Evaluation of

The Environmental Impact Assessment Report

New Nuclear Power Plant in Lithuania

Prepared by:

Mark Chernaik, Ph.D.
Staff Scientist
Environmental Law Alliance Worldwide U.S.

May 2009

This document expresses the opinion of its author and not necessarily the opinions of the U.S. office of the Environmental Law Alliance Worldwide or other individuals or oganizations affiliated with the Environmental Law Alliance Worldwide.

1. The EIA fails to assess reasonable alternatives that would fulfill that actual need for the proposed project.

1.1. Relevant Provisions of the Espoo Convention

Article 4 of the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention) states:

> "1. 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."

Appendix II of the Espoo Convention states:

> "Information to be included in the environmental impact assessment documentation shall, as a minimum, contain, in accordance with Article 4: ... (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."

Guidance on the Practical Application of the Espoo Convention states:

> "The documentation has to include all relevant items mentioned in Appendix II of the Convention. The identification of alternatives is usually felt to be the most difficult part in preparing the documentation but also among the most important ones. The alternatives set the scene for the entire assessment and thus they should be identified at an early stage."[1]

1.2. Relevant Material from the EIA

> "The project assessed in this EIA Report is the construction of a new nuclear power plant (NNPP) in the near vicinity of the present Ignalina nuclear power plant (INPP), in the municipality of Visaginas on the shore of Lake Druksiai in north-eastern Lithuania (see Figure 2). The INPP is the main electricity source for Lithuania at the moment, but, as a condition of entry in the European Union, the Lithuanian government has agreed on shutting down the INPP since it does not meet the required safety standard conditions. The first unit of INPP was shut down in 2004, the second is still in operation and is to be shut down by the end of 2009. In order to face this electricity gap, the Lithuanian government started the decisional process for the construction of a new and safer regional NPP, capable of supplying also part of the neighbouring countries' needs for electricity."[2]

> "Lithuania needs new carbon dioxide emission-free electricity production capacity to meet the challenges posed by climate change, competitiveness and reliability of operation, and to ensure economic growth and the Lithuanians' standard of living. The objective is to reduce the dependence on fossil fuels. The measures proposed by the European Commission in January 2008 with a view to curb climate change require that carbon dioxide emissions will

[1] Guidance on the Practical Application of the Espoo Convention at Section 2.6.1
[2] EIA at page 16

be reduced by 20 % from the 1990 level in the EU area by 2020. The long-term target is to cut carbon dioxide emissions by 60–80 % in the developed countries by 2050. (European Commission, 2008)"[3]

"4.5 OPTIONS EXCLUDED FROM THE INVESTIGATION …

"Energy saving

"The organisation responsible for the project, Visagino atomine elektrine, UAB, 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. Thus energy saving has not been investigated as an alternative to the new NPP.

"Alternative ways to produce energy

"Other options to generate the electricity would be by using other energy sources such as oil products, coal, natural gas, peat, biofuels, hydropower or wind power. However, 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. The purpose and justification of the nuclear power plant project is described more in detail in Chapter 1.

"Thus impacts of alternative forms of electricity production in Lithuania have not been assessed in this EIA process. However, the differences between the impacts from other energy generating sources and nuclear power plants on air quality, the emissions of greenhouse gases and other pollutants caused by producing the corresponding amount of energy with other fuels are demonstrated in Section 7.2.2."[4]

1.3. Relevant Comments on the EIA

1.3.1. Proposals from Latvia

"Detailed description and considerations for the need of new NPP as energy supplier are missing in Chapter 1. These considerations should take into account also demand for energy in Latvia, Estonia and Poland, as well as improvements in energy efficiency that reduce the total demand for the electric energy. Report should include information about other alternatives that were considered for energy supply and more complete explanation for the particular location of the planned NPP.

"The report practically does not consider various project alternatives, which are in contradiction with principles of environmental impact assessment. Likewise, the EIA report includes such alternative solutions as implementation of energy efficiency measures, as well as use of other energy resources. The EIA report must provide with an insight into the

[3] EIA at page 31
[4] EIA at page 92

impact of the expected economic (suggested) activities on environment, in order that when assessing the possible effects and various risks, such solution could be selected, which would cause the environment as little risk as possible. No such alternatives have been considered in the given EIA report, therefore the report should be revised.

