable Development – Legal Principals and Recommendations, Graham & Trotman/Martinus Nijhoff, London 1986, at p. 75.

[22] Draft Principles for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources shared by Two or More States (1978 UNEP principles), 17 ILM 1097 (1978).

[23] See hereunto *Ute Stiegel*, Das Übereinkommen über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (2001) pp. 54 and 67.

[24] See hereunto Commentary to Article 2 of the Draft Articles on Prevention of Transboundary Harm from Hazardous Activities Adopted by the International Law Commission at its Fifty-third Session (2001), Official Records of the General Assembly, Fifty-sixth Session, Supplement No. 10 (A/56/10), chapter V.E.1.

General guidance for identifying criteria to determine significant adverse impact is set out in Appendix III.

According to Appendix II, the concerned Parties may consider whether the activity is likely to have a significant adverse transboundary impact in particular by virtue of one or more of the following criteria:

(a) Size: proposed activities which are large for the type of the activity;

(b) Location: proposed activities which are located in or close to an area of special environmental sensitivity or importance (such as wetlands designated under the Ramsar Convention, national parks, nature reserves, sites of special scientific interest, or sites of archaeological, cultural or historical importance); also, proposed activities in locations where the characteristics of proposed development would be likely to have significant effects on the population;

(c) Effects: proposed activities with particularly complex and potentially adverse effects, including those giving rise to serious effects on humans or on valued species or organisms, those which threaten the existing or potential use of an affected area and those causing additional loading which cannot be sustained by the carrying capacity of the environment.

Article 4 (3) of Council Directive 97/11/EC of 3rd March 1997 amending Directive 85/337/EEC on the Assessment of the Effects of Certain Public and Private Projects on the Environment states that when a case-by-case examination is carried out or thresholds or criteria are set for the purpose of paragraph 2 (projects listed in Annex II), the relevant selection criteria set out in Annex III shall be taken into account.

According to Annex III of the EIA-Directive, the selection criteria referred to in Article 4 (3) can be subdivided into characteristics of projects, location of projects and characteristics of the potential impact.

Referring to the characteristics of projects, the following criteria are mentioned:

- the size of the project;
- the accumulation with other projects;
- the use of natural resources;
- the production of waste;
- pollution and nuisances;
- the risk of accidents, directing attention in particular to substances or technologies used.

As far as the characteristics of the potential impact are concerned, the following criteria must be considered:

- the extent of the impact (geographical area and size of the effected population);
- the transboundary nature of the impact;
- the magnitude and complexity of the impact;
- the probability of the impact;
- the duration, frequency and reversibility of the impact.

Although the criteria mentioned in Annex III of the EIA-Directive are primarily to decide on the potentiality of substantial impacts on the projects mentioned in Annex II, they can be used as interpretation aids to decide on the question of the existence of significant transboundary impacts.

The report by the UNECE-Secretary titled "Specific Methodologies and Criteria to Determine the Significance of Adversary Transboundary Impact"[25] can also be used as interpretation aid for the decision on the significance of negative transboundary impacts.

Although all publications primarily mention the criteria included in Annex III, Section I.7. specifically provides that, as a general rule, notification should be transmitted **whenever there is a possibility, no matter how uncertain**, that an impact **may** be significant.

With regard to the question of the definition of thresholds for the decision on the significance of negative transboundary impacts, the guidance on the practical application of the ESPOO-Convention[26] refers to the publication of the Economic Commission for European Environment, Series 6, titled "Current Policies, Strategies and Aspects of Environmental Impact Assessment in a Transboundary Context."

Annex V provides a framework for evaluating the significance of a transboundary impact.

For a decision on whether a project is likely to have significant effects on the environment of a neighbouring state, the following criteria are to be considered:

- Geographical area:

  What is the extent of the area of a likely impact under the jurisdiction of another country?

- Environmental importance:

  Are any particular environmental values (e.g. protected areas) likely to be effected?

- Magnitude:

  What will be the probable magnitude of the chance in relevant variables relative to the status quo, taking into account the sensitivity of the variable?

- Probability:

  What is the degree of probability of the impact?

  Is the impact likely to occur as a consequence of normal conditions or exceptional situations, such as accidents?

- Duration:

  Is the impact likely to be temporary, short-term or long-term?

  Is the impact likely to relate to the construction, operation or decommissioning phase of the activity?

- Frequency:

  What is likely to be the temporal pattern of the impact?

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[25] http://www.unece.org/env/eia/cepwg3r6.htm.

[26] http://www.unece.org/env/eia/guidance/espoo_convention.pdf.

- Reversibility:

  Is the impact likely to be reversible or irreversible?

Based on the arguments above, the following conclusion can be drawn:

(1) According to the recommendations of the UNECE-Secretary, the threshold for defining at what point negative transboundary impacts are to be considered significant is to be established at a rather low level: **Whenever there is a possibility, no matter how uncertain,** that an impact **may** be "significant", a notification should be transmitted.

(2) Even if the Hungarian authorities adopt the view that disturbances of a degree of probability of less than10^{-5} per year are not to be taken into account, and that thus the extension of the operating permit of the nuclear power plant Paks does not fall into the scope of the ESPOO-Convention, this does not reach far enough and is neither in accordance with Annex III and the recommendations published by the ESPOO-Authority, nor with Annex III of the Council Directive 97/11/EC amending Directive 85/337/EEC: According to the criteria for the decision on the question of the significance of a transboundary impact mentioned therein, **the probability of an impact is only one of the factors relevant for the assessment**. Along with this criterion, other factors such as environmental importance, dimension, duration and reversibility are to be taken into account.

4.3.6 The Term "Likelihood of Having Significant Effects on the Environment" according to Decisions of the European Court:

The decisions of the European Court with regard to the question of the interpretation of the term "likelihood of having significant effects on the environment" are of major importance in the current case. As mentioned above, the European Court ruled in its Grosskrotzenburg[27] decision that the EIA-Directive is to be applied directly. As a consequence, not only the national provisions transforming the EIA-Directive have to be interpreted according to the Directive; moreover, in case of a contradictory national provision, the EIA-Directive shall apply directly. Although in the cited case, the European Court only decided that Article 2, 3 and 8 of the EIA-Directive are to be applied directly, the direct effect of Article 7 is to be accepted as this provision is sufficiently defined and worded without conditions.[28]

The relevant decisions of the European Court with regard to the question of the interpretation of the term "likelihood of having significant effects on the environment" concern Article 2 of the Directive, i.e. the question as to whether an EIA has to be conducted. But since Article 2 (1) of Council Directive 97/11/EC amending Directive 85/337/EEC uses the same wording with regard to the question of interest (the interpretation of the term "likelihood of having significant effects on the environment"), the relevant

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[27] ECJ Case C-431/92, Grosskrotzenburg, ECR 1995, I-2211.

[28] See *Ute Stiegel*, Das Übereinkommen über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (2001), p. 157.

decisions with regard to Article 2 can be directly consulted for an evaluation of the significance of transboundary effects.

In its Kraaijeveld decision of October 24, 1996[29], the European Court provides that the wording of the Directive indicates that it has a **wide scope and a broad purpose**. Relevant for the applicability of the Directive and the need to conduct an EIA resulting thereof is the question of the significance of the effect that a project is likely to have on the environment. When a project "**may** have a significant effect" on the environment, it has to fall under the Directive (para. 31 and 32 of this decision).

The World Wild Life Fund decision as well as others also confirm the broad and extensive scope of applicability of the Directive.[30]

Deriving from this broad interpretation of the term, the case Commission of the European Communities vs. Kingdom of Spain[31] consults, with regard to the applicability of the Directive, the question of whether the construction project is "**by its nature**" likely to have significant effects on the environment (para. 50). For the scope of applicability of the Directive, it was not crucial whether the planned project had an actual impact on the environment. Rather, the relevant criterion was the significant effect that a particular project was **likely to have** on the environment. The duty of the Commission was not to establish the concrete negative effects that a project would in fact have on the environment. It was sufficient that a project of this type was likely to cause significant nuisance (para. 59).

In a recent decision of September 9, 2004,[32] which concerns the interpretation of Article 6 of the Habitats Directive but is also relevant in our case as the wording of Article 2 (1) of the Directive 85/337 resembles the wording of Article 6 (3) of the Habitats Directive, the court indicates that it was not important for the scope of applicability of the Directive that the project considered had a defined significant effect on the environment, but that the **mere probability** that such an effect attaches to that project was important.

The requirement to examine the project as to its compatibility thus depended on the precondition that there was a probability or risk that a project would have significant effects on the environment (para. 43). The necessity of an EIA results whenever **it cannot be excluded**, on the basis of objective information, that a project will have a significant effect on the environment (para. 45).

Summing up, it may be said that according to the wide interpretation by the European Court, it is not important for the question of significance of transboundary effects whether there is certainty from the beginning that a project will have significant impact on the neighbouring state. Rather, it is sufficient that there is a **mere probability or risk of such an impact**. It is thus sufficient for a project to have **by its nature** a potential transboundary impact. Whenever it **cannot be excluded** from the very beginning that a neighbouring state might, based on objective criteria, be significantly affected by a project, a transboundary EIA according to Article 7 of the EIA-Directive or the ESPOO-Convention has to be conducted.

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29 Case C-72/95, ECR 1996 p. I-05403.

30 Judgement of 16th September 1999, case C-435/97, para. 40.

31 Case C-227/01, ECR 2004 p. 00000.

32 Case C-127/02, ECR 2004 p. 00000.

4.3.7 The Likelihood of Having Significant Transboundary Effects both as Initial Question as well as a Result of an EIA:

When applying the decisions of the European Court, which acts on the assumption of a wide interpretation of the EIA-Directive, the question of likelihood of having significant, transboundary effect has, with regard to the current case, to be evaluated from two perspectives.

In a first step, which deals with the question of the initiation of a transboundary EIA according to Article 2 of the ESPOO-Convention and Article 7 of the EIA-Directive, an extensive standard has to be applied when determining the threshold of significance:

By applying a typed approach considering the provision of Article 2 (1) of the EIA-Directive, the question has to be asked whether the project based on its nature, size or location is likely to have transboundary impacts. This evaluation shall be based on the typical impacts associated with a certain plant.

At this stage, it is not essential that a project has to have concrete negative transboundary impacts with a certain probability but that the project is **by its nature** likely to have significant effects on the environment of the neighbouring state.[33]

Only in a second step, based on the concrete specifications by the project applicant, does it have to be determined, on the basis of extensive scrutiny, whether the planned project has a transboundary impact and what its probability is.

As a result, the EIA shall contribute to determine the probability of concrete transboundary impacts.

Finally, when determining the probability of transboundary impacts already when determining whether a transboundary EIA is or is not to be conducted without the participation of the neighbouring state, on the mere basis of specifications by the project applicant, the result of an EIA would have to be anticipated, whereby the purpose of an EIA would be frustrated.[34]

This interpretation is also emphasised by the fact that when it comes to the question of whether significant impacts exist, not only the emission from the state of origin is essential, but rather the question of the specific sensitivity of the affected area of the neighbouring state.

Article 3 (6) of the ESPOO-Convention therefore states that Party affected shall, at the request of the Party of origin, provide the latter with reasonably obtainable information related to the potentially affected environment on the jurisdiction of the Party affected where such information is necessary for the preparation of the environmental impact assessment documentation.

The EIA preliminary study also provides in chapter 10, which deals with transboundary impacts, that a definite assessment of the transboundary impacts is in most cases not

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[33] See Judgement of the European Court of Justice of 16th September 2004, case C-227/01 para. 50 and 59.

