

Environmental Impact Assessment Program

„New Nuclear Power Plant in Lithuania“

Expert Statement

Antonia Wenisch, Gabriele Mraz

Vienna, January 2008



**Erstellt im Auftrag des
Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft,
Projektleitung Abteilung V/6 „Nuklearkoordination“
GZ BMLFUW-UW.1.1.4/0049-V/6/2007**



lebensministerium.at

TABLE OF CONTENT

1. Introduction.....	1
2. Summary and Conclusions.....	3
3. The EIA Procedure.....	8
4. The Proposed Project	8
5. Safety and Risk Analysis.....	12
6. Radioactive Waste.....	14
7. Environmental Impact.....	16
8. References.....	18
9. Glossary.....	19

1. INTRODUCTION

Lithuania plans to construct a new Nuclear Power Plant (NPP).

Two RBMK units are located at Ignalina NPP in Lithuania. Each reactor unit has a net electrical capacity of 1300 MW. Operation of these reactors has started in 1977 and 1978, respectively. Unit 1 has been closed at the end of 2004, unit 2 is scheduled for shutdown at the end of 2009. The planned new power plant is intended to replace the old one. The new NPP shall have a maximum net electrical capacity of 3400 MW.

According to European Union (EU) regulations, in summer 2007 Lithuania has started an Environmental Impact Assessment (EIA) procedure for the construction of this NPP. Lithuania has invited its neighbouring countries to participate in the process and published the EIA Program in English language. The Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management has expressed its interest in the procedure and had received the Environmental Impact Assessment (EIA) Program for a New Nuclear Power Plant (NPP) in Lithuania from the Lithuanian Ministry of Environment.

The Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management, has commissioned the Austrian Institute of Ecology to elaborate an Experts Statement on the EIA Program for a new NPP in Lithuania.

The EIA Program gives an overview on the content of the EIA, which Lietuvos Energija AB, the developer of the plant, has to prepare in the framework of application for a license for construction and operation of a new NPP.

Austria participates in this EIA program in the framework of the Espoo Convention (Convention on environmental impact assessment in a transboundary context). The Experts Statement analyses the comprehensiveness of the proposed content of the Lithuanian EIA Program compared to the European Commission's EIA directives and the Espoo convention, respectively.

The task is to evaluate whether the information proposed to be provided by the EIA will allow to assess the safety of the new NPP concerning emissions into the environment in a transboundary context, both during normal operation and accidents (design base and beyond design base accidents). For Austria mainly airborne emissions could be relevant, in particular emissions due to severe accidents could contaminate not only the vicinity of the plant but depending on the climatological conditions at the time of a large accidental release also regions far from the NPP could be affected. The Experts Statement formulates information requirements which will allow the assessment of the significance of accidents with a large release of radioactive substances.

A team from the Institute of Meteorology of the University of Natural Resources and Applied Life Sciences, Vienna and the Austrian Institute of Ecology analysed the climatological risk that emissions due to severe accidents at NPPs in Europe could affect Austrian territory to an extent that would require radiation protection measures for risk groups (children and young people, expecting and nursing mothers) and normal population, respectively. „Climatological risk for the Ignalina NPP site“ means the probability of weather conditions in Europe which lead to transport and deposition of emissions released from the Ignalina NPP site to Austrian territory, expressed as percent of all weather situations. As a result of this study the climatological risk for the site of Ignalina NPP was assessed to be 6,7% (risk group) and 2,25% (for general population), respectively. This is just the same as for the Swedish NPP Ringhals. [SEIBERT et al. 2004]

An impact to Austria of a severe accident at NPP Ignalina cannot be excluded. Depending on the amount of radioactive substances released due to an accident, the impact could be significant, i.e. protection measures could be required for people living in Austria. Therefore Austria has an interest in the planning of this large new NPP in Lithuania.

Transboundary impacts are the subject of the Espoo convention. Based on a review of international treaties, conventions, EU law and bilateral treaties, the following items should be considered in an Espoo-procedure [LERCHER 2005]:

- the precautionary principle should play a dominant role when interpreting the term of “likelihood of having significant transboundary effects”
- the specific nature of the risk of operating a nuclear power plant: relatively low probability of occurrence on the one hand, but potentially disastrous consequences on the other hand
- severe accidents (beyond design basis accidents) have to be taken into consideration by determining the likelihood of having significant transboundary effects

Therefore, Austria is interested to take part in the discussion:

- of alternative options to the NPP,
- measures to prevent accidents which could cause a large release of radioactive substances and
- safety targets and standards for the planned NPP.

This Experts Statement refers to the document Austria received from Lithuania:

**“Environmental Impact Assessment Program
New Nuclear power Plant in Lithuania”**

of November 15th, 2007 prepared by the Consortium Pöyry Energy Oy, Finland and
Lithuanian Energy Institute.

This document is referred to herein after as [EIA Program, page-number].

This Experts Statement for the scoping phase in the EIA procedure for a New Nuclear Power Plant in Lithuania analyses the concept for the EIA Report as it is presented in the EIA Program.

Preparation of the EIA Report is scheduled to be finished in summer 2008. In autumn 2008 the report is open for commenting by the public, domestic and international EIA parties. International consultancies are scheduled for October, 2008.

Chapter 1 of this Expert Statement “Summary and Conclusions” presents the most important findings and recommendations for the content of the EIA Report.

The following chapters deal with the issues, presented in the EIA Program and relevant from the Austrian point of view, in more detail.