"Our request: Perform assessment on the expected environmental impact in Lithuania and regional section and accordingly supplement the EIA report by describing the situation for case if the considered EIA project would not be implemented, including consideration of options to produce electric power using various energy resources, implementing measures of improving energy efficiency, or importing the electric power."[5]

1.3.2. Proposals from Sweeden

"The Swedish National Board of Housing, Building and Planning highlights the need to study alternative structures for the Lithuanian power generation sector. Alternatives involving a more diversified power-generation sector should be considered, inter alia to promote achievement of the EU objective for renewable energy by 2020. A diversified power-generation sector could also make power generation more robust and less vulnerable to various types of events."[6]

1.3.3. Proposals from non-governmental organizations

"The reluctance by the reporters to deal with alternatives is unacceptable from legal, environmental and governance point of view. Ruling out renewable energy and energy efficiency measures is not justifiable and the assumption that in the absence of new nuclear reactors, electricity would be produced almost solely with fossil fuels is not sensible. As is imminent from the EIA report itself, the potential impact of the project on the Lithuanian electricity market is so large, that limiting the analysis to measures that can be implemented by the company is not justifiable. The assumption of increased reliance on fossil fuels is arbitrary. Furthermore, emissions from electricity production in Lithuania are bound by the Emissions Trading System of the European Union and most likely also by a new commitment period of the Kyoto protocol under negotiation at the moment. Therefore the emission targets will need to be met regardless of whether new nuclear capacity is added, ruling out the option of increased use of fossil fuels."[7]

1.4. Analysis and Transboundary Significance

The EIA has impermissibly excluded consideration of reasonable alternatives that would fulfill the actual need of the project but with potentially fewer and less serious environmental consequences. A fundamental principal of the Environmental Impact Assessment process is that the range of alternatives that must be considered should relate to the actual need of the project. According to the U.S. Environmental Protection Agency:

"Environmental impact assessment documents typically begin with an introduction describing the purpose of, and need for, the proposed project. The statement of purpose and

[5] EIA Appendix at page 262
[6] EIA Appendix at page 305
[7] EIA Appendix at page 338

need is important because it provides the framework for identifying project alternatives. For example, a project to build a new highway may be proposed because the existing highway is too narrow and cannot accommodate the volume of traffic. The need for the project is a decrease in the amount of time drivers spend in slow traffic. The purpose, or goal to be met in addressing the need, is to build a new highway of adequate width to accommodate projected traffic flow in the future at sufficient travel speeds. The project alternatives could include various locations for the proposed highway, construction of additional mass transit capacity to avoid building the highway, designation of high occupancy vehicle (HOV) lanes, or a combination of these alternatives. All of these alternatives address the need for the proposed project. Some of them address the purpose better than others. All reasonable alternatives that fulfill the purpose and need should be evaluated in detail. The more alternatives, the greater the possibility of avoiding significant impacts.

"Example of an Alternative: If a proposed project involves building a thermoelectric plant, alternative approaches to meeting energy needs might include demand-side management to reduce energy consumed by users, purchase of energy from other power plants, alternate sources of energy, and expansion of existing plants."

"Alternatives often involve different locations for the proposed project, new or different technologies, and/or completely different approaches to achieving project objectives. All reasonable alternatives should be carried through the identification of mitigation approaches stage (see Section 2.2.6). Thoroughly assessing a range of alternatives enables project proponents, environmental impact assessment reviewers, and decision makers to gain a complete understanding of the potential impacts of the proposed project over the full spectrum of implementation scenarios and to refine the final preferred alternative with mitigation measures, if necessary."[8]

It is obvious that the actual need of the proposed project is to meet the expected difference between future energy demand and future energy generation. Page 16 of the EIA states: "In order to face this electricity gap, the Lithuanian government started the decisional process for the construction of a new and safer regional NPP, capable of supplying also part of the neighbouring countries' needs for electricity." However, a wide variety of actions, including demand-side management to reduce energy consumed by users and alternate sources of energy, would also meet the expected difference between future energy demand and future energy generation and would therefore constitute reasonable alternatives that the EIA must consider.

The failure of the EIA to consider these reasonable alternatives for meeting future energy demand is of tremendous transboundary significance. The proposed activity is intended to supply: "a part of the neighbouring countries' needs for electricity." However, new nuclear power plants require a long time to build, during which time there are financial risks that could result in cancellation of the project. According to the EIA:

"The scheduled construction time for the new NPP is around 8-9 years from the start of the EIA procedure. This would mean 2015 as the earliest year for commissioning of the NNPP, which would match the forecasts of the Lithuanian National Energy Strategy."

[8] U.S. EPA (1998) "Principles of Environmental Impact Assessment Review."