[34] See also opinion of Advocate General Juliane Kokott delivered on 29th january 2004 concerning the case C-127/02 para. 70 and 80 in context with the scope of application of the Habitats Directive.

possible at this stage, as the sensitivity of the areas across the border, the impacts within a certain radius and their reactions are not certain and assessable.

When a neighbouring state is involved, open questions may be clarified that would otherwise remain unsettled on account of lack of information on the part of the state of origin.

4.3.8 The Precautionary Principle as Guidance for the Interpretation of the Term "Likelihood of Having Significant Transboundary Effects":

There are a number of international conventions which define the obligation to consider the precautionary principle, as for example Principle 21 of the Stockholm-Declaration, Principle two of the 1992 Rio-Declaration, the 1982 UN Convention on the Law of the Sea or the UNECE Bergen Ministerial Declaration on Sustainable Development.[35]

In the 1990 Bergen Ministerial Declaration on Sustainable Development, which is mentioned in the preamble of the ESPOO-Convention, the precautionary principle reads as follows: "In order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damages, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation."[36]

As a consequence of the Maastricht Treaty, the precautionary principle found its way into the EC Treaty and takes an important position under the guiding principles of the EC environmental policy. Article 174 (2) of the EC Treaty provides:

"Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. **It shall be based on the precautionary principle** and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay."

The Council Directive 96/29/EURATOM of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation[37] in its preamble also refers to the principle of precaution and prevention by providing that "the Member States should be prepared for the likelihood of potential radiological emergencies on their territory and should cooperate with other Member States and with third countries in order to facilitate the preparedness and management of those situations".

Finally, also the Hungarian Act LIII of 1995 on the General Rules of Environmental Protection provides in Section 6 (2) the principle that the use of the environment shall be

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[35] See hereunto *Hintsteiner*, Legal Approaches to Tansboundary Pollution – Relating to Nuclear Activities, Salzburg (2000), pp. 60 et seqq.

[36] Bergen UNECE Ministerial Declaration on Sustainable Development, 15th May 1990 in: *H. Hohmann* (Ed), Basic Documents of International Environmental Law, Vol I, *Graham & Trotman/Martinus Nijhoff*, London 1992, at pp. 558 et seq.

[37] OJ L 159 , 29/06/1996 p. 0001 – 0114.

performed by observing the principle of precaution, by treating carefully and using economically the environmental components. The term "precaution" is defined in Section 4 x) as "decisions and measures necessary for the reduction of environmental risks and the prevention or reduction of environmental damage in the future".

The precautionary principle becomes effective at an earlier level than that of the threshold of risk. It makes environmental policies necessary not only to avert imminent damages or a concrete risk, but already at the level of avoiding risks. According to the precautionary principle, a **concern** of a potential environmental impact that is based on actual facts entails sufficient reason for environmental intervention.[38]

The decisions define the precautionary principal in such a way as to allow, in case of uncertainties with regard to the existence or the extent of risks, the application of safety method without awaiting that the existence and the severity of the risks be finally defined.

The European Council argued in its decision of September 7, 2004 with regard to the applicability of the Habitats Directive[39], that the question of likelihood of having a significant effect on the environment is to be examined based on the precautionary principle. If, on the basis of objective information, it cannot be excluded that a project will have a significant effect on the site concerned, an assessment has to be carried out (see para. 44 of the decision).

As the question of the necessity to conduct a transboundary EIA, which can be seen as instrument for the implementation of the precautionary principle in a transboundary context, in general poses the same question as the applicability of the Habitats Directive, a transboundary EIA has thus to be conducted in case **it cannot be excluded *a priori,*** on the basis of objective facts, that the neighbouring state is significantly affected by the project.

4.3.9 The Operation of a Nuclear Power Plant as Ultra-Hazardous-Activity:

When deciding on the hazard deriving from a nuclear power plant, two kinds of impacts have to be distinguished: emissions due to the regular operation of the plant, and emissions in case of an accident.

When deciding on the existence of significant transboundary impacts, the risk of disturbances or accidents plays a dominant role.

The particularity of transboundary impacts deriving from a nuclear power plant is this: Although the probability that an effect in the form of an accident will occur is considered to be relatively low, when it does occur, the damage can be enormous and far-reaching. Projects with the specific characteristic of having a relatively low probability of causing harm on the one hand, but, on the other hand, of having disastrous consequences when the risk materializes, are called "ultra-hazardous-activities".[40]

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[38] See *Breier/Vygen* in Lenz (Ed.), EG-Vertrag Kommentar, 2nd edition, Köln 1999, Art 174 para. 13.

[39] See case C-127/02, ECR 2004 p. 00000.

[40] See *G. Hintsteiner*, Legal Approaches to Transboundary Pollution – Relating to Nuclear Activities, Salzburg 2000 pp. 51 et seq; *Birnie/Boyle*, International Law and the Environment (Oxford Universtity Press, Oxford 1993) pp. 345 et seqq.

The disastrous accident at the Chernobyl Nuclear Power Plant in Ukraine on April 26, 1986 demonstrated that in case of a severe nuclear accident, large areas all over Europe may be affected.

It is obvious that looking merely at the probability of the occurrence of a disturbance while disregarding its possible consequences is insufficient for a determination of the hazard potential deriving from a nuclear power plant, as well of the extent to which the neighbouring states are significantly affected by an extension of the operation time of a nuclear power plant.

4.3.10 The Distance to the Border as Significant but not Critical Factor for the Decision on the Question Whether a Neighbouring State is Likely to be Significantly Effected:

The distance between the nuclear power plant Paks and the Austrian border is approximately 220 kilometres.

There is no doubt that, when considering the general characteristics of an activity, the distance to an international frontier is an important starting-point. If an activity is planned for a site close to a frontier, the nature of the activity and its associated transboundary impact can be sufficient to require notification according to the ESPOO-Convention.[41]

However, close to the border of a neighbouring state, transfer mechanisms such as transboundary watercourses, prevailing winds and migration of organisms have to be considered, as they can be the cause of transboundary impacts.

In the technical part of this opinion, it will be impressively demonstrated by using a dispersing model that under certain weather conditions, a severe nuclear accident may result in significant contamination in Austria.

While prior to the Chernobyl nuclear accident, the vicinity to the border of the neighbouring state played an important role when determining whether a nuclear power plant is likely to significantly affect the neighbouring state, a trend reversal has occurred since then. While former bilateral treaties, which establish regulations on information exchange and the obligation of consultation, still refer to the distance to the border, in 1987 at least a restricted information and consultation procedure with regard to nuclear power plants has been established in Central Europe, regardless of the distance to borders.[42]

Especially the treaty between the Government of Austria and the Government of Hungary on rules on questions of common interest with regard to nuclear plants of April 29, 1987 was a pioneer work. For the first time, it did not refer only to sites within a certain border line, as was common practice in Central Europe at that time.[43]

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41 See Economic Commission for Europe, Environmental Series 6 with the title "Current Polices, Strategies and Aspects of Environmental Impact Assessment in a Transboundary Context, New York 1996, p. 50.

42 See *Günther Handl*, Grenzüberschreitendes nukleares Risiko und völkerrechtlicher Schutzanspruch, Duncker & Humblot, Berlin 1992, pp. 35 et seqq.

43 See *Moser*, Das österreichisch-ungarische Abkommen über kerntechnische Anlagen, Österreichische Juristenzeitung 1998, pp. 78 et seqq.

Also Article 37 of the Euratom Treaty, which defines the obligation that each member state shall provide the Commission with general data relating to any plan for the disposal of radioactive waste in whatever form, allowing to determine whether the implementation of such a plan is likely to result in radioactive contamination of water, soil or airspace of another Member State, does not refer to the distance to neighbouring states. In contrast, such obligation also exists if the distance to the nearest member state is several hundred kilometres.[44]

Also EIA-Directive 97/11/EC amending Directive 85/337/EEC according to the wording of Article 7 does not refer to the existence of a common border but to the fact whether impacts on other member states might derive from the project. Vicinity to other member states might play a certain role in this context, but Article 7 of the EIA-Directive takes into account that impacts deriving from environmental pollution may reach far.[45]

Finally, the definition of transboundary impact used in the ESPOO-Convention (Article 1 (8)) also includes long-range impacts, which means that the likelihood of a long- range impact has to be examined as well.[46]

It may therefore be said that the distance of the nuclear power plant Paks to the Austrian border **by itself** is not crucial for denying the introduction of a procedure according to the ESPOO-Convention.

4.3.11 The Likelihood of Having Significant Effects as a Product of the Probability of Occurrence of the Impact and its Magnitude:

As argued in Chapter 9, the transboundary effects deriving from a nuclear power plant in case of an accident are of a specific nature – they are characterized by a low probability of occurrence on the one hand but the potential of producing devastating consequences on the other.

The magnitude of risk consists therefore of two elements, namely the probability of the event to occur, and the amount of harm which may be caused. The greater the threat of harm, the smaller the probability of its occurrence needs to be in order for a risk to qualify a risk as significant.[47]

In other words, it may be argued that a relatively low probability of occurrence can be compensated by the enormous magnitude of an impact.

This is exactly the case when operating a nuclear reactor: Although the probability that an accident occurs is considered relatively low, the damage caused by an accident can be enormous and far-reaching, considering that the flora and fauna of large areas as well as the

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[44] See for example The French transmission concerning the Nuclear Power Plant Nogent-sur-Seine, which remotes 200 km to the border to Belgium and Luxembourg and 270 km to Germany (see commission statement of 28th july 1987, OJ L 238/30).

[45] See Opinion of Advocate General Siegbert Alber delivered on 18th april 2002, case C-334/00, para. 38.

[46] See Guidance chapter 3.2 p. 26.

[47] *G. Hintsteiner*, Legal Approaches to Transboundary Pollution – Relating to Nuclear Activities, Salzburg (2000), p. 51.

lives and health of many people may be affected. As we have seen in Chapter 9, operating a nuclear reactor can therefore be qualified as an ultra-hazardous-activity.

At first *Kirgis*[48] and then *Handl*[49] developed a new modified formula of evidence for the rating of the risk of operating a nuclear power plant, arguing that because of the specific nature of the risks, characterized as ultra-hazardous-activities, the classical risk approach cannot be applied.

On the basis of this reflection, the international Law Commission defined at its 50-3rd session (2001) in Article 2 of the Draft Articles on Prevention of Transboundary Harm From Hazardous Activities[50] the "risk of causing significant transboundary harm" as follows:

"Risks taking the form of high probability of causing significant transboundary harm and a low probability of causing disastrous transboundary harm."

In the commentary of Article 2, the International Law Commission argued that for the purpose of this Article, "risk of causing significant transboundary harm" refers to the **combined effect of the probability of occurrence of an accident and the magnitude of its injurious impact.** It is therefore the combined effect of "risk" and "harm" which sets the threshold.[51]

This concept can also be applied to our case when judging whether a transboundary environmental impact assessment should or should not be established.