2.SUMMARY AND CONCLUSIONS

The Proposed Project and Alternative Options

The proposed project is the construction of a new Nuclear Power Plant (NPP), which shall replace the Ignalina NPP (INPP) units 1 and 2. Unit 1 has been shutdown at 31.12.2004 and unit 2 is scheduled to shutdown at the end of 2009. The net electrical output of the new NPP will be maximal 3400 MW.

Net electrical capacity of the two INPP units is 1300 MW each. 3400 MW is more than simply a replacement of the capacity of the old NPP. After shutdown of INPP-1, 70% of the total Lithuanian electricity has been produced by the second unit of INPP. It is said that the current Lithuanian generating capacities will be sufficient to meet the national demand until 2013. Finalization of the new NPP is planned for 2015.

In the EIA Program it seems that the construction of a nuclear power plant at the Ignalina site has been decided before the EIA procedure began. All other options to produce electrical energy are excluded from the investigation.

The presented alternatives are no substantial:

- Both proposed sites are at the location of INPP within a distance of less than 3 km from each other.
- The proposed technological alternatives are in principle all the same only different nuclear reactor types are considered

The Site

The only site considered for the new NPP is the site of Ignalina NPP. The new NPP is planned to be located in the area where INPP unit 3 and 4 were planned to be built.

An actually different site has not been considered at all, because of the existing infrastructure (water supply, transmission lines etc.). This decision would cause the prolongation of the enormous waste of thermal energy, which significantly affects the ecosystem in Lake Druksiai, because of the cooling water released into the lake. The INPP site may be the best site for a NPP, but not the best for a thermal power plant of this large capacity.

Recommendation

Potential interferences of simultaneous activities at the site as decommissioning of the old units, construction and later operation of the new NPP should be analysed in the EIA Report (including timetables for both activities). The total inventory of radioactive material at the site should be estimated for the different phases of the activity at the site.

Considering the influence of thermal pollution due to the NPP's waste water release into the lake, the alternative to construct smaller co-generation heat and power plants fuelled either by gas or biomass should be analysed in the EIA report. Such plants could be constructed near villages and provide effectively electricity and heat which both could be used locationally.

The Zero Option

Treatment of the zero option (i.e. non action alternative) is mentioned in the Espoo Convention [ESPOO 1997, Appendix II]. We emphasize that it would be of interest to discuss it in the EIA Report.

Even if Lietuvos Energija AB is not responsible for the Lithuanian energy policy, as applicant for the construction license of a NPP it should be able to present a serious discussion of the energy saving potential and the zero-option. At present one unit of INPP provides 70% of the Lithuanian electricity demand. An increase in the demand of 100% in less than 10 years is not self-evident.

Recommendation

Concerning development and prognoses of demand and generation of electricity more detailed information should be provided by the EIA Report, including data on export and import of electricity. The EIA Report should provide a serious discussion of the prognoses for electricity demand, as well as an assessment of the potential for efficiency enhancement and demand side management.

Technological Alternatives

Independent of the formal mandate of the applicant it should be proved that the NPP is the best option to generate the required electricity in an environmentally sound, sustainable and efficient way. To examine different technological options is the standard in other EIA procedures in European Union member states (e.g. Romania concerning construction of NPP Cernavoda or Bulgaria concerning NPP Belene) as well as a discussion of the non action alternative.

Besides the ample explanation in the EIA Program why the applicant is not responsible for other electricity generation options, it seems that an analysis of environmental impacts of different systems is foreseen in the EIA Report.

Recommendation

In order to analyse the differences in impacts from other electricity generating sources and nuclear power plants on air quality, the emissions of greenhouse gases and other pollutants caused by use of different fuels we recommend to include demand side efficiency improvements and energy saving and demand side management, as well as different renewable energy forms. The comparison of the environmental impact has to include the total life cycle of all considered alternatives.

The Three Nuclear Options

From the EIA Program it is unclear what will be the subject of the analysis:

- Three different existing specific reactors from companies which Lithuania wants to invite for bidding
- Prototype reactors as EPR, AES 2006, ACR, at present in the design phase or under construction
- Three reactor types Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR) and Pressurized Heavy Water Reactor (PHWR)

The EIA Program suggests that the subject of the EIA Report will be a general discussion of the features and impacts of the three reactor types.

Ignalina NPP had two reactor units, for the new NPP it is unclear how many units it shall have, the biggest reactor units under construction now have a capacity of 1600 MWel.

Therefore the new NPP will also consist of two or more reactor units. For a safety assessment it is required to know whether this will be stand-alone units or they will be located in a common building.

Recommendation

If the EIA is performed in order to prepare a decision about the reactor type a detailed comparison of emissions, waste and fuel requirements. However a more detailed assessment will be required for the safety and risk assessment of the plant.

Safety and Risk Analysis

For Austria the safety and risk analysis of the new NPP is the most important issue of the transboundary EIA process. Accidents with a large release of radioactive substances into the atmosphere could affect Austria as well as Russia, the Baltic neighbours and other countries in Europe. According to the ESPOO-Convention and the EC EIA-Directive the EIA report has also to deal with the potential impact of severe accidents. Results of the Probabilistic Safety analysis (PSA) concerning Design Basis Accidents (DBA) and Beyond Design Basis Accidents (BDBA) and their potential effects should form an essential part of the EIA report.

Accident Situations are treated in chapter 7 of the EIA report consisting of only two paragraphs gives only a very general description of the content of the EIA Report. There it is announced that the safety assessment which will be carried out for application of the construction and operation license will be described in the EIA Report. The description of the requirements for the safety assessment is no substitute for the safety assessment itself.

At least the safety and quality requirements and standards which are to be fulfilled by the new NPP are to be given in the EIA Report.

