LIETUVOS ENERGIJA AB

NEW NUCLEAR POWER PLANT IN LITHUANIA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT SUMMARY, INTERNATIONAL HEARING

August 27th, 2008

1 THE PROJECT AND ITS JUSTIFICATION

Lietuvos Energija AB is conducting an Environmental Impact Assessment procedure (EIA procedure) for investigating the environmental and social impacts of a planned economic activity, a New Nuclear Power Plant (new NPP). Lietuvos Energija AB has assigned a consortium of independent companies the task of carrying out the EIA Report phase and preparing the related documents. The consortium is composed of two companies, Pöyry Energy Oy (Finland) and Lithuanian Energy Institute (Lithuania).

The economic activity 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. 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.

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.

The planned new nuclear power plant would meet the aims of the National Energy Strategy (*Lithuania Parliament Decision No. X-1046 dated 18 January 2007, State News Nr. 11-430, 2007*). According to the strategy, one of the identified main tasks is "to ensure the continuity and development of safe nuclear energy; to put into operation a new regional nuclear power plant not later than by 2015 in order to satisfy the needs of the Baltic countries and the region".

This document presents a summary of the EIA Report phase of the project. The document will be used in the international hearing according to the United Nations Convention on Environmental Impact Assessment in a Transboundary Context (*Espoo Convention, 1991*).

1.1 LOCATION AND LINKS TO OTHER PROJECTS AND PLANS

The new nuclear power plant would be located in the near vicinity of the present Ignalina nuclear power plant (INPP) on the southern shore of Lake Druksiai close to the borders with Latvia and Belarus (Figure 1.11-1). The nearest large cities are Vilnius, located 130 km, and Daugavpils in Latvia, located 30 km from the NNPP site.

Figure 1.11-1. Location of the new NPP.

The new NPP will be erected next to Ignalina NPP, but will be operated by a different company. The location next to INPP provides the opportunity to utilise existing infrastructure, whenever this is feasible. This existing infrastructure that can possibly be utilised includes among others the hydraulic systems, cooling water inlet and outlet channels, electric systems and transmission lines, and monitoring systems. The temporary storage site for spent nuclear fuel used by INPP cannot be utilised by also the new NPP. New facilities are under study and planning, and will be studied and assessed in other EIAs.

Decommissioning of INPP will continue for decades, and will thus be ongoing during construction and operation of the NNPP. New radioactive waste handling and storage facilities will be constructed as part of the decommissioning project. The aggregated impacts of these projects have been assessed in this EIA.

The Visaginas municipal waste water treatment plant (WWTP), which INPP utilizes and which also the NNPP will utilise, is to be modernised in a project which has started in 2008. After this the capacity and treatment efficiency will be sufficient for the NNPP.

1.2 PROJECT ALTERNATIVES

The environmental impact assessment evaluates the construction and operation of a new nuclear power plant with an approximate electric power up to 3 400 MW.

There are two potential sites for the construction of the new NPP, both located on the shore of Lake