In this context, the publication of the Economic Commission for Europe Environmental Series No. 6, with the title "Current Policies, Strategies and Aspects of Environmental Impact Assessment", part three, "Specific Methodological Issues of Environmental Impact Assessment in a Transboundary Context", Chapter II, "Significance of Adverse Transboundary Impact", inter alia, reads as follows:

"Impacts which are much less likely to occur would require a different type of consideration from that used for high probably impacts. … The risk of an impact could be defined as the consequences of the impact multiplied by the probability of occurrence. … For most environmental risks related to the activities listed in Appendix I to the convention, a frequency approach would, however, not be sufficient in an analysis of risks as part of a transboundary EIA. Many risks related to transboundary impacts are characterized by low probability. Thus, there would be no or very weak empirical justification for an analysis based on frequencies. For example, estimates of **risks of nuclear accidents**, explosions at integrated chemical installations, or the breaking of dams could only to a limited extent be based on empirical data for frequency of occurrence. A systematic evaluation of potential impacts of low probability and of factors influencing the probability is likely to be important."[52]

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48 *Kirgis*, Technological Challenge to the Shared Environment: United States Practice, 66 AJIL 1972, pp. 290, 294.

49 *G. Handl*, Grenzüberschreitendes nukleares Risiko und völkerrechtlicher Schutzanspruch, Berlin 1992, pp. 15 et seqq.

50 See report of the international law commission on the work of its 50-3rd session, official records of the general assembly, 50-6th session, supplement No. 10 (A/56/10), chp. V. E.1.

51 See also the Code of Conduct on Accidental Pollution of Transboundary Inland Waters adopted by the Economic Commission for Europe in 1990 Article 1 para. (f), E/ECE/1225-ECE/ENVWA/16.

52 ECE, Current Policies, Strategies and Aspects of Environmental Impact Assessment in a Transboundary Context, United Nations, New York and Geneva, 1996, pp. 49 et seq.

In another section of this publication, it is stated that the extent and magnitude of a likely impact related to a proposed activity may contribute to the significance of an impact. An overall conclusion on the degree of significance would require combining the consideration of geographical scale of a likely impact and its magnitude in areas under the jurisdiction of other countries with information on environmental conditions in these areas and the duration, frequency, probability and reversibility of the impact.

When the Hungarian authorities argue in their notification that an extension of the operating time of the nuclear power plant Paks does not fall under the scope of the ESPOO-Convention because radioactive emissions emerging from the nuclear power plant in normal operation mode including accidents (design basis accidents) with a probability of more than 10^{-5}/year will not cause any relevant transboundary harm, the important interrelationship between the probability of an accident on the one hand and the magnitude of its injurious impact on the other hand is ignored.

Recapitulating these arguments, we must arrive at the conclusion that when answering the question whether or not to conduct an EIA, the term "likelihood of having significant effects on the environment in an other Member State" as defined in Article 7 (1) Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC must be applied by **simultaneous consideration of the possibility of occurrence of an impact on the one hand and the magnitude and the character including the question of irreversibility on the other hand**.[53]

Owing to the fact that when including beyond design basis accidents (BDBA) as presented in the dispersion model in the technical part of this opinion, large areas of Austria can be affected assuming that certain weather conditions occur, the conclusion has to be drawn that the extension of the operating time of the Nuclear Power Plant Paks falls under the scope of the ESPOO-Convention and the EIA-Directive.

4.3.12 Other Cases in Connection with Nuclear Facilities in Which Transboundary EIAs were Conducted:

When deciding on the question of whether a transboundary environmental impact assessment should or should not be established, the previous practice of neighbouring states offer guidance. In connection with nuclear facilities, the following EIAs have been accomplished in the last years (some of them are still in progress):

- EIA Temelin nuclear power plant concerning reconstructions in the building for processing nuclear waste (February 2000)
- EIA Temelin nuclear power plant concerning major changes in the control system and reactor core (October 2000)
- EIA concerning the Temelin nuclear power plant as a whole based on Chapter 5 of the "Protocol of Melk from 13.1.2000" (November 2000 until mid of 2001)
- Fuel assembly intermediate storage Gundremmingen in Germany

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[53] See Opinion of Advocate General Kokott delivered on 29th january 2004 case C-127/02 para. 73 and 108; as far as the Austrian law ist concerned see *Bergthaler/Weber/Wimmer*, Die Umweltverträglichkeitsprüfung, Wien 1998, chapter 2 para. 49.

- Fuel assembly intermediate storage Biblis, Grafenrheinfeld, Neckar Westheim and Phillipsburg in Germany
- Fuel assembly container storage Isar/Niederaich, Aichbach in Germany
- Fuel assembly intermediate storage in Temelin (since August 2003)
- EIA Cernavoda nuclear power plant, Romania (neighbouring state Bulgaria)
- EIA Belene nuclear power plant, Bulgaria (neighbouring state Romania)
- EIA Loviisa 3 nuclear power plant, Finland (neighbouring state Russia)

Based on the above cases, one can draw the conclusion it has become common practice over the last years for a neighbouring state to take part in the decision-making process concerning nuclear activities by accomplishing a transboundary EIA.

4.4 The Obligation to consider severe accidents (beyond design basis accidents) in an EIA-documentation as a consequence of the necessity to conduct a transboundary EIA

According to the Hungarian decree concerning nuclear security (Gov. decree 108/1997 from 25. VI, Annex 3, Chapter 3.5.) only such accidents have to be considered that have a probability of occurrence of more than 10^{-5}/year (design basis accidents (DBA)).

Based on this regulation, the Hungarian authorities arrived at the conclusion that there will be no significant transboundary effects and an EIA-procedure therefore does not have to be established.

Another consequence of this standpoint was that beyond design basis accidents (BDBA) do not form part of the preliminary study.

As mentioned above, the question as to whether the extension of the operating time of the nuclear power plant Paks is likely to have significant effects on the environment of Austria should not only be posed at the beginning of an EIA, but primarily during the assessment.

Article 7 (1) of Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC stipulates that a member state aware of a project's probability of having significant effects on the environment of another member state (the same has to be the case when a member state that is likely to be significantly affected so requests) shall be required to send to the affected member state as soon as possible a description of the project together with **any available information** on its possible transboundary impact.

Although an analysis concerning severe accidents (beyond design basis accidents) is not explicitly mentioned, there is no doubt that an EIA concerning an ultra-hazardous-activity has to contain an analysis of the transboundary effects of beyond design basis accidents.

There are a number of relevant documents on the international as well as European level clearly indicating that severe accidents should be given due consideration in the EIA documentation:

Primarily, the precautionary principle presented in Article 174 (2) European Treaty is to be taken into consideration: As already mentioned in Chapter II 8., an environmental impact assessment can be considered as a special instrument to enforce the precautionary principle in practice. However, **the environmental impact assessment procedure can only be regarded as truly precautionary when it adopts a worst-case-scenario** planning where uncertainty exists with respect to environmental harm and where irreversible effects are threatened.[54]

Secondly, the "Commission Communication on the Implementation of Council Directive 89/618/EURATOM of 27 November 1989 on Informing the General Public about Health Protection Measures to be Applied and Steps to be Taken in the Event of a Radiological Emergency" (91/C 103703) deals with prior information to the general public. According to Article 5 of the said Directive under the heading "Various Types of Radiological Emergency and Their Consequences for the Population and the Environment", it is recommended to inform, inter alia, about "the types of emissions (gas, dust, liquid) that might be released from the installations in the event of an accident, and how far and how quickly they might spread." Council Directive 89/618/EURATOM of 27 November 1989 defines "radiological emergency", inter alia, as "... accidents from which a significant release of radioactive material occurs or is likely to occur." This definition clearly includes severe accidents. Certainly, it would be most prudent to include this kind of information already in the EIA documentation.

Furthermore, the Commisson Recommendation of 6 December 1999 on the Application of Article 37 of the Euratom Treaty"[55] requests information on "unplanned releases of radioactive effluents", using the term "reference accident(s)", which is definitely not limited to design basis accidents. Although not directly applicable to information for the general public, this is a clear indication that severe accidents should be considered at an early stage.

Regarding the ESPOO-Convention on Environmental Impact Assessment in a Trans-boundary Context, in Article 1 (vii) the term "impact" is defined as "any effect caused by a proposed activity on the environment including human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interaction among these factors; it also includes effects on cultural heritage or socio-economic conditions resulting from alterations to those factors."

Subsequent to this definition, Article 1 (viii) defines the term "transboundary impact" as "any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party."

The wording "**any impact**" gives no indication that beyond design basis accidents should not be discussed in the EIA.

As already mentioned above, the ECE-Publication Environmental Series No. 6 with the title "Current Polices, Strategies and Aspects of Environmental Impact Assessment in a Transboundary Context"[56] provides an important resource to determine the significance of a

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[54] See *Cameron/Wade/Gery/Abouchar*, Precautionary Principle and Future Generation, in: E. Agius et al., Future Generations and International Law, Earth Scan Publication, London 1998, pp. 93-113 and 109 et seq.

[55] 1999/829/Euratom, OJ L 324, 16.12.1999, p. 23.

[56] ECE/CEP/9, New York and Geneva 1996.

transboundary impact. Part 3 chapter II with the title "Significance" of Adverse Transboundary Impact, inter alia, reads as follows:

"Many risks related to transboundary impacts are characterized by low probability. Thus, there would be no or very weak empirical justification for analysis based on frequencies. For example, estimates of risks of nuclear accidents ... could only to a limited extent be based on empirical data for frequency of occurrence. A systematic evaluation of potential impacts **of low probability** and of factors influencing the probability is likely to be important." This indicates that in an in-depth-EIA beyond design basis accidents should form a central part of the analysis.

Furthermore, the Consolidated Environmental Impact Assessment Checklist concerning "Project 2B – Nuclear Power Stations"[57] highlights in the context of the category "human health and safety" "the risk of nuclear accidents" as a factor to which consideration should be given.

Finally, ANNEX II of the report by the UNECE-Secretariat with the title "Specific Methodologies and Criteria to Determine the Significance of Adverse Transboundary Impact", which provides a tool for determining the significance of impacts, recommends in supra note 8 that if significant impacts are expected, only in the event of an accident, the full table can be filled in to illustrate **the worst case scenario**.[58]

Summing up, it can be stated that the exclusion of severe accidents (beyond design basis accidents, i.e. accidents with a probability of occurrence of less than 10^{-5}/year) in the preliminary study, which led the Hungarian authorities to the conclusion that the extension of the operating time of the Nuclear Power Plant Paks is not covered by the scope of application of the EIA-Directive or the ESPOO-Convention, is not in line with this aforesaid Directive and Convention.

It should therefore be requested that an in-dept-analysis of severe accidents (beyond design basis accidents) and their effects on the Austrian population as well as on the flora and fauna form an essential part in the detailed environmental documentation.

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57 http://www.unece.org/env/eia/documents/eachecklist/project02b.pdf.

58 http://www.unece.org/env/eia/cepwg3r6.htm.

4.5 SUMMARY

Based on the arguments presented above, the following conclusions can be drawn:

1. The case of the extension of the operating time of the nuclear power plant Paks is covered by the application scope of the EIA-Directive respectively the ESPOO-Convention.
2. The position of the Hungarian authorities on to the question of whether their neighbouring states are likely to be significantly affected, which only takes into account the probability of the occurrence of accidents while at the same time excluding severe accidents (beyond design basis accidents) is not in line with the ESPOO-Convention and the EIA-Directive.