It is unclear which nuclear safety guides of the IAEA will be considered for the design of the new NPP for Lithuania. Will the European Utilities Requirements [EUR 2001] be regarded?

Risk Analysis is dealt with in chapter 10 of the EIA Program. In this chapter all the important information is promised to be presented in the EIA program. The EIA Report should provide a comprehensive risk assessment of the selected reactors.

Internal Events are mentioned in the EIA Program only as part of the risk analysis. We expect that the EIA Report contains more concrete information about the reactors considered to be constructed for Lithuania and about their safety and risk evaluation or at least about the requirements these reactors have to meet.

External Events can be caused by natural disasters or by impacts from human activities outside of the reactor. Also interference between nuclear facilities at the same site have to be considered as a potential hazard.

According to the EIA Program earthquake risk in Lithuania is low and the Lithuanian nuclear authority has adapted its regulations concerning seismic design to recent standards.

Other major impacts on the NPP, as plane crash, terrorism or sabotage cannot be excluded.

In particular air traffic has increased rapidly in the last years in Lithuania. Extreme weather could also result in damaging impacts to the NPP. Since the new NPP is designed for a lifetime of 60 years it is recommended to discuss the impact of climate change in the EIA Report, in particular the potential increase of extreme weather conditions as storms, heavy rain and floods.

To prevent the impairment of safety in case of external impacts buildings and structures of the new NPP have to be designed properly. We expect that the related design requirements will be described in the EIA Report.

Recommendation:

The EIA Report should contain more concrete information about the reactors considered to be constructed for Lithuania.

The following information corresponding to the reactor type should be given by the EIA Report:

- a description of the plant and its safety and control systems
- the number of reactor units,
- the description of common facilities and structures
- allocation of all facilities at the NPP site,
- refuelling cycle, and maximum fuel burn-up,
- radioactive core inventory
- Safety targets, safety standards and requirements, (IAEA guidelines, Euratom directives etc.)
- PSA results including source terms for DBA and BDBA should be given in the EIA Report.

Radioactive Waste

Concerning treatment and conditioning of radioactive waste from operation of the new NPP the EIA Program refers to the „Regulation on the Pre-Disposal Management of Radioactive Waste at the Nuclear Power Plant, VD-RA-01-2001. Several treatment and storage options are mentioned. Furthermore the EIA program mentions the possibility that the new NPP could use existing solutions at the INPP, but it is unclear which of these waste treatment facilities already exist.

The management of spent nuclear fuel (SNF) and high level radioactive waste (HLW) is described only in general. Different options for SNF management will be described in the EIA Report (wet storage, dry storage, reprocessing), but long-term storage and disposal of SNF will be subject of an own EIA procedure in the future. Estimation of future cost for SNF and radwaste management is not mentioned in the EIA Program.

For the new NPP an initial decommissioning plan is required in order to quantify the amount of waste and to estimate the decommissioning cost. For the new NPP an initial decommissioning plan is required in order to quantify the amount of waste and to estimate the decommissioning cost.

Recommendation

The EIA Report should include a preliminary estimation of cost for long-term treatment of SNF and radioactive waste, just as it is required in the EIA Program for decommissioning in order to establish and collect appropriate funds for these activities during operation of the plant.

Environmental Impact

Water Pollution

The Status of Lake Druksiai and the impact of NPP operation on this lake are very relevant issue. Lake Druksiai is the largest lake in Lithuania and it is an area of importance for habitat protection (Natura 2000) and subject of the Ramsar Convention.

The yearly amount of water taken from and discharged to the lake for the cooling of the two units of INPP was ninefold the volume of the lake. In the EIA Program it is stated that this discharge had no significant impact. However the UN Working Group on Monitoring and Assessment of transboundary and international Lakes disagrees with that position. According to its assessment the discharge of industrial thermal waste water from INPP results in accumulation of pollutants in sediments and to eutrophication.

Air Pollution

In the EIA Program data on greenhouse gas (GHG) emissions are presented, which show a significant decrease between 1990 and 2000 in Lithuania. Since then GHG emissions are increasing again. For understanding the rationale for the construction of a new large NPP, it would be worth to present information on the causes of this development (changes in the economy, traffic etc.) in the EIA Report.

Concerning monitoring of radioactive emissions and contamination of water, sediments, soil foodstuff etc. data from INPP are presented in the EIA Program. The result of the dose assessment based on the monitored emissions of INPP is also presented. Only data from recent years are presented, which seems not enough in order to assess the background contamination.

Recommendation

Monitoring results should give the detection limits instead of zero-values.

Monitoring results should be completed by the description of the sampling (location and frequencies) and the measurement methods.

For the dose assessment the calculation method including the dispersion model used, the considered exposure pathways and a specification of the critical group have to be presented in the EIA Report.

Since INPP is operating since 30 years a time series of measurement data should be given. We recommend to provide time series of data not only concerning the radiation monitoring but also concerning the public health in order to allow a serious discussion of the impact of radioactive emissions.

The EIA Report should present the estimation of the emissions of the planned new NPP and their impact.

3.THE EIA PROCEDURE

Lithuania plans to construct a new Nuclear Power Plant (NPP).

Two RBMK units are located at Ignalina NPP in Lithuania. Each reactor unit has a net electrical capacity of 1300 MW. Operation of these reactors has started in 1977 and 1978, respectively. Unit 1 has been closed at the end of 2004. Unit 2 is scheduled for shutdown at the end of 2009. The planned new power plant is intended to replace the old one. The new NPP shall have a maximum net electrical capacity of 3400 MW.

According to EU regulations, in summer 2007 Lithuania has started an EIA procedure for the construction of this NPP.