In contrast, investments in demand-side management to reduce energy consumed by users have an immediate effect on meeting the expected difference between future energy demand and future energy generation. Moreover, other types of energy generation projects require far less time to construct and incur less financial risk. For example, the average construction time for new wind power facilities is between 9-18 months (0.75-1.5 years). The failure of the EIA to consider other reasonable alternatives for meeting future energy demand would thus likely deprive neighboring countries of needed energy for a period of several years compared to reasonable alternatives that the EIA has not considered.

Another stated need for the project is that: "Lithuania needs new carbon dioxide emission-free electricity production capacity to meet the challenges posed by climate change, competitiveness and reliability of operation, and to ensure economic growth and the Lithuanians' standard of living. The objective is to reduce the dependence on fossil fuels." However, nuclear power plants do not provide carbon dioxide emission-free electricity production capacity. A recent study estimates that because of the energy required to mine and process uranium, and the energy required to construct facilities, new nuclear power plants are associated with the release of 24.2 grams of carbon dioxide for each kilowatt-hour of energy produced (g-CO2/kWh). This compares unfavorably with new wind power facilities, which are estimated to emit 20.3 g-CO2/kWh.[9]

2. The EIA underestimates the release of radioactivity that would occur as a result of a severe accident

2.1. Relevant Provisions of the Espoo Convention

Article 4 of the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention) states:

> "1. 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."

Appendix II of the Espoo Convention states:

> "Information to be included in the environmental impact assessment documentation shall, as a minimum, contain, in accordance with Article 4: ... (f) An explicit indication of predictive methods and underlying assumptions as well as the relevant environmental data used; (g) An identification of gaps in knowledge and uncertainties encountered in compiling the required information.

2.2. Relevant Material from the EIA

> "An accident condition involving significant core degradation is called a Severe Accident (SA). In case of SA a large proportion of the fuel in the reactor is damaged, and a large amount of this radioactive material is released from the fuel matrix (the first barrier). However, there are further barriers, such as reactor vessel and primary circuit, inner and

[9] Hondo, H. (2005) "Life cycle GHG emission analysis of power generation systems: Japanese case" Energy 30:2042–2056

outer containment, which prevent a release to the environment. The limit of release after a core damage accident and an effective final barrier (the containment) should not cause acute health effects to the population in the vicinity of the NPP, nor should it cause long term restrictions on the use of extensive areas of land or water. There are no regulations for releases in case of SA in Lithuanian legislation. Therefore the limit for the release of radioactive materials arising from a severe accident (100 TBq release of Cs-137) defined in Finnish legislation (Council State decision 395/91) is used for environmental impact estimation. According to the Council State decision (395/91) accidents leading to large releases of radioactive materials shall be very unlikely. The numerical design objective for this very unlikely release is specified in Finnish Radiation and Nuclear Safety Authority (STUK) Guide YVL 2.8, where it is stated that the mean value of the probability of a release exceeding the target value 100 TBq of Cs-137 must be smaller than 5·10-7 per year."[10]

2.3. Relevant Comments on the EIA

2.3.1 Proposals from Austria

"The source term chosen as representative for a severe accident in a Generation III reactor by the EIA report, is not justified by any arguments. In Finnish regulation the 100 TBq Caesium release is set as a limit for radiation protection. It is a probalistic target for limited releases due to an accident. A large release (exceeding this limit) should have a probability of occurrence of <5.0 E-7/a.

"PSA results for the EPR indicate that 9% of all core damage scenarios lead to late containment failure and 6% to early containment failure (Wenesch, et al. 2008). These are the accidents relevant for the assessment of transboundary impacts.

"The release rates of such accidents are in the range of 2% to 2% for iodine and caesium as assessed for EPR. These releases are derived from the PSA level 2 results for the large German Konvoi reactor (GKN-2). According to this PRA 18% of the large release scenarios are due to late non-filtered release from annular space (Wenesch, et al. 2008 b). The release rates for the ABWR are in the same range, according to the design control document for the ABWR (suppression pool bypass scenario) (DCD ABWR). A release rate of about 1% would give more than 1,000 TBq Cs-137 and 10,000 TBq I-131, respectively if the source term is based on the core inventory of the APWR as given in the EIA report (EIA report, p 493), showing that the assumed source term of 100 TBq Cs-137 and 1,000 TBq I-131 used in the EIA Report is rather low for the investigation of severe accident consequences. Therefore, for the Austrian evaluation of transboundary impacts a release of 5% of the Cs-137 core inventory of 714 PBq Cs-137 was applied, which amounts to 35.5 PBq. We consider this as a possible release in the case of a severe accident in a "Generation III" reactor."[11]