   Owing to the fact that

   (1) the impact caused by the extension of the operating time of the nuclear power plant Paks is not exclusively of a global nature in the legal sense of Article 1 (viii) of the ESPOO-Convention,

   (2) a number of international conventions and declarations define the obligation to co-operate in the way of consultations in the field of nuclear energy,

   (3) according to the recommendations of the UNECE-Secretary the threshold to determine the significance of negative transboundary effects has to be set at a very low level, i.e. whenever there is a possibility, no matter how uncertain, that an impact may be significant, notification should be transmitted,

   (4) according to ANNEX III of the Council Directive 97/11/EC amending Directive 85/337/EEC and the recommendations published by the ESPOO-Authorities, the possibility of the occurrence of a (severe) accident should only be one criterion amongst others when determining whether or not a transboundary EIA should be accomplished,

   (5) according to the decisions of the European Court, the wording of the EIA-Directive indicates that it has a very wide scope and a broad purpose and therefore a transboundary EIA should be in all cases established unless it can be excluded, on the basis of objective facts, that the neighbouring state will be significantly affected by the project,

   (6) the likelihood of causing significant transboundary effects should only be tentatively analysed before the decision to accomplish a transboundary EIA is taken by asking whether the project may by its nature have significant effects on the environment of the neighbouring state; the detailed analysis, taking into consideration the sensitivity of the flora and fauna of the neighbouring state affected (this information should be transmitted from the affected country), should be carried out during the EIA-Process,

   (7) the precautionary principle should play a dominant role when interpreting the term of "likelihood of having significant transboundary effects",

   (8) the specific nature of the risk of operating a nuclear power plant which can be qualified as ultra-hazardous-activity (relatively low probability of occurrence on the one hand but probability of causing disastrous consequences on the other hand),

(9) neither in the ESPOO-Convention and the EIA-Directive nor in the treaty between the Republic of Austria and the Republic of Hungary concerning questions of common interests in the context of nuclear activities, the distance to the border of the neighbouring state constitutes a relevant criterion,

(10) the likelihood of having significant effects must be seen as a product of the probability of occurrence of the impact and its magnitude,

(13) in the last years the practice has been established that a neighbouring state takes part in the decision-making process concerning nuclear activities by accomplishing a transboundary EIA

and

(14) severe accidents (beyond design basis accidents) have to be taken into consideration by determining the likelihood of having significant transboundary effects,

the Republic of Austria takes the position that it is significantly affected by the extension of the operating time of the nuclear power plant Paks and therefore a transboundary EIA should be conducted.

3. The exclusion of severe accidents (beyond design basis accidents) in the preliminary study is neither in line with the ESPOO-Convention nor with the EIA-Directive.

   A detailed analysis of beyond design basis accidents and their potential effects should form an essential part in the EIA-Documentation.

5 Part B Technical Perspective

Technical Comment on the EIA procedure for the lifetime extension of Paks NPP

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Vienna 2005

5.1 Introduction

In the scoping phase of the EIA procedure for the lifetime extension of Hungary's nuclear power plant Paks, two documents were submitted to the Austrian government:

- the Preliminary Environmental Study
- the Ruling concerning the environmental licensing of the Paks NPP life extension (hereinafter called the "Ruling")

The task of the authors of this comment was to assess whether the preliminary environmental study provides sufficient information for the purpose of holding discussions on the possibility of a significant adverse transboundary impact of the lifetime extension project. The comment addresses the following areas in the preliminary environmental study:

- the effects of plant life extension on the accident risk,
- the discussion of accident scenarios, source terms and probability of severe accidents, and
- the analysis of potential transboundary effects of emissions

The comment lists the problems for which additional information should be presented in the EIA documentation (environmental study), in addition to the present valid requirements of the Hungarian regulatory body for environmental, nature and water protection.

The Ruling demands under 1.A) 27. that the detailed environmental study has to provide the analysis of transboundary effects and measures for a minimization of these effects. Point 27.b. requires the description of events which cause transboundary impacts. However, the explanatory statement to the Ruling confirms the conclusion of chapter 8 of the preliminary environmental study that no negative impact is to be anticipated along the Hungarian border due to the conservative approach in the analysis of the design base accident with the largest emission.

Concerning the analysis of beyond design base accidents, it is stated that it is not required by the “Ruling“ because of their low probability of below 1E-5 , and this in spite of the fact that such accidents could have severe impact in Hungary and in neighbouring countries. Accordingly, no description of measures for accident management and minimisation of consequences is demanded by the Hungarian regulatory body.

In order to underline the importance of discussing severe accident scenarios, the comment presents dispersion calculations by the Institute of Meteorology, University of Natural Resources and Applied Life Sciences in Vienna.

5.2 Factors which can increase the accident risk during an extended plant lifetime

5.2.1 Ageing Effects:

Ageing already occurs during the lifetime of an NPP as originally planned (30 years in the case of NPP Paks). Naturally, ageing mechanisms become increasingly important over the years, particularly with plant lifetime extension, contributing to overall plant risk.

The most important influences leading to ageing processes in a nuclear power plant are: Irradiation; thermal and mechanical loads; corrosive, abrasive and erosive processes; as well as combinations and interactions of these factors.

The measures to monitor and control ageing processes are known as ageing management. Ageing management includes programmes with accelerated samples, in-service-inspections, monitoring of thermal and mechanical loads, safety reviews and also the precautionary maintenance or even exchange of components, if feasible. Furthermore, it includes optimizing of operational procedures in order to reduce loads.

Of particular importance, and potential safety significance, is the ageing of the reactor pressure vessel, the steam generators, as well as of the confinement system.

Ageing of the reactor pressure vessel – embrittlement:

Importance of reactor pressure vessel ageing:

Various types of ageing can occur in the reactor pressure vessel, the vessel head, core internals and shroud, nozzles and bolts. The most important is embrittlement of materials close to the core through neutron irradiation. Embrittlement stands for reduction of toughness as well as a shift of the ductile-to-brittle-transition temperature to higher values – meaning that the material is still in a brittle state, and hence more prone to brittle failure under increasingly higher temperatures. Impurities like copper and phosphorus are known to increase embrittlement, as well as nickel and manganese. The importance of embrittlement is high for VVER reactors due to the high neutron fluences encountered at their vessels.

Reactor pressure vessel embrittlement increases the hazard of vessel bursting – particularly in case of the injection of emergency core cooling water during an incident, which leads to cooling of the vessel wall (so-called thermo-shock). The failure of the pressure vessel

constitutes a beyond design basis accident for all light water reactors. Furthermore, pressure vessel failure can lead to immediate confinement (or containment) failure as well, for example through the pressure peak after vessel bursting. A core melt accident with high and early radioactive releases would be the consequence.

In order to contain this hazard, the following must be available, in accordance with internationally recognized standards:

- Reliable data on the original state of the pressure vessel, and the composition of the materials (base material and welds).
- A surveillance programme, with representative samples, providing reliable data on the progression of embrittlement to be expected.
- To supplement the surveillance programme, a database on the embrittlement properties of the materials used in the vessel concerned that is sufficient for a statistically sound derivation of curves describing the dependence of material properties on temperature.
- A reliable, state-of-the-art system of in-service-inspection (in particular, ultrasound tests), regularly used for testing all the relevant parts of the vessel for small cracks.
- State-of-the-art thermo-hydraulic analyses of all relevant accident sequences which can lead to mechanical and thermal loads to the vessel.
- Based on the thermo-hydraulic analyses, state-of-the-art fracture mechanics analyses for all potentially relevant sequences, taking into account appropriate crack sizes, shapes and locations, to determine the critical ductile-to-brittle-transition temperature. This critical temperature is a most decisive parameter – if it is reached by vessel materials, brittle failure cannot be excluded in case of a DBA.
- Definition and justification of an appropriate safety margin between the critical temperature as determined by analyses, and the maximum ductile-to-brittle-transition temperature that the materials concerned are permitted to reach.
- Counter-measures with demonstrated effectiveness, which can be implemented as required (for example, a low-leakage core to reduce neutron fluence in the vessel wall; heating of emergency cooling water; annealing).

If safety cannot be demonstrated on this basis, either because crucial data are lacking, or because the appropriate safety margin cannot be guaranteed until the end of the operating time envisaged, a limitation of the plant lifetime or even immediate shut-down of the plant concerned will be required.

Treatment of reactor pressure vessel ageing in the Preliminary Environmental Study:

The embrittlement of the reactor pressure vessels is discussed in section 3.2.2. The study points out that the critical ductile-to-brittle-transition temperature is 140°C. This value was determined in calculations for the Finnish NPP with a VVER 440/213 (Loviisa). Presumably, it is based on thermo-hydraulic and fracture mechanics analyses of accident scenarios. However, these analyses are not described. Furthermore, no justification is provided that this result also applies for Paks NPP. Even nuclear power plants of the same reactor type will usually differ in some design details. It must also be kept in mind that Loviisa, the only VVER ever built in a Western country, was considerably modified in the design and construction phase.

The expected values for the ductile-to-brittle-transition temperature for up to 50 years of operation are presented in a table. One value for base material and welds respectively is given per unit (presumably, the maximum value reached), without specifying the location. There is no description of the surveillance programme and no explanation for how those values were determined. The study points out that the welds of units 1 and 2 come close to the critical temperature and that annealing (heat treatment of the vessel area concerned) might become necessary (again, the Finnish experience is mentioned in this context).

In order to mitigate possible thermo-shocks, the water in the tanks of the emergency core cooling system is to be heated at units 1 and 2, beginning in the 24th year of operation (i.e. 2006 and 2008, respectively). Similar measures implemented in Finland are briefly described.

In section 6, table 6.2, the consequences of embrittlement are summarized by stating that only a minor increase of the accident risk is to be expected. This statement is not quantified or discussed in any way.

Assessment:

Ageing of the reactor pressure vessel due to embrittlement clearly constitutes an important problem for nuclear power plants with VVER reactors. Potentially, embrittlement can increase the hazard of severe accidents with large, early releases and far-reaching consequences.

There is no reason to assume that the conditions listed above are not fulfilled at Paks NPP, and that safety could not be demonstrated. However, the Preliminary Environmental Study does not provide information concerning most of the points listed and if any, it is summary.

In the further course of the environmental impact assessment of the lifetime extension of Paks NPP, the issue of pressure vessel embrittlement will have to be presented and discussed in a comprehensive and detailed manner in order to permit the assessment whether, and (if applicable) to which extent, additional risks for the Austrian population will arise from pressure vessel ageing during the envisaged, extended operating time.

Ageing of steam generators:

Importance of steam generator ageing:

Corrosive and erosive damage in steam generators has occurred repeatedly world-wide, as well as wall thinning. These problems have led to comprehensive ageing management activities. Increasingly, they include exchanges of the whole components.

Steam generator ageing is particularly hazardous since it weakens the separating border between primary and secondary circuit. A leakage between the two circuits implies a loss of coolant which is bypassing the containment. Hence, the cooling water lost is not available for the emergency core cooling system. Furthermore, there is a direct pathway for releases into the atmosphere, potentially leading to large source terms.

Treatment of steam generator ageing in the Preliminary Environmental Study:

Possible ageing problems of steam generators are discussed very briefly in section 3.2.2. It is mentioned that in-service-inspection takes place every four years and that stress corrosion

can occur both at the primary and the secondary side (in spite of changes in the secondary water chemistry which have already been implemented).

Countermeasures envisaged are the exchange of the collector (regarding primary-side corrosion and erosion) and plugging of steam generator tubes (regarding secondary-side stress corrosion). An exchange of the whole steam generator is regarded as necessary only if more than 20% of tubes have to be plugged. The calculations and analyses upon which this number is based are not presented. It is considered unlikely that an exchange will be required during 50 years of operation.

In section 6, table 6.2, it is again emphasized that it is unlikely for an exchange of steam generators to be required. It is also pointed out, however, that an exchange could be performed within 3 months, if necessary.

The severe incident in unit 2 in April 2003, occurring in the context of fuel element decontamination, is mentioned in section 5.5.3. However, the connection between fuel element contamination and corrosion problems in the steam generators is not discussed in the Preliminary Environmental Study.