The EIA Program contains a comprehensive and perfectly clear description of the procedure and the participation options, including the participation of concerned countries. Furthermore a comprehensive and generally clear description of the EIA process is given, which explains also the way how different stakeholders can take part in the procedure. But some points require clarification [EIA Program, 20ff]:

1. Why are no environmental and societal NGOs invited to send their experts to the stakeholder group?
2. Who are the "relevant EIA parties"?
3. The difference between "relevant EIA parties" and "stakeholders" should be clearly defined.

4.THE PROPOSED PROJECT

The proposed project is to build a Nuclear power Plant with a net electrical output of maximal 3400 MW. The new plant shall replace the Ignalina NPP (INPP) units 1 and 2. Finalization of the new NPP is planned for 2015.

Net electrical capacity of the two INPP units is 1300 MW each. 3400 MW is more than simply a replacement of the capacity of the old NPP. After shutdown of INPP-1 the second unit of INPP produced 70% of the total Lithuanian electricity. In the EIA Program it is said that the current Lithuanian generating capacities will be sufficient to meet the national demand until 2013. Since INPP-2 is scheduled to shutdown in 2009, it appears that there will be a gap in electricity production for the Lithuanian demand, if nuclear power is the option Lithuania chooses.

Concerning development and prognoses of demand and generation of electricity more detailed information should be provided by the EIA Report, including data on export and import of electricity.

In the EIA Program alternative options are presented concerning the location and the technology, as well. But the presented alternatives are not substantial:

- The proposed sites are all at the location of INPP within a distance of less than 3 km from each other.
- The proposed technological alternatives include only nuclear power as an option to generate electricity, only different nuclear reactor types are considered.

In the EIA program it seems that the construction of a nuclear power plant at the Ignalina site has been decided before the EIA procedure began.

The Site

The justification for the decision to choose the Ignalina NPP site according to the EIA Program is:

"There are not any other realistic options for the location of a new nuclear power plant in Lithuania, because it is essential for the project to utilise existing land use plans and infrastructure." [EIA Program, 31]

This seems to be plausible, but it also allows the prolongation of an enormous waste of thermal energy. Ignalina may be the best site for a NPP, but not the best for a thermal power plant of this large capacity.

The new NPP will be built at the site of Ignalina NPP. It shall be located in the area where INNP unit 3/4 was planned to be. There is also another option to build the new plant on the other side of INPP 1/2. The first option appears to be the preferred one, because some construction work has been started previously - as the construction of cooling water channels.

Because of the existing infrastructure (water supply, transmission lines etc.), an actually different site has not been considered at all.

Recommendation

Potential interferences of simultaneous activities at the site as decommissioning of the old units, construction and later operation of the new NPP should be analysed in the EIA Report (including timetables for both activities). The total inventory of radioactive material at the site should be estimated for the different phases of the activity at the site.

Considering the influence of thermal pollution due to the NPP's waste water release into the lake, the alternative to construct smaller co-generation heat and power plants fuelled either by gas or biomass should be analysed in the EIA report. Such plants could be constructed near villages and provide effectively electricity and heat which both could be used locally.

The Zero Option

Treatment of the zero option (i.e. non action alternative) is mentioned in the Espoo Convention [ESPOO 1997, Appendix II]. We emphasize that it would be of interest to discuss it in the EIA Report.

In the EIA Report concerning the zero-option it is said that if *"the new NPP will not be constructed the electricity consumption in Lithuania will exceed the electricity generation"* [EIA Program, 31].

In the EIA Report the environmental impact of the import of the respective electrical energy will be assessed on a general level. Energy saving will not be assessed in the EIA Report. This is justified by the following argument: *"The organisation responsible for the project, Lietuvos Energija AB, does not have means to save energy in Lithuania so that the new nuclear power plant or corresponding amount of electricity would not be needed."* [EIA Program, 31]. Even if Lietuvos Energija AB is not responsible for the Lithuanian energy policy, as applicant for the construction license of a NPP it should be able to present a serious discussion of the energy saving potential and the zero-option. At present one unit of INPP provides 70% of the Lithuanian electricity demand. An

increase in the demand of 100% in less than 10 years is not self-evident, therefore more information on this topic is necessary.

Recommendation

The EIA Report should present a serious discussion of the prognoses for electricity demand and analyse options for efficiency enhancement and demand side management is necessary.

Technological Options

In the EIA Program it is explained that *"the nuclear power plant project organisation, and later project company, has been established for constructing and operating a new nuclear power plant in Lithuania and therefore does not have a mandate or possibilities to construct any other kind of power plants. If another company or organisation should begin to develop such power plants, the environmental impacts of them would be assessed as a part of those projects."* [EIA Program, 31]

This is not the usual understanding of the Espoo-Convention and the EIA directive of the European Commission [97/11/EC]. Article 4 of the Espoo convention states: *"The environmental impact assessment documentation to be submitted to the competent authority of the Party of origin shall contain, as a minimum, the information described in Appendix II"* which is:

"(a) A description of the proposed activity and its purpose;

(b) A description, where appropriate, of reasonable alternatives (for example, locational or technological) to the proposed activity and also the no-action alternative;

(c) A description of the environment likely to be significantly affected by the proposed activity and its alternatives;" [ESPOO 1997]

It is beyond belief that Lietuvos Energija AB and the Consortium Pöyry-LEI are not able to provide a serious comparison of the environmental impact of different alternatives for generating electricity. Independent of the formal mandate of the applicant it should be proved that the NPP is the best option to generate the required electricity in an environmentally sound, sustainable and efficient way. To examine really different technological options has been the standard in other EIA procedures in European Union member states (e.g. Romania concerning construction of NPP Cernavoda or concerning Bulgaria's NPP Belene). Even in the Hungarian EIA procedure concerning NPP Paks Lifetime Extension the environmental impact of real alternatives to produce the electricity by other power plants was analysed, even though the applicant, Paks NPP, would not implement another electricity generation plant.