2.3.2. Proposals from non-governmental organizations

[10] EIA at page 591

[11] EIA Appendix at pages 68-69

"The evaluation of a nuclear accident in the EIAreport is based on a 0,1 PBq emission of caesium-137 and a 1,0 PBq emission of iodine-131. Thus the total radioactivity of the evaluated emissions would only amount to less than 10PBq, which is less than 1/10000 of the radioactivity contained in a modern reactor [This estimate is based on the isotope distribution in a 1000 MW pressurized water reactor with a fuel burnup of 35 GWd/t. Data: Large & Associates 2007: Assessments of the radiological consequences of releases from proposed EPR/PWR nuclear power plants in France, Annex 2]. This presupposes that only 0.015 percent of the caesium, for instance, and 0.03 percent of the iodine contained in a European Pressurized Reactor would be released into the environment [Bouteille, François & al. 2006: The EPR overall approach for severe accident mitigation. Nuclear Engineering and Design 236 (2006), p. 1464 – 1470]. This does not correspond to a serious nuclear accident. Analyses made on the international level typically suppose that between 10 and 50 percent of caesium and at least one percent of iodine is emitted in a nuclear accident [Large & Associates 2007: Assessments of the radiological consequences of releases from proposed EPR/PWR nuclear power plants in France. / US Nuclear Regulatory Commission 1975: Reactor Safety Study, an Assessment of Accident Risks in US Commercial Nuclear Power Plants, WASH-1400.]

"The total radioactive emission of the Chernobyl disaster was approximately 12 000 PBq, i. e. a thousand times that used in the EIA estimates [Nuclear Energy Agency 1995: Chernobyl, Ten Years On, p. 29.], although compared to the Chernobyl facility, the planned Visaginas reactor would be many times larger and its fuel burn-up drastically higher. The estimates of the caesium release fraction, for example, in the Chernobyl accident vary from 20 to 80 percent [Sich, A. R. 1994: The Chernobyl Accident Revisited: Source Term Analysis and Reconstruction. MIT]. The radioactivity of caesium in an EPR, for example, is approximately 700 PBq, that is 2,5 times that in the Chernobyl reactor.

"The high fuel burn-up and the possible use of MOX fuel further dramatically increase the potential emission of radioactive substances. The following illustrates one example of a sequence of events that might lead to a serious nuclear accident in a modern pressurised water reactor."[12]

2.4. Analysis and Transboundary Significance

The requirement of the Espoo Convention that an EIA must contain: "an explicit indication of predictive methods and underlying assumptions as well as the relevant environmental data used;"[13] and "an identification of gaps in knowledge and uncertainties encountered in compiling the required information;"[14] requires the proponents of the Visaginas NPP to minimize the use of assumptions and uncertainties by providing in the EIA an assessment of the impacts of a credible worst-case scenario. The EIA report explicitly refuses to do this. The EIA report acknowledges that it is only willing to assess a scenario that under an approach used in Finland is equivalent to "a release which causes neither acute harmful health effects to the population in the vicinity of the nuclear power plant nor any long-term restrictions on the use of extensive areas of land and water." Not only is this an arbitrary approach - it seems to be an attempt to reach a pre-determined conclusion that a severe accident at the proposed facility would not cause a transboundary impact.

[12] EIA Appendix at pages 338-339
[13] Espoo Convention Appendix II, paragraph (f)
[14] Espoo Convention Appendix II, paragraph (g)

3. The EIA fails to assess the epidemiological consequences of a DBA, LOCA or serious accident

3.1. Relevant Provisions of the Espoo Convention

Article 4 of the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention) states:

> "1. 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."

Appendix II of the Espoo Convention states:

> "Information to be included in the environmental impact assessment documentation shall, as a minimum, contain, in accordance with Article 4: ... (d) A description of the potential environmental impact of the proposed activity and its alternatives and an estimation of its significance."

3.2. Relevant Material from the EIA

> "Inhabitants, living in the territories of Latvia and Belarus, which fall inside the 30 km radius zone around the INPP have been taken into account (Figure 7.9-1). Within a 30 km radius the density of population is about 48 people per km2. This is lower than the average density of population in Lithuania (56.7 people per km2). In fact, population density in the new NPP region is one of the lowest in Lithuania."[15]

> "Neither of the cases, DBA LOCA or Severe Accident, would cause any direct or immediate health impacts in the vicinity of the plant even without protective actions. Delayed random impacts from radiation exposure may only be estimated statistically. The International Commission on Radiological Protection (ICRP) has estimated that exposure to a radiation dose of 1000 mSv at small doses and dose rates increases the risk of cancer by 5.5% (ICRP 2007). In the case of Severe Accident the maximum calculated lifetime external dose without any protective actions is significantly lower, 117 mSv."[16]

3.3. Relevant Comments on the EIA

3.3.1 Proposals from Austria

> "From published data on "Generation III" reactors, we have shown that containment failures cannot be excluded and even early containment failure contributes with some percent to the large release frequency. The large releases – as far as published – indicate that releases of volatile aerosols could amount from 2 to 20% of the core inventory, which is much more than the chosen limit of TBq Cs-137.