Assessment:

Corrosion of steam generators is an important issue for VVER plants and has created considerable problems at Paks NPP in the past – problems which apparently are not completely resolved even today.

Severe deposition of corrosion products (cruds) on the primary side of steam generator tubes has been reported [VÖRÖSS 2003]. Decontamination work was performed in 1995/96 and 2001/02. Magnetite corrosion products (cruds) reached the reactor core, contaminating fuel element surfaces, and after partial remobilization, getting stuck at the lower spacer grid. The fouling of the fuel elements has been described as “extensive” [LEYSE 2003].

This not only led to the necessity of fuel element cleaning (and hence, the incident of April 2003), but also to a more immediate consequence: A non-uniform distribution of the flow rate of cooling water through the core. Therefore, reactor power had to be decreased temporarily.

Replacement of the collector (without decontamination) is presented as a definite solution by VÖRÖSS [2003]. However, there are indications that the problems are still not completely resolved. Research is presently under way at the Hungarian KFKI Atomic Energy Research Institute to fully understand primary circuit corrosion and crud behaviour, particularly in the reactor core [NAGY 2004].

These issues have to be treated in the further course of the environmental impact assessment of the lifetime extension of Paks NPP. Furthermore, questions of in-service-inspections of steam generators require attention. The accuracy of the eddy current inspection methods, the scope, methods and results of the analyses for the determination of the remaining thickness of tube walls to guarantee integrity, and questions concerning mechanisms and speed of crack growth and the plugging criteria derived on this basis have to be discussed.

Also, the issue of steam generator exchange needs to be dealt with in more detail. In the Preliminary Environmental Study, an exchange is assessed as unlikely, but feasible. On the other hand, a recent report by an international expert group (including a representative of the

Hungarian KFKI), states that steam generator replacement at Paks “is not realistic due to the high costs, thus their eventual failure is an economic limit of lifetime” [DAVIES 2002].

It should be clarified to which extent an exchange of the Paks steam generators is actually considered a realistic option, and the consequences for the potential hazards of a lifetime extension.

Ageing of the confinement system:

Importance of confinement system ageing:

The confinement system of VVER 440/213-plants consists of a system of rooms, containing the primary circuit, with a steel liner to minimize leakages, the barbotage tower with large trays filled with water and air trap (for passive pressure suppression by condensation of steam in case of accidents) and an active spray system.

The behaviour of the confinement system is of crucial importance for all severe accidents where the confinement is not damaged at an early stage by a massive impact, or by-passed. In such cases, the time and extent of radioactive releases is determined by the ability of the confinement to withstand loads more severe than the design basis, and its leak-tightness.

Furthermore, regarding design basis accidents, failure of the confinement in this case can lead to a transition into a beyond-design-basis accident, with an increase of radioactive releases and possibly an aggravation of the accident sequence, due to the loss of cooling water out of the confinement, which is lost to the sump of the reactor building and hence, for later emergency core cooling.

Treatment of confinement system ageing in the Preliminary Environmental Study:

Ageing problems of the confinement system are discussed briefly in section 3.2.2 and also in section 6, table 6.2. With one exception, it is regarded as sufficient if the maintenance, repair and exchange work as practised for the operating period of 30 years is extended for the additional two decades.

The only recommendation beyond that is to exchange the seal bushings of the confinement spray system.

Assessment:

In view of the fact that the confinement system is important for plant safety, and particularly for the timing and extent of releases in case of accidents, potential ageing problems of this system need to be dealt with in more detail in the further course of the environmental impact assessment of the lifetime extension of Paks NPP.

In particular, the long-term behaviour of the steel liner of the confinement rooms and possible implications for confinement leak-tightness would deserve attention, as well as potential ageing effects to the barbotage condenser system which would be subject to considerable loads during accidents, and the safety reserves which can be of importance in case of beyond-design-basis accidents.

Other systems, structures and components; ageing management:

Overall importance:

All systems, structures and components are subject to ageing. Apart from those particularly crucial ones discussed here, this concerns the pressurizer, the primary coolant pumps and

the pipes and valves of the primary cooling circuit, components and pipes of the secondary circuit, as well as a multitude of SSCs with comparatively less safety significance.

Even failures and damages in systems, structures and components of lesser relevance for safety can be relevant for the overall plant risk; and plant risk will increase if such failures and damages become more frequent through ageing. “Small” failures can be precursors to more serious incidents, and the more often they occur, the higher the probability that one of them will indeed develop into an accident sequence, or increase the severity of an accident sequence not initiated by ageing.

Therefore, an all-embracing system of ageing management is required for an NPP, particularly in case of life extension. Ageing management is the totality of all administrative and engineering measures which are executed by the plant operator with the goal of controlling all ageing mechanisms relevant for safety. The main task of ageing management consists of the recording of possible ageing mechanisms, and of the effective prevention of their adverse effects.

Ageing management has to include the following areas [RSK 2004]:

- mechanical components
- electrical and components of instrumentation and control (I&C)
- buildings
- auxiliary and operational materials
- operating management systems
- documentation
- preservation of personnel competence
- conceptional and technological ageing

For each of these areas – as far as applicable – the following aspects have to be considered [RSK 2004]:

- scope of application, possibly with grouping according to safety relevance
- applicable rules and regulations
- relevant ageing mechanisms
- assignment of mechanisms to components
- appropriate methods for monitoring and control
- treatment of ageing defects which have been found
- documentation
- integration into existing structures

An ageing management programme fulfilling these requirements would not guarantee completely safe operation. This is because of the possibility of unforeseen phenomena or impacts, human error, malicious human acts etc, as well as unavoidable degradation of components which can be monitored but not replaced. However, it would provide the

maximum achievable amount of protection against ageing effects – which has to be regarded as obligatory in case of a lifetime extension to 50 years.

Treatment of ageing management in the Preliminary Environmental Study:

Apparently, there is an ageing management programme implemented at Paks NPP, which is being developed further as part of the planning for the lifetime extension. In section 1.2, there is mention of systematic monitoring of ageing, which was begun 8 years ago, focusing on the reactor pressure vessel embrittlement, and erosion corrosion.

Furthermore, a programme of registration of ageing effects, description of the changes they lead to, and determination of corrective action is mentioned. However, no detailed information is presented and discussed.

The results of the programme concerning ageing effects, including brief indications which measures are required in case of a lifetime extension to 50 years are listed in section 3.2.2 and again, in a different context, in tables 6.1 and 6.2. However, in this summary treatment, again, the system of ageing management is not described; rather, it presupposes implicitly that such a system exists without elaborating it.

Furthermore, the listing is restricted to building structures and mechanical components and systems (including emergency diesel generators, ventilation, off-gas treatment and waste water treatment). The whole complex of electrical and I&-C-Systems is summarily dealt with in one sentence. The other areas listed above are not discussed at all in this context.

Assessment:

The overall treatment of ageing in an NPP, even regarding SSCs of comparatively lesser safety significance, is of importance for the risk of extended plant operation. This issue is therefore connected to the issue of severe accidents with possible consequences for the Austrian population.

Therefore, the ageing management programme and questions associated with it need to be dealt with in more detail in the further course of the environmental impact assessment of the lifetime extension of Paks NPP. This should include the presentation of past experiences with ageing, in particular regarding incidents which have occurred because of ageing effects.

5.3 Other factors which could increase the accident risk

Power uprating:

Importance of power uprating for safety:

Increasing the electric capacity of a nuclear power plant beyond the original design value is generally referred to as power uprating. In principle, there are two ways to implement this goal:

- Increasing the thermal efficiency of the plant, at constant reactor power. This is achieved, in a PWR, through modifications in the secondary circuit, chiefly in the turbines.

- Increasing the thermal power of the reactor, generally by raising the coolant temperature. In this case, more steam is produced by the steam generators, and more electricity can be produced in the turbines (which will require modification).

In the first case (constant reactor power), plant safety remains nearly unaffected.

In the case of an increase in reactor power, the risk of plant operation is also increased. Safety margins are reduced and plant ageing is accelerated.

One of the limiting factors for the raise of coolant temperature is the corrosion of the fuel element hulls, which grows more than proportionately with the temperature.

The radionuclide inventory in the reactor core is increased roughly proportionately to the power increase. A larger inventory implies a higher rate of decay heat, which accelerates the heat-up of the core in case of an accident and reduces the time until core uncovery.

In order to assess the feasibility of a thermal power uprate, plant behaviour during normal operation as well as during incidents must be considered. Among other things, the emergency core cooling system has to be examined, as well as the containment or confinement system.

Furthermore, it should be noted that a power uprate leads to an increase of the average maximum neutron flux on the inside of the reactor pressure vessel wall [RSK 2003]. This increase can be of importance for pressure vessels with potential embrittlement problems.

Treatment of power uprating in the Preliminary Environmental Study:

According to section 2.1.6, the original capacity of 440 MW electric per unit has been increased, until 2003, to a nominal power of 472 MWe. (actual capacity is 467 MWe for unit 1, 468 MWe for unit 2, 460 MWe for unit 3 and 471 MWe for unit 4). The increases were achieved by improving the thermal efficiency; reactor power remained unchanged.

In the introduction to section 6, it is mentioned that further power uprating is to take place within the next five to six years, to a nominal power of 500 MW electric. This is to be achieved by the use of a new type of fuel, modifications of the impellers of the main coolant pumps, and modifications in the secondary circuit. There is no further discussion or description of this envisaged uprating. However, the mentioning of a new type of fuel in this context, a fact which is also confirmed by other sources, e. g. [ELTER 2004], indicate that this will be the first thermal reactor power uprating experienced at Paks NPP.

Possible hazards arising from the reduction of safety margins caused by power uprating are not discussed in the Preliminary Environmental Study. The possibility of embrittlement acceleration due to increased neutron flux is not mentioned.

Assessment:

As far as can be seen from the documents at hand, the power uprating to nominal 500 MWe is dealt with – in the context of licensing procedure and environmental impact assessment – independently of the lifetime extension. Nevertheless, the effects of uprating have to be taken into account in the further course of the environmental impact assessment for the lifetime extension. Uprating and ageing can both potentially reduce safety margins; and interactions and synergistic effects between those two factors are possible (for example,

regarding pressure vessel embrittlement). Furthermore, without the lifetime extension, power uprating would be hardly worthwhile, at least for the two older units.

Increased fuel corrosion and the acceleration of ageing processes have an indirect impact on the accident risk, and hence on potential consequences for the Austrian population. The acceleration of accident sequences can have a direct impact on risk since it reduces intervention times of operators and thus the chances of controlling or mitigating the effects of an accident. The greater radionuclide inventory also has a direct impact in case of accidents since it will proportionately increase releases.

A recent publication by a representative of Paks NPP shows that the plant operator is aware of the safety problems associated with power uprating, and also that open questions remain in this context [ELTER 2004].

In this article, it is reported that deterministic and probabilistic safety analyses were under way in 2003/04. The impact of the proposed power uprate on core damage frequency had not yet been quantitatively evaluated. It is assumed that heat removal success criteria would not be affected and it is believed that the time frame for successful operator response will not be significantly reduced. The impact on the frequency of large releases and on the progression of severe accidents had not yet been addressed. All in all, in this article it is not contested that safety margins are reduced, in principle, by power uprating.

Also taking into account other sources, it is summarily stated that the most significant impact of the uprating results from the increased inventory and the possible acceleration of events in case of an accident. The latter statement is somewhat at variance with the belief that the time for operator action will not be significantly reduced, emphasizing that analyses are still ongoing and no final assessment appears to be possible so far.