Furthermore this chapter contains a contradiction in itself, because in the second paragraph it is stated that alternative forms of electricity production will not be assessed in the EIA process, but *"the differences in impacts from other energy generating sources and nuclear power plants on air quality, the emissions of greenhouse gases and other pollutants caused by producing a corresponding amount of energy with other fuels (coal, gas, biomass) will be demonstrated."* [EIA Program, 31] This should include efficiency improvements and energy savings, as well as different renewable energy forms and a comparison of all environmental impacts of the total life cycle of all considered alternatives. Furthermore the analyses should include an assessment of the total cost of all options considered.

Recommendation

In order to analyse the differences in impacts from other electricity generating sources and nuclear power plants on air quality, the emissions of greenhouse gases and other pollutants caused by use of different fuels we recommend to include demand side efficiency improvement, energy saving and demand side management, as well as different renewable energy forms. The comparison of the environmental impact has to include the total life cycle of all considered alternatives.

The Three Nuclear Options

Section 5.1 is a short summary of the functionality of a NPP. But some statements in this description belittle the reality of NPP operation e.g. "*water, which circulates inside the reactor, contains fission and activation products, but this water is not mixing with the cooling water at any process.*" [EIA Program, 32], since leakages in different systems in particular in the steam generators cannot be excluded.

This section also explains which pollutants nuclear power does **not** produce directly. However we want to emphasize that the analysis of environmental impacts of nuclear power has to contain the complete life cycle of the nuclear fuel from mining to its final deposition.

Table 5-1 presents basic data for the planned new NPP compared to the existing Ignalina NPP. Ignalina NPP consists of two reactor units, for the new NPP it is unclear how many units it shall have. However, it will exceed the net electrical capacity of the old one. The biggest reactor units under construction now have a capacity of 1600 MWe. Therefore, the new NPP will also consist of two or more reactor units. For a safety assessment it is required to know whether this will be stand-alone units or they will be located in common buildings.

The new plant shall have a higher efficiency. However the wasted thermal heat will be substantial (~90% of that of NPPI 1/2), and will cause a significant impact, if it is released to the Lake Druksiai.

From the EIA Program it is unclear what will be the subject of the analysis:

- Three different existing specific reactors from companies which Lithuania wants to invite for bidding
- Prototype reactors as EPR, AES 2006, ACR, at present in the design phase or under construction.
- Three reactor types in general, as it is to be assumed by the explanations of section 5.2 of the [EIA Program, 32]

Section 5.2 gives a very general overview on the three reactor types, which are considered for the new NPP:

- pressurized water reactors (PWR),
- boiling water reactors(BWR) and
- pressurized heavy water reactor (PHWR)

Unfortunately the description of the reactor options is without any information which plants will be the reference plants for the analysis, only concerning the PHWR it is specified that an advanced CANDU reactor (ACR) is considered. Furthermore it is mentioned that this ACR is using natural uranium as fuel, but the ACR 1000 which is designed by AECL will use slightly enriched uranium.

If the EIA is performed in order to prepare a decision about the reactor type, a detailed comparison of emissions, waste and fuel requirements of the reference plants has to be

carried out. A detailed assessment would also be required concerning safety features and accident analysis of the reference plants.

Section 5.3 explains that "*The latest safety requirements will be taken into account in the planned new power plant so that it can survive even for the most severe accidents without causing significant radiological consequences for the persons and environment.*" [EIA Program, 35] This statement refers to the IAEA recommendations (IAEA, 2005: Assessment of defence in depth for nuclear power plants) and VATESI normative documents (VD-B-001-0-97 and VD-T-001-0-97). Besides that it is unclear which nuclear safety guides of the IAEA will be considered for the design of the new NPP for Lithuania. Will the European Utilities Requirements [EUR 2001] be regarded?

Section 5.4 „*Procurement of fuel*“, does not present any information about the environmental impact of nuclear fuel production, but only a listing of potential suppliers.

In section 5.7 sources for radioactive emissions are listed in general. Besides that the information is given that the Ministry of Environment is responsible for issuing permissions to release radioactive substances into the environment following the Regulation "*On the Restrictions on the Release of Radionuclides from Nuclear Installations and Procedure for the Authorisation of Release of Radionuclides and Radiological Monitoring*" (State Journal, 2001, No. 13-415; 2005, No. 142-5136). But this regulation is online only available in Lithuanian language.

Recommendation

If the EIA is performed in order to prepare a decision about the reactor type a detailed comparison of emissions, waste and fuel requirements. However, a more detailed assessment will be required for the safety and risk assessment of the plant.