[15] EIA at page 432
[16] EIA at page 631

"Therefore an investigation of transboundary emissions was carried out with a conservative source term for a severe accident: 5% of the total core inventory of Caesium 137, which is used in most of our analysis as a characteristic nuclide. The result of this analysis (figure 6) indicates that serious impacts to Austria (and other) countries cannot be excluded."

3.3.2 Proposals from Latvia

"We consider that the possible consequences of severe accidents in the Baltics region as described in the EIA report cannot be acceptable in essence and the report authors should elaborate additional recommendations for the project design, which would eliminate such consequences. Otherwise, there is no motivation to place such object in the Baltics region, thus creating an opportunity for a severe accident, which with its parameters would be close to the Chernobyl catastrophe."[17]

3.4. Analysis and Transboundary Significance

The risk analysis and assessment in Chapter 10 of the EIA fails to inform the public and their governments about the actual consequences of a severe accident at the proposed nuclear power plant. Providing information about the estimated exposure to radiation in the case of a severe accident does not inform the public and their governments about the number of people who would contract cancer in the case of a severe accident.

To illustrate the kind of information the EIA should have provided, consider that, according to the EIA report:

- The population with 30 km of the proposed nuclear plant is 116,900 persons[18];
- Exposure to a radiation dose of 1000 mSv at small doses and dose rates increases the risk of cancer by 5.5%;
- In the case of Severe Accident, the maximum calculated lifetime external dose without any protective actions is 117 mSv; and
- The risk of cancer is proportional to the dose of radiation.

Using the data supplied by the EIA report, the increased risk of cancer from exposure to radiation released in the case of a Severe Accident would be 0.65% [5.5% x 117 mSv/1000 mSv]. This increased risk of cancer would impact, at the least, a population of 116,900 persons living within 30 kilometers of the proposed power plant.

According to recent data, the baseline lifetime risk of cancer incidence is approximately 46.5% for males (46,500 cases per 100,000 persons) and 38% for females (38,000 cases per 100,000 persons)

[17] EIA Appendix at page 258

[18] The assumption that only 116,900 persons live within 30 km of the proposed facility is questionable considering that the population of Daugavpils, Latvia was estimated at 108,000 persons in 2006.

or roughly 42% for the general population.[19] Therefore, the baseline lifetime risk of cancer for persons living within 30 kilometers of the proposed Visaginas nuclear power plant would be 49,400 cases of cancer [42% x 116,900 persons].

If exposure to radiation released in the case of a Severe Accident were associated with an increased lifetime risk of cancer of 0.65%, then such radiation would be expected to cause 321 additional cases of cancer [0.65% x baseline cancer incidence of 49,400 cases].

However, according to proposals from Austria, a severe accident at the proposed Visaginas nuclear power plant should be assumed to release 35.5 PBq (for the Cs-137 isotope alone), or 355 times more than the amount of radiation the EIA report assumes would be released.[20]

Although the amount of radiation that would be deposited within 30 km of the proposed Visaginas nuclear power plant is not directly proportional to the amount released, if a severe accident at the Visaginas nuclear power plant released 35.5 PBq of radioactivity, rather than 100 TBq of radioactivity assumed by the EIA report, then such radiation would be expect to cause a significant multiple of 321 additional cases of cancer within 30 km of the proposed facility. In fact, it is likely a severe accident at the Visaginas nuclear power plant involving the release of 35.5 PBq of radioactivity would be associated with several thousand additional cases of cancer considering the proximity of major population centers (e.g. Vilnius and Minsk) within a few hundred kilometers of the proposed project.

The failure of the EIA report to adequately present these consequences of a severe accident constitutes a violation of the requirement of the Espoo Convention that an EIA report include a "description of the potential environmental impact of the proposed activity."

[19] U.S. NRC (2006) "Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2."
[20] By comparison, for the accident at Chernobyl, the total Cs-137 "release was estimated to be 70 petabecquerels (PBq) of which 31 PBq were deposited in the Soviet Union." http://www.nea.fr/html/rp/chernobyl/c02.html