A new type of fuel is mentioned in connection with the power uprating. No information is provided concerning this fuel. It can be assumed that, following a marked trend world-wide, fuel with higher initial enrichment, and hence higher achievable burn-up, will be used.

This would imply a further reduction of safety margins. There is a trend towards an increasing rate of fuel damage with increasing burn-up. In particular, “shadow corrosion” (corrosion of fuel rod hulls in the vicinity of the spacers) seems to play an important role; the mechanism of this type of corrosion is not yet understood in detail. Open questions also remain concerning the behaviour of high burn-up fuel rods under accident conditions [BORN 2003; NEA 2002].

Seismic hazards and ground instability:

Importance of seismic hazards:

Earthquakes can lead to severe damage of a nuclear power plant, especially if the plant is not designed to withstand the seismic loads that could occur in this geographical area. A core melt accident could be the consequence, possibly with damage to the containment and large early releases. World-wide, seismic events are regarded as an important potential contributor to NPP risk at many sites.

The assessment of seismic risks for an NPP is complex and beset with many uncertainties. Basically, an assessment consists of two steps: The evaluation of site seismicity, i.e. the determination of the maximum accelerations which have to be assumed at the site for the design-basis earthquake (which belongs to the DBAs); and the evaluation of the seismic

design of the NPP, i. e. the determination whether the buildings, structures and components of the NPP can indeed withstand this design-basis earthquake.

The basis for the evaluation of site seismicity and seismic design is continuously evolving. It is a process that has become particularly dynamic during the last decade.

Regarding site seismicity, new methods for geologic investigations have been developed in the last couple of years (for example, paleoseismic methods as well as data collection by remote sensing). Furthermore, experiences from recent earthquakes have provided new insights [WENZEL 2004a].

Accordingly, the International Atomic Energy Agency published a new Safety Guide concerning “Evaluation of Seismic Hazards for Nuclear Power Plants” in December 2002 [IAEA 2002], which supersedes a Safety Guide from 1991. Also, the IAEA recently came to the conclusion that their existing nuclear safety standards, which concentrated on new NPPs in the licensing phase, were not adequate for handling specific issues in the seismic evaluation of operating NPPs. It was concluded that a dedicated document was necessary and subsequently, a Safety Report on “Seismic Evaluation of Existing Nuclear Power Plants” was published [IAEA 2003a].

Evaluation of seismic design also has made considerable progress in the last years. mainly based on the experience and measurements from recent seismic events. It has become clear that traditional approaches do not satisfy the requirements of a realistic assessment of the seismic capacity of structures [WENZEL 2004b]. This development is mirrored by the publication of a new Safety Guide on “Seismic Design and Qualification for Nuclear Power Plants” by the IAEA [IAEA 2003b], superseding a Safety Guide from 1992.

Regarding other problems related to site geology, instability of the ground can be an important issue, which potentially could lead to damages similar to those resulting from seismic events.

Treatment of Seismic Hazards in the Preliminary Environmental Study:

Questions of site seismicity are dealt with in section 4.3.4.1 and in appendix 3. IAEA guidelines were followed to determine the design basis earthquake (in particular the maximum accelerations to be assumed). The IAEA regulations played a particularly important role since specific national regulations were not available before December 1996 (and the new national regulations again were largely based on IAEA guidelines).

The maximum horizontal acceleration assumed for Paks NPP is 0.25 g, the maximum vertical acceleration 0.2 g.

The investigations which constitute the basis for those assumptions were mostly concluded by 1996. Some additional work was finished 1998, and 2000.

Regarding seismic design, it is briefly mentioned in section 2.16 that seismic backfitting of building structures and safety systems took place, but without any specification. There is no systematic discussion of seismic design issues in the Preliminary Environmental Study.

In section 3.2.1, there is mention of instability of the ground around unit 4 of the Paks NPP, which can lead to subsidence of the soil and hence damages to buildings. The study also notes that stabilization of the ground through injections might become necessary already during the first 30 years of operation.

Assessment:

Seismic events can potentially lead to severe accidents with large releases. The evaluation of seismic hazards therefore is of great importance, also regarding potential consequences for the Austrian population. Since this field was under rapid development in the last couple of years, including new insights and experiences gained as well as methods developed, it is of particular importance that all investigations and analyses correspond to the most recent state-of-the-art.

However, the state-of-the-art as represented in the latest IAEA publications (of 2002 and 2003) apparently has not been taken into account in the Preliminary Environmental Study and the investigations described therein. It appears that the determination of site seismicity was based on the level of knowledge of the early 1990s, as compiled in the IAEA Safety Guide of 1991.

Regarding seismic design, it is known from other sources that seismic upgrading has taken place in the late 1990s and the early 2000s [VAMOS 1999; PAKS 2005]. Thus, it is clear that operators and regulators are aware of the importance of this topic. However, due to the lack of information in the Preliminary Environmental Study, it is not clear to which extend new information and new methods have been applied in this field recently.

Clearly, a re-assessment of seismic risk at Paks, based on the present valid IAEA recommentation, is particularly urgent in view of the lifetime extension.

In the further course of the environmental impact assessment of the lifetime extension of Paks NPP, the issue of seismic hazards (including both site seismicity and seismic design) will have to be presented and discussed in a comprehensive, detailed manner. This must be done in order to permit the assessment of:

- to which extent the appropriate, state-of-the art data and methods have been applied; and
- to which extent additional work of seismic hazard re-assessment may be needed, the schedule of this additional work, and, eventually, its results.

The crucial question from the Austrian point of view is clearly to which extent – if at all - the corresponding potential risks for the Austrian population will have to be revised upwards because of the application of new, state-of-the-art data and methods.

The issue of ground instability (subsidence) concerning unit 4 should also be presented and discussed in detail in the further course of the environmental impact assessment, in particular regarding counter-measures which might be required up to the end of an extended lifetime (and beyond).

5.4 Terrorist attacks and sabotage:

Malicious acts of third parties against Paks NPP and their possible effects are not discussed at all in the Preliminary Environmental Study.

It is general consensus that this topic should not be treated publicly in a manner thatl could provide “useful” information to terrorists and saboteurs, and/or provide them with new ideas for attack scenarios.

If this restriction is consistently taken into account, however, the issue of malicious human acts against NPPs can and should be discussed whenever NPP hazards (in particular, severe accident with possible cross-border effects) are addressed – for the following reasons [HIRSCH 2005]:

- The terrorist threat appears to be particularly great in the 21st century. The reason for this lies in the overall global situation, which is determined by economic, military, ideological and political factors and cannot be discussed and evaluated further here.
- It is prudent to assume that a nuclear power plant can appear as an "attractive" target for terrorists because of the potential long-term effects of radioactive contamination, the immediate effects on electricity generation (as well as possible longer-term effects on nuclear power use all over the world) and last but not least because of the symbolic character of nuclear power as typical "high-tech".
- Nuclear power plants are vulnerable to a broad spectrum of possible pathways of attack, including attack from the ground, the air, water ways, and by insiders; as well as to a broad spectrum of possible means of attack, including bombs, suicide attacks with aircraft, shelling, missiles, application of explosives etc. A number of targets are available at the NPP site. Besides the reactor building, there are further buildings and installations on the site which could be attacked to incite severe radioactive releases.
- An attack on a nuclear power plant can lead to radioactive releases equivalent to several times the release at Chernobyl. Relocation of the population could become necessary for large areas (up to 100.000 km^2). The number of cancer deaths can reach 1 million and more. Significant contamination can occur in great distances from the attacked installation (hundreds of kilometres and more).
- Certain protective measures against terror attacks are conceivable. However, their use appears to be rather limited.

These points apply to all types of commercial reactors presently in operation in the world. However, there are plant-specific differences, for example regarding vulnerability of spent fuel pools, robustness of the reactor building or spatial separation of other buildings and systems.

It seems obvious that a terror attack against Paks NPP could have consequences for the Austrian population. Because of the importance of this topic, and because of the existing variations between NPPs regarding vulnerability that give rise to the requirement of plant-specific analyses, the issue of terror attacks and sabotage should be considered and discussed in the further course of the environmental impact assessment of the lifetime extension of Paks NPP. This is important in order to obtain a better understanding of the consequences of a terror attack.

In a source not related to the lifetime extension, it is stated that the reactor buildings at Paks NPP are not designed against the crash of even a small airplane [HAVERKAMP, 2004]. If this is indeed the case, it would imply a comparatively high vulnerability to terror attacks. In any case, the issue of reactor building design and protection against external impacts would have to be included into further considerations and discussions.

When discussing any aspects regarding the vulnerability of Paks NPP, the restriction regarding confidentiality as formulated above must be consistently and rigorously observed.

5.5 Potential severe accidents and assessment of impacts in Austria

Treatment of accident risk in the Preliminary Environmental Study

The standpoint of the Hungarian authorities in the Ruling is that there will be no significant adverse transboundary impact of Paks NPP because the emissions due to design base accidents will be below the limits. The Ruling excludes beyond design base accidents (BDBA) from the discussion because their probability is below 1 E-5/year. No impact of life extension on the accident risk is assumed by the Ruling.

Emissions during normal operation and from design base accidents (DBA) are discussed in the preliminary environmental study. The study concludes that in all the DBA scenarios discussed, the emissions will be lower than the limits. There are some deficiencies in the description of the calculation method for the accident consequences. There is no clear description of either the model used or the assumptions and factors that enter into it. The problem of applying a Gaussian model with constant meteorology for distances up to 100 km is not discussed.

In the dose calculation, the contribution of other nuclides than the four ones listed in Table 8.1 is unclear. Certainly, a two-day dose (as mentioned in one place) is not sufficient to assess the radiological consequences.

The DBA scenario with the highest release of radioactive substances among those analysed has a Cs-137 emission of 1.4 E11, which is five orders of magnitudes lower than releases usually considered in beyond design base accidents. It is not justified to draw conclusions for the severe accident scenario based on DBA dose calculations.

The overall risk for core damage in Paks is estimated to be between 3.4 E-5/year for unit 2 and 4.5 E-5/year for unit 3 (table 5.50). Severe accidents may have a low probability of occurrence but they could lead to very high radioactive emissions and thus can cause a transboundary impact in Austria and other countries, and hence constitute a high risk (being the product of probability and consequences). Therefore it is in the interest of the Austrian population to receive more detailed information about:

- the PSA results for Paks;
- the behaviour of the confinement system;
- potential source terms; and
- the probability of large releases.

5.6 Austrian analysis of BDBA impacts

5.6.1 Release scenario for a beyond-design-base accident

Since there are no BDBA scenarios and source terms in the preliminary environmental study, other literature was used in order to obtain a source term for the calculation of the potential impact of a severe accident at Paks NPP in Austria.

A scenario with failure of the reactor pressure vessel, for example, would lead to high radioactive emissions. The bubble condenser is designed to deal with design base accidents only. In the case of a failure of the pressure vessel, however, the confinement function is not guaranteed.

The determination of a complete source term, including all important nuclides, is well beyond the scope of this report. Only the source term for Cs-137, as a characteristic, leading nuclide, is considered.

The release fraction for Cs-137 for the scenario was estimated to be 30%. [ALBRECHT 1987]

The source term table of the RISKMAP project confirms this estimation with two similar data for VVER 440 V213 accidents: 20% and 50 % respectively. [RISKMAP 1995]

The VVER 440 V213 reactor core has 41.9 t fuel and a maximal burn-up of 37 Gwd/t, with 3 to 4 cycles until this burn-up is reached. This results in a Cs-137 inventory of 1.2 E17 Bq.