5.SAFETY AND RISK ANALYSIS

For Austria the safety and risk analysis of the new NPP is the most important issue of the transboundary EIA process. Accidents with a large release of radioactive substances into the atmosphere could affect Austria as well as Russia, the Baltic neighbours and other countries in Europe. According to the ESPOO-Convention and the EC EIA-Directive the EIA report has also to deal with the potential impact of severe accidents. A detailed analysis of design basis and beyond design basis accidents and their potential effects should form an essential part of the EIA report, too. [LERCHER, 2005]

A team from the Institute of Meteorology of the University of Natural Resources and Applied Life Sciences, Vienna and the Austrian Institute of Ecology analyzed the climatological risk that emissions due to severe accidents at NPPs in Europe could affect Austrian territory to an extent that would require radiation protection measures for risk groups (children and young people, expecting and nursing mothers) and normal population, respectively. "Climatological risk for the Ignalina NPP site" means the probability of weather conditions in Europe which lead to transport and deposition of emissions released from the Ignalina NPP site to Austrian territory, expressed as percent of all weather situations. As a result of this study the climatological risk for the site of Ignalina NPP was assessed to be 6,7% (risk group) and 2,25% (for general population), respectively. This is just the same as for the Swedish NPP Ringhals. [SEIBERT et al. 2004]

The source term assumed for this analysis was a worst-case scenario for the release from a severe accident at a PWR 1000 MW reactor. Only the source term for Cs-137 of 6.75 E16 Bq, as a characteristic nuclide, was considered in the dispersion model. A

simple conversion factor to derive dose estimates from the total Cs-137 depositions was applied, which 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.

Transport, diffusion and deposition of the released substances 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. The calculations were made for 88 different dates in the year 1995 as a part of the RISKMAP study. This year has been shown to be climatologically representative at least for the Alpine region. [SEIBERT et al. 2004]

Accident Situations are treated in chapter 7 consisting of only the following two paragraphs. The explanation there is very general and unclear:

"The EIA report will discuss the environmental impacts of exceptional situations based on the safety analyses and assessments prepared for corresponding plants elsewhere as well as on the requirements imposed on the new power plant. The ramifications of exceptional situations will be assessed based on the extensive research data on the health and environmental impacts of radiation. In addition to the above, the progress of the safety of nuclear power plants will also be considered.

The safety assessments, which will be carried out for the purpose of applying for a construction and operating license, as well as other types of surveillance, will be described. The assessment report will also describe the current emergency arrangements for a nuclear accident." [EIA Program, 89]

In the second paragraph it is announced that the safety assessment which will be carried out for application of the construction and operation license will be described in the EIA Report. The description of the requirements for the safety assessment is no substitute for the safety assessment itself. At least the safety and quality requirements and standards which are to be fulfilled by the new NPP are to be given in the EIA Report.

Risk Analysis is dealt with in chapter 10 of the EIA Program. In this chapter all the important information is promised to be presented in the EIA Report. We want to emphasize that the EIA Report has to provide a comprehensive risk assessment of the selected reactors.

"Potential impact on environment under different NPP conditions, i.e. under normal operational conditions, in case of design basis accidents and in general – in case of beyond design basis accidents will be analysed in the EIA report. ... Potential hazards will be identified, their occurrence will be assessed and risk of emergencies will be analysed and evaluated in EIA report. Internal and external events potentially leading to incidents or accidents will be considered. Hazard risk mitigation and accident prevention measures will be discussed in EIA report." [EIA Program, 92]

Internal Events are mentioned in the EIA Program only as part of the risk analysis. We expect that the EIA Report contains more concrete information about the reactors considered to be constructed for Lithuania and about their safety and risk evaluation (e.g. assumed initiating events, DBA and BDBA frequencies and source terms) and about the requirements these reactors have to meet.

External Events can be caused by natural disasters or by impacts from human activities outside of the reactor. Also interference between nuclear facilities at the same site have to be considered as a potential hazard.

According to the EIA Program Lithuanian territory is considered as a "non-seismic or low-seismic" zone [EIA Program, 72]. Figure 7-14 shows that the maximum observed

historical earthquake in the Baltic Region had a maximal amplitude of 5 at the Richter scale¹. The most recent took place in Kaliningrad in 2004. [EIA Program, 72ff]

It appears that the Lithuanian nuclear authority has adapted its regulations concerning seismic design to recent standards: "A new VATESI regulation P-2006-01 (*Requirements for Analysis of Seismic Impact, 2006*) provides requirements and recommendations for the seismic design and impact analysis of the structures, systems and components of nuclear installations." [EIA Program, 73]

We assume that these requirements will be described in the EIA Report.

Even if the earthquake risk seems to be low other major impacts on the NPP, as plane crash, terrorism or sabotage cannot be excluded, e.g. air traffic has increased rapidly in the last years in Lithuania [EIA Report, 86]. The EIA Report should provide a prognosis of the further development of air traffic.

Extreme weather conditions caused by climate change could also result in damaging impacts to the NPP. Therefore a prognosis of the influence of climate change on the Baltic region should be part of the risk assessment. To prevent the impairment of safety in case of external impacts buildings and structures of the new NPP have to be designed properly. We expect that the related design requirements will be described in the EIA Report.

Recommendation:

The EIA Report should contain more concrete information about the reactors considered to be constructed for Lithuania.

The following information corresponding to the reactor type should be given by the EIA Report:

- a description of the plant and its safety and control systems
- the number of reactor units,
- the description of common facilities and structures
- allocation of all facilities at the NPP site,
- refuelling cycle, and maximum fuel burn-up,
- radioactive core inventory
- Safety targets, safety standards and requirements, (IAEA guidelines, Euratom directives etc.)
- PSA results including source terms for DBA and BDBA should be given in the EIA Report.

6.RADIOACTIVE WASTE

Chapter 6 of the EIA Program deals with management of all waste the new NPP will generate. Some information on types and treatment of radioactive waste is presented in chapter 5:

Section 5.5 "Radioactive Waste Management" provides a very short explanation of principles concerning radioactive waste management: its basis is said to be "the permanent isolation of waste from the environment" [EIA Program, 36].

¹ Amplitude 4-5 on the Richter scale: the earthquake is felt by almost everyone near the epicenter (30km). Small objects moved, trees and walls may shake.

In the classification of radwaste high level radioactive waste (HLW) is missing. [EIA Program, 36] Concerning treatment and conditioning of radioactive waste from operation of the new NPP the EIA Program refers to the "*Regulation on the Pre-Disposal Management of Radioactive Waste at the Nuclear Power Plant, VD-RA-01-2001.*" [EIA Program, 37] In section 5.6 it is said that low and intermediate level waste (LILW) will be disposed of in the final repository constructed for them, liquid waste will be solidified in the solidification facility, operational and decommissioning waste of the new NPP will be solidified, dried and absorbed in a suitable medium. From this explanation it is unclear which of these waste treatment facilities already exist. A near surface radwaste disposal facility and a landfill for very low level waste are planned to be constructed.

It is beyond the scope of this statement to study and consider properly the EIA Reports concerning the interim spent fuel storage for INPP 1/2, the decommissioning of INPP Unit1 and the new solid waste management and storage facilities.

Furthermore it is said in the EIA program that "*the new plant is to utilise existing solutions at the INPP (designed or already in use) to the extent possible. The suitability of the existing radioactive waste management and storage facilities... will be evaluated in the EIA Report*" [EIA Program, 37]. In this respect not only the issue of extension of the existing facilities, but also their safety status and material aging should be discussed in the EIA Report.

Section 5.6 continues the description of radioactive waste management. In this section high level waste is mentioned as spent nuclear fuel (SNF) and constructive elements of fuel assemblies. The management of SNF and HLW is described here only in general.

Chapter 6 provides a listing of very general requirements for a safe radwaste management. Besides that it is promised that the EIA Report will describe:

- Composition and amount of SNF and radioactive waste will be evaluated based on the operational experience of the existing LWR and HWR reactors
- Treatment and storage methods and their environmental impacts

[EIA Program, 41ff]

Different options for SNF management will be described also: wet storage, dry storage, reprocessing, but long-term storage and disposal of SNF will be subject of an own EIA procedure in the future. [EIA Program, 42]

Section 6.3 gives an overview over decommissioning of the new NPP. Since it is expected that the new NPP will operate 60 years, it is assumed that the waste management facilities used for decommissioning INPP will no more be operable. For decommissioning of the new NPP new facilities will be necessary.

For the new NPP an initial decommissioning plan is required in order to quantify the amount of waste and to estimate the decommissioning cost. [EIA Program, 42]

Nonetheless a preliminary estimation of cost for long-term treatment of SNF is required for EIA Report, since all waste management cost have to be assessed in order to establish and collect appropriate funds by selling electricity during operation of the plant, just as it is required in the for decommissioning.

Recommendation

The EIA Report should include a preliminary estimation of cost for long-term treatment of SNF and radioactive waste from the NPP's operation, just as it is required in the EIA Program for decommissioning in order to establish and collect appropriate funds for these activities during operation of the plant.

7. ENVIRONMENTAL IMPACT

Water Pollution

The Status of Lake Druksiai and the impact of NPP operation to this lake is a very relevant issue. Lake Druksiai is the largest lake in Lithuania and it is an area of importance for habitat protection (Natura 2000) and subject of the Ramsar Convention

"Lake Druksiai belongs to the following Ramsar wetland types: Inner wetlands, permanent freshwater lake (O), permanent streams (N), permanent freshwater marshes (Tr), seasonal (temporal) freshwater marshes including flooded meadows and sedge marshes, freshwater tree-dominated wetland (Xf), tree-dominated peatbogs (Xp)." [UN/ECE 2002]

The yearly amount of water taken from the lake for the cooling of the two units of INPP and discharged back was nine fold the volume of the lake and 27 times the natural influx of the lake. The annual amount of waste heat transferred to the lake was approximately 40 TWh. According to the EIA Program this had no significant impact on the water dynamics and no visible influence on the evaporation and the amount on atmospheric precipitation. [EIA program, 48ff]

We recommend to provide in the EIA report a comparison of the state of the lake before start of operation of INPP (1977/78] and the actual situation, since the UN/ECE document presents a different assessment of the influence of the discharge of waste water into Lake Druksiai:

„The discharge of industrial thermal waters from the Ignalina Nuclear Power Plant and non-purified sewage from the Lithuanian town Sneckus are a problem. An accumulation of polluted sediments was registered in deeper parts of the lake (up to 1.4 kg/m²). 3.9 % of the bottom is polluted with oil products. 27.5% of the lake bottom sediments are moderately or heavily polluted with heavy metals (Pb, Cd, Cr, Zn, Cu) and petroleum hydrocarbons. As a result the lake is transforming into a moderately polluted watercourse. Thermal pollution influences extremely negatively on the lake resulting in eutrophication and, subsequently, degradation of the most valuable relict component of a zoo- and phytocenosis complex."

Considering the influence of thermal pollution due to the NPP's waste water, the alternative to construct smaller co-generation heat and power plants fuelled either by natural or biogas or by biomass should be included in the EIA report. Such plants could be constructed near villages and generate effectively electricity and heat which both could be used locally.

Release of radioactive substances from the NPP into Lake Druksiai is reported in the EIA program as well as the estimated dose for members of the critical group of population caused by these releases. It is stated that the impact is far below the limits set in Lithuania [EIA Program, 49ff]. Furthermore it is announced that potential radioactive releases from the new NPP and the other existing and planned nuclear facilities will be evaluated in the EIA Report. Concerning the presentation of this data we want to emphasize, that tables of monitored releases should be completed by the description of the measurement methods. Detection limits are to be given instead of "0". Besides total gamma activity, total alpha and beta activity should be given, too.

Concerning the dose assessment the calculation method and the considered exposure pathways are to be described in the EIA Report, the critical group should also be specified.

Monitoring programs e.g. the sampling of fishes in Lake Druksiai should also be described in more detail (number and frequency of taking samples, sampling points and methods,

measurement methods). Heavy metal pollution of sediments in lake Druksiai is monitored [EN/ECE 2002]. It is recommended to present data on concentration of radioactive substances in sediments in the EIA Report, too.

Air Pollution

This chapter contains a comprehensive description of present climate data, though we miss data on the distribution of dispersion classes.

Since the new NPP is designed for a lifetime of 60 years it is recommended to discuss the impact of climate change in the EIA Report, in particular the potential increase of extreme weather conditions as storms, heavy rain and floods.

A second issue covered by the EIA Program is background contamination: data on greenhouse gas (GHG) emissions are presented, which show a significant decrease between 1990 and 2000. Since than GHG emissions are increasing again. For understanding the rationale for the construction of a new large NPP, it would be worth to present information on the causes of this development (changes in the economy, traffic etc.) in the EIA Report.

In this part of the EIA Program the generation of GHGs "*by organic fuel burning in other Lithuanian power plants*" after shutdown of INPP [EIA Program, 58] is mentioned. It should be clarified which kind of fuel is meant.

Tabled 7-10 and 11 [EIA Program, 59ff] present annual radioactive emissions from INPP into atmosphere. Concerning the presentation of these data we want to emphasize, that tables of monitored releases should give the detection limits instead of „0“. The information should also be completed by the description of the measurement methods. Derived annual dose to critical group members of the population are given in table 7.12. [EIA Program, 60] The critical group should be specified and dispersion model, exposure pathways and dose calculation method should be described in the EIA Report.

The EIA Report should present the estimation of the emissions of the planned new NPP and their impact.

Table 7-13 presents some data from the INPP monitoring program concerning soil samples in the region of Ignalina NPP [EIA Program, 62]. Unfortunately we miss here in also information on the sampling and measurement methods as well as on detection limits. The first data presented are from 1999. In order to estimate the impact of emissions from INPP the contamination of the environment before operation of the plant should be presented. We recommend, to present immission data also, if available.

Monitoring data of radioactivity concentration of agricultural products are given in table 7-14 [EIA Program, 74] without any information on the sampling locations and frequency. Only data from 2006 are presented. Since Ignalina NPP is operating since 30 years a time series of measurement data should be given. We recommend to provide time series of data not only concerning the radiation monitoring but also concerning the public health in order to allow a serious discussion of the impact of radioactive emissions.

Recommendation

Monitoring results should give the detection limits instead of zero-values.

Monitoring results should be completed by the description of the sampling (location and frequencies) and the measurement methods.

For the dose assessment the calculation method including the dispersion model used, the considered exposure pathways and a specification of the critical group have to be presented in the EIA Report.

Since INPP is operating since 30 years a time series of measurement data should be given. We recommend to provide time series of data not only concerning the radiation monitoring but also concerning the public health in order to allow a serious discussion of the impact of radioactive emissions.

The EIA Report should present the estimation of the emissions of the planned new NPP and their impact.

8. REFERENCES

[97/11/EC] Council Directive on the assessment of the effects of certain public and private projects on the environment, as amended

[ESPOO 1997]: Convention on environmental impact assessment in a transboundary context, Bundesgesetzblatt für die Republik Österreich, Jahrgang 1997, Teil III, 201, published 28. November 1997

[EUR 2001]: „European Utility Requirements for LWR Nuclear Power Plants“ (Generic Nuclear Island Requirements)

[LERCHER 2005] Part A: Legal Perspective - Transboundary environmental impact assessment Procedure of the nuclear power plant PAKS in „Report to the Austrian Government - EIA procedure for the lifetime extension of Paks NPP - Statement on the Preliminary Impact Assessment Study, Vienna 2005

[SEIBERT et al. 2004]: Entwicklung von Entscheidungskriterien betreffend die Beteiligung an UVP Verfahren entsprechend der Espoo-Konvention, Seibert P., Frank A., Formayer H., (Universität für Bodenkultur, Institut für Meteorologie), Wenisch A., Mraz G. (Österreichisches Ökologie-Institut), Wien 2004, im Auftrag des BMLFUW.

[UN/ECE 2002] Background paper for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes, UN/ECE Working Group on Monitoring and Assessment Monitoring of International Lakes Finnish Environment Institute, Helsinki 2002

9.GLOSSARY

ACR	Advanced CANDU reactor
AES	Russian acronym for NPP
BDBA	Beyond Design Basis Accident
BWR	Boiling Water Reactor
CANDU	Canadian Natural Uranium Deuterium
DBA	Design Basis Accident
EIA	Environmental Impact Assessment
EPR	European Power Reactor
EU	European Union
GHG	Greenhouse Gas
HILW	Low and Intermediate Level (radioactive) Waste
HLW	High Level (radioactive) Waste
HWR	Heavy Water Reactor
IAEA	International Atomic Energy Agency
INPP	Ignalina Nuclear Power Plant
LLW	Low Level (radioactive)Waste
LWR	Light Water Reactor
MW	Megawatt
MWeI	Megawatt electric
NGO	Non Governmental Organisation
NPP	Nuclear Power Plant
PHWR	Pressurized Heavy Water Reactor
PWR	Pressurized Water Reactor
RBMK	Russian acronym for the boiling water pressure tube reactor
SNF	Spent Nuclear Fuel