With the assumed 30% fraction, the Cs-137 release amounts to 3.6 E16 Bq. [HANDBOOK 2004] This Cs-137 source term was used in order to assess the potential impact in Austria.

Results from the Loviisa PSA are in the same order of magnitude: Cs-137 release of 2.6 E16 Bq. [ROSSI 2000].

In VVER 440 V213 reactors, the fuel pool lies close beside the reactor pressure vessel. Therefore, the fuel pool cooling system could be damaged due to the vessel failure. Because of the situation inside the reactor building, an intervention could be impossible for a rather long period of time after the event. Overheating of the spent fuel in the pond would lead to an additional release of Cs-137 (and other nuclides) from the fuel pool. [ALVAREZ 2003] estimates this release to be 10 to 100% of the inventory in the pool. The fuel pool contains a maximum of 70 t fuel (burn-up 37 Gwd/t). [HANDBOOK 2004] The additional release thus would amount to 3.1 E16 Bq (with 10% release fraction), and the total release would amount to 6.7 E16 Bq.

5.6.2 Methodology

a) Dispersion model

Transport, diffusion and deposition were calculated with the Lagrangian particle dispersion model FLEXPART. FLEXPART is a model suitable for the meso-scale to global-scale calculations, which is freely available and used by many groups all over the world [STOHL1998], see model homepage at http://zardoz.nilu.no/~andreas/flextra+flexpart.html).

The version developed for the project RISKMAP (ANDREEV 1998, HOFER 2000, RISKMAP 1995) was used here. Meteorological input data are gridded fields from the European Centre for Medium-Range Weather Forecasts (ECMWF) with 1 degree resolution. This model produces surface contamination due to dry and wet deposition as endpoints. The only species considered in this model is aerosol-bound Caesium-137, which is used as a characteristic nuclide. The output is given on a latitude-longitude grid with a grid size of about 30 km x 30 km. Thus, features smaller than this cannot be resolved, including the local maximum near the NPP site.

b) Dose estimation

A simple conversion factor to derive dose estimates from the total Cs-137 depositions is applied. This factor is based on results of previous calculations carried out with Mainframe Cosyma. This code, designed for the assessment of radiological consequences of NPP accidents, considers all relevant nuclides and delivers various dose values as endpoints. In the calculations mentioned, it was fed with a similar source term for a BDBA at Temelin NPP, and run for three years of meteorological data (total of 8760 runs per year). For each run, the grid point in Austria with the highest dose was selected, and the dose was related to the Cs-137 deposition in this grid element. The dose considered here is the effective dose equivalent for all nuclides and all exposure pathways (without ingestion) for the first year after the accident. The result is shown in Figure 1. As the wet cases are considered more relevant for the transport distances considered here (longer than from Temelin to adjacent Austria), the boundary towards the wet cases is used to derive the dose conversion factor. This factor is 4.8 E-8 Sv / (Bq Cs-137 m-²).

This dose factor is representative if the accident is assumed to be in winter. If the accident is assumed to be during the vegetation period, the potential exposure in the first year could be considerably higher (up to 80% of the total exposure could be caused by ingestion).

Effective doses for the first year (ingestion included) are used as the basis for assessing radiation hazards in Austria [Rahmenempfehlungen 1995] according to Table 1.

Table 1 : *Radiation hazard levels in Austria*

radiation hazard level	***1st-year effective dose mSv***	***Cs-137 deposition kBq/m²***
0	< 0,5	< 10
1	0,5 - 2,5	10 - 52
2	2,5 - 25	52 - 520
3	25 - 250	520 - 5200
4	> 250	> 5200

*****

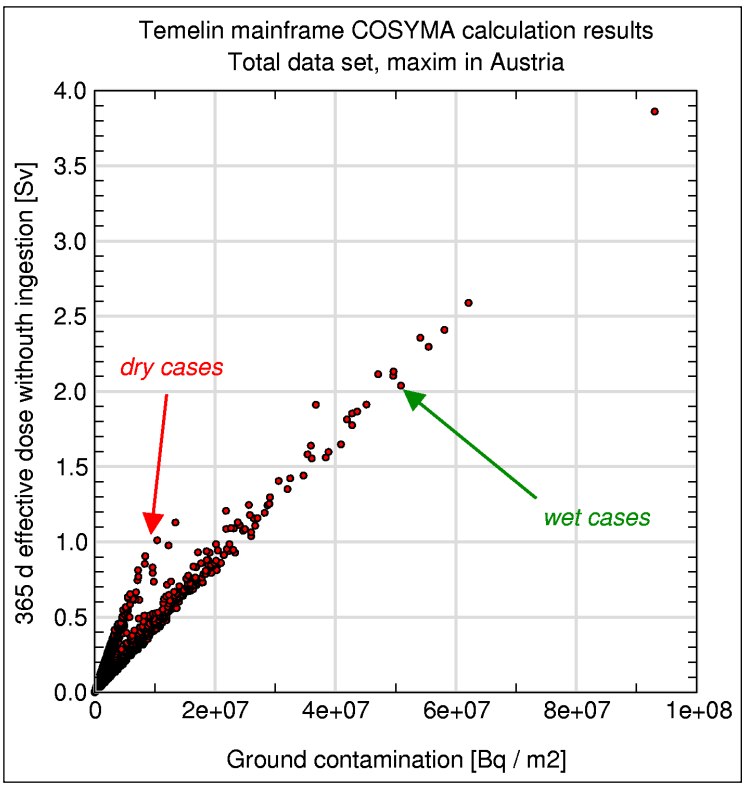

Figure 1 *Correlation between first year effective dose (without ingestion) and Cs-137 soil contamination, calculated by Mainframe-COSYMA for the NPP Temelin and the maximal contaminated grid point in Austria.*

5.6.3 Selection of cases

Below, we are showing three selected cases which would severely impact different countries (besides Hungary the countries are: Austria, Germany, Slovakia, Czech Republic, Poland, Croatia, Slovenia, and Italy). These cases were selected from a pool of simple trajectory calculations made for many dates in the year 1995, which is also the base year for the RISKMAP study. This has been shown to be climatologically representative for the Alpine region. The selected dates were then simulated in detail with FLEXPART. The selection criterion was that heavy transboundary effects are simulated, and that in each case a different geographic region is affected. This procedure does not include an estimate of the probability of such cases. We aim to demonstrate here that severe adverse effects in other countries are possible and thus have to be included in the EIA. From other studies that we have performed, however, we can confirm that such meteorological conditions are not too infrequent.

5.6.4 Results and discussion

Figures 2, 3 and 4 show the distribution of the total deposition of Cs-137 for the three meteorological scenarios. The release date and time for each scenario is given in the captions.

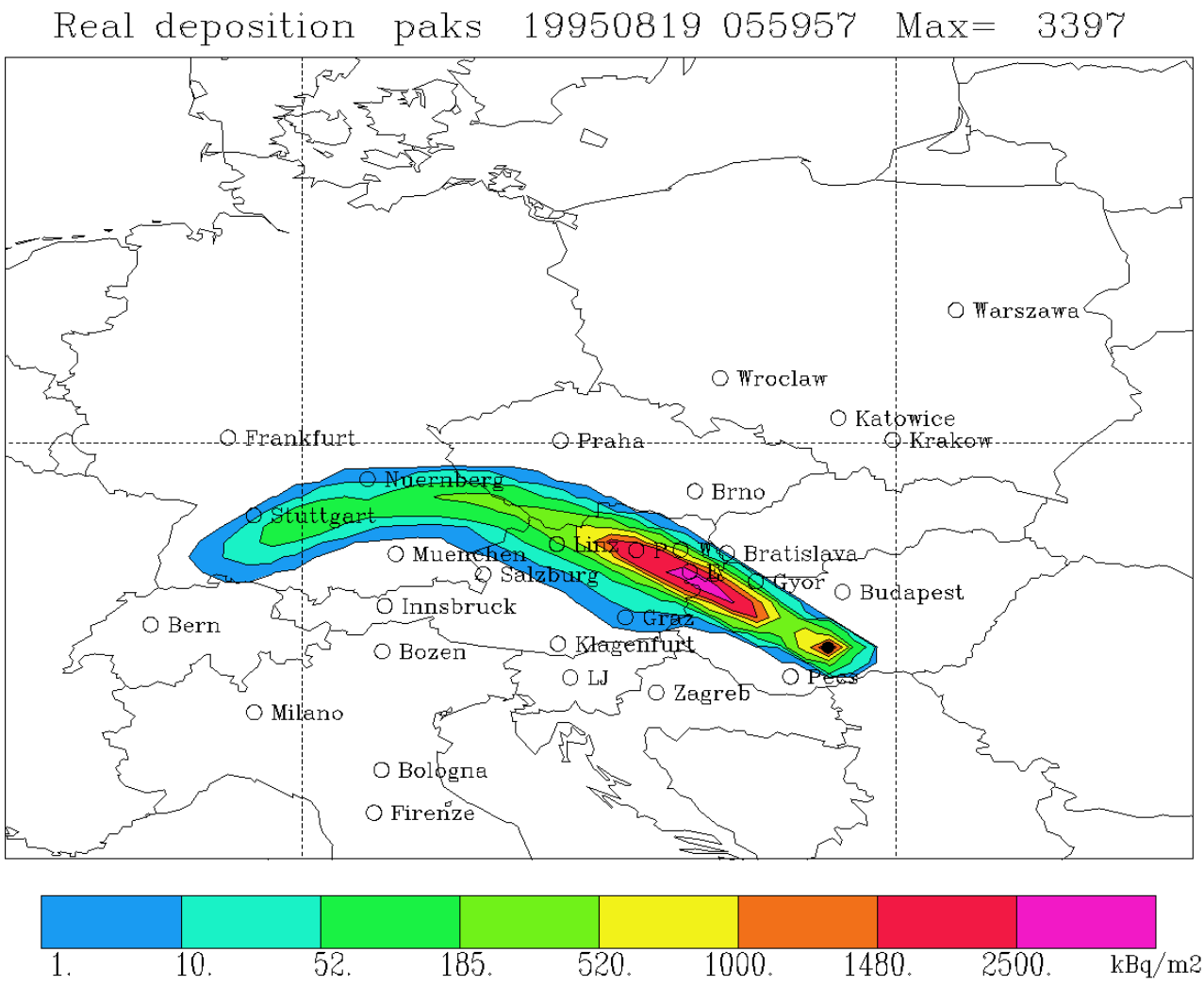

***Figure 2**: Total deposition of Cs-137 [kBq/m²] from a hypothetical BDBA at NPP Paks with release of radioactivity on 19.08.1995 at 06 UTC (05:59:57 UTC).*

The following city names are abbreviated: W Wien, E Eisenstadt, P St. Poelten, LJ Ljubljana.

Hazard level 1 starts with the turquise color, level 2 with green, and level 3 with yellow. The value at the right of the title line indicates the absolute maximum of the contamination on the evaluation grid in kBq/m².

The deposition pattern reflects the track of the contaminated air across the border from Hungary to Austria. A large region from Western Hungary into the Burgenland and extending further into Oberösterreich (Upper Austria) would become highly contaminated mainly by wet deposition (Cs-137 deposition above the maximum deposition from Chernobyl in Austria). In these regions, parts of the city of Vienna included, radiation hazard level 3 would be distinctly exceeded. The situation would require protection measures for the whole population such as iodine-prophylaxe for all children and adults up to 45 years, sheltering in houses, and limitations to the use of vegetables, milk and meat from the affected regions. Meteorologically, this situation is characterized by a persistent low pressure over Italy, not dissimilar to the situation which recently caused heavy rains along the northern edge of the central Alps. Such situations are common during summer. During summer, the impact on

agriculture would be dramatic, and long-term effects in Austria and Hungary must be expected. Also in the Czech Republic and in Germany significant contamination would occur.

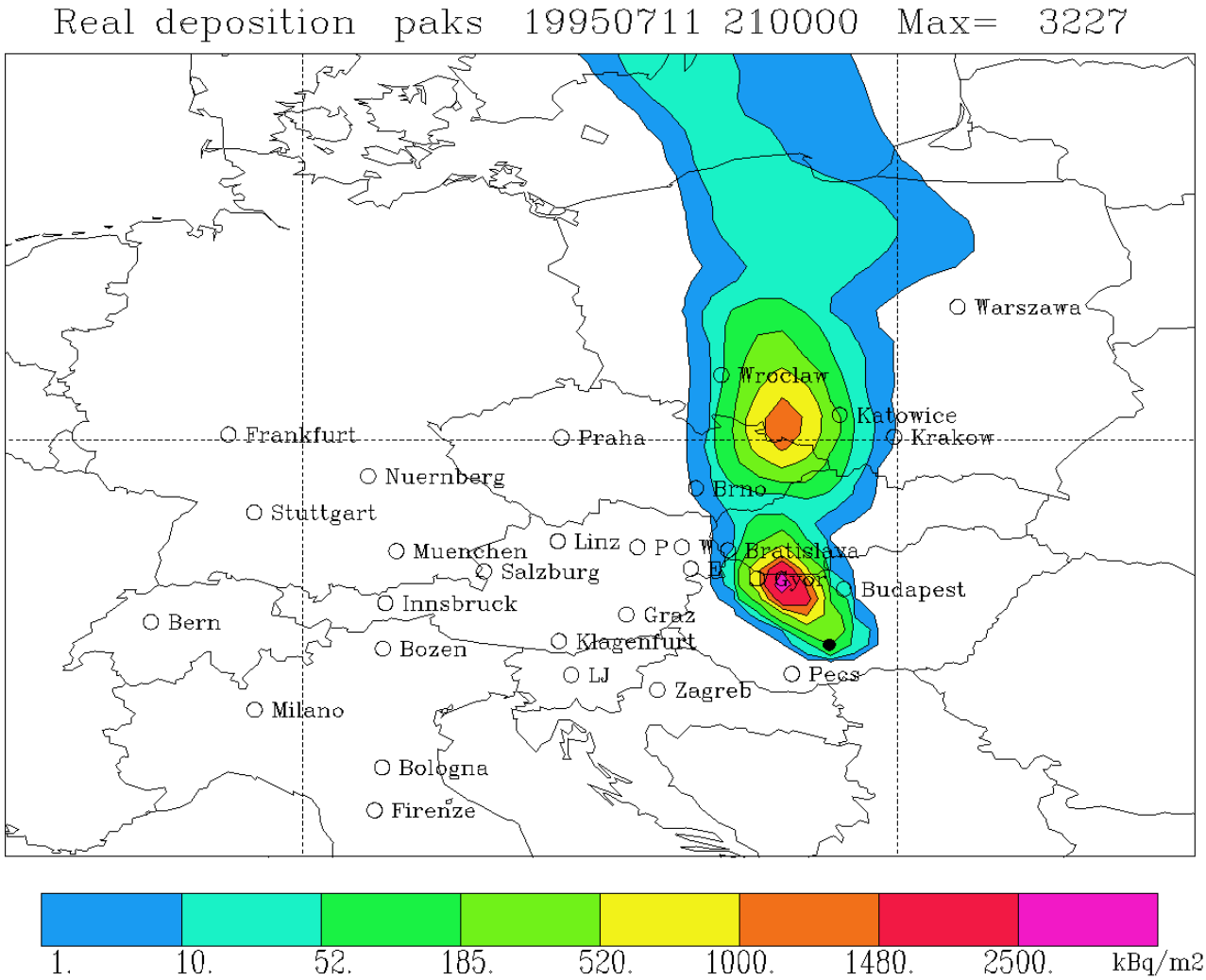

***Figure 3**: Total deposition of Cs-137 [kBq/m²] from a hypothetical BDBA at NPP Paks with release of radioactivity on 11.07.1995 at 21:00:00 UTC.*

The following city names are abbreviated: W Wien, E Eisenstadt, P St. Poelten, LJ Ljubljana. Hazard level 1 starts with the turquise color, level 2 with green, and level 3 with yellow. The value at the right of the title line indicates the absolute maximum of the contamination on the evaluation grid in kBq/m².

In these weather conditions, the contaminated air moves north and the maximum deposition – linked again to precipitation – strikes the border between Hungary and the Slovak Republic. A second maximum occurs on the border between the Czech Republic and Poland.

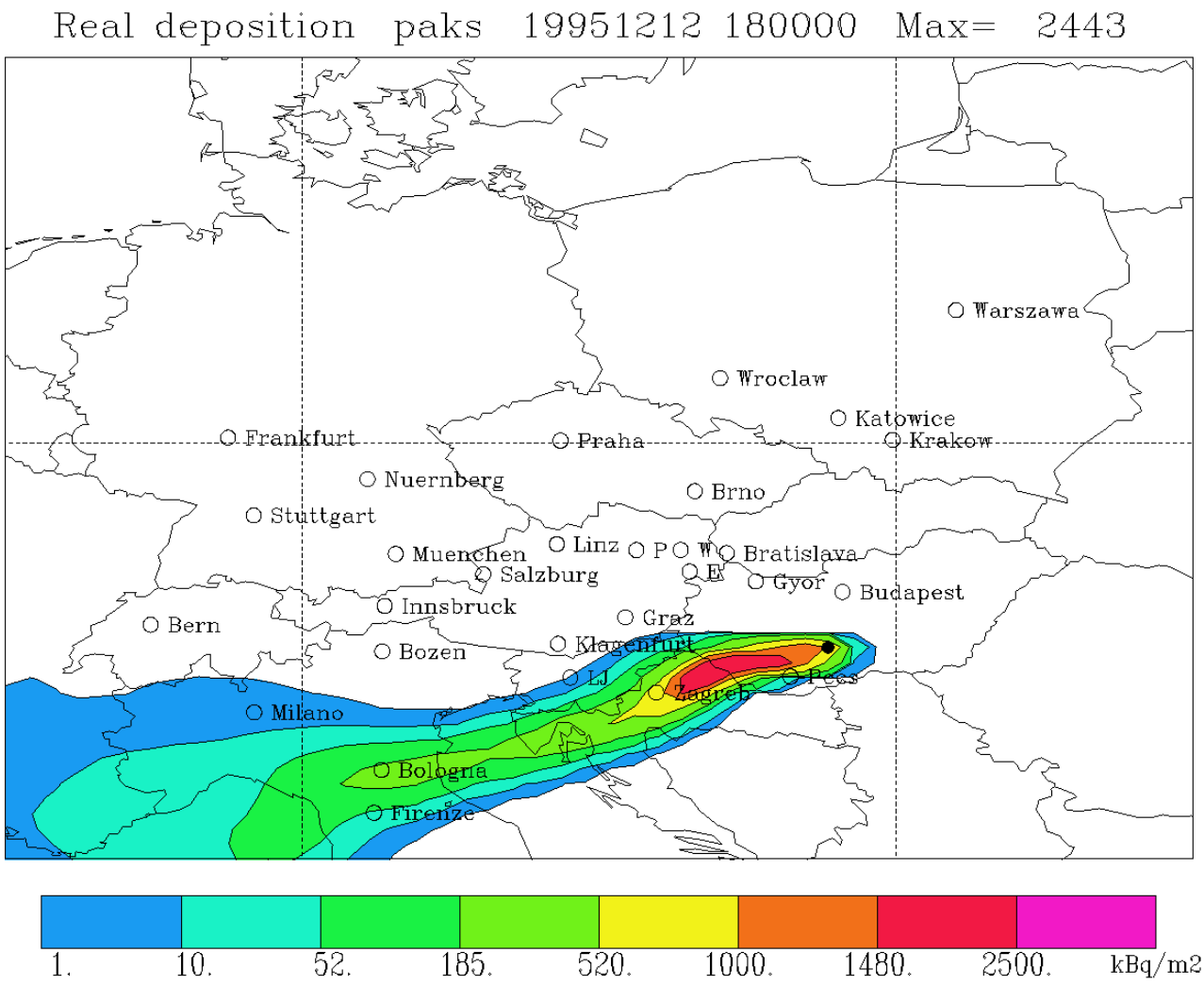

Figure 4: *Total deposition of Cs-137 [kBq/m²] from a hypothetical BDBA at NPP Paks with release of radioactivity on 12.12.1995 at 18:00:00 UTC.*

The following city names are abbreviated: W Wien, E Eisenstadt, P St. Poelten, LJ Ljubljana. Hazard level 1 starts with the turquise color, level 2 with green, and level 3 with yellow. The value at the right of the title line indicates the absolute maximum of the contamination on the evaluation grid in kBq/m^2.

As shown by this case, contaminated air can also move westward and take a track south of the Alps. Also in this case, precipitation patterns cause an extended and heavy maximum of contamination extending from Southern Hungary through Croatia, striking also Italy and Slovenia.

5.7 Conclusions for the EIA procedure

As a general conclusion of the evaluation of the preliminary environmental study, it must be stated that relevant issues for neighbouring countries are not sufficiently elaborated. In order to permit the assessment whether, or to which extent, additional risk for the Austrian population will arise from the life extension of NPP Paks the detailed elaboration of the following issues in the environmental documentation is requested:

- The overall treatment of ageing in an NPP is of importance for the risk of extended plant operation. Of particular importance and safety significance is the ageing of the reactor pressure vessel, the steam generators.,and the confinement system.
- Reliable data on the original state of the pressure vessel, the composition of the materials, the embrittlement surveillance program, the thermo-shock analyses performed etc. should be presented in the documentation.
- Also treated in some detail should be the corrosion of steam generators and the option of steam generator exchange; as well as the connection between steam generator corrosion and fuel element contamination.
- The long-term behaviour of the confinement system (steel liner, barbotage system etc.) should be discussed in the documentation.
- Furthermore, the ageing of many other systems, structures and components can also be of safety significance. A comprehensive ageing management program is required and should be presented in the documentation.
- The effects on the safety margins of the plant related to ageing in connection with power uprating should be presented in the documentation, including the specifications and effects of the new type of fuel to be used.
- The issue of seismic hazards (including both site seismicity and seismic design) will have to be presented and discussed in a comprehensive manner in order to permit the assessment to which extent appropriate, state-of-the art data and methods have been applied and which additional analyses might be required.
- The issue of terror attacks and sabotage can and should be discussed without disclosing sensitive information.
- A comprehensive discussion of DBA and BDBA scenarios and severe accident management measures, including the results of safety analyses concerning BDBA (initiating events, scenarios, source terms) is required to assess the potential risk for the Austrian population in greater detail.

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5.9 Glossary

BDBA	Beyond Design Base Accident
Bq	Becquerel, unit for radioactivity
Cs-137	Cesium 137
DBA	Design Base Accident
EIA	Environmental Impact Assessment
GWd	Gigawattday – unit for energy
I&C	Instrumentation and Control
NPP	Nuclear Power Plant
PWR	Pressurized Water Reactor
SSC	Systems,Structures and Components
Sv	Sievert, unit for dose equivalent
VVER	Russian Version of the Pressurized Water Reactor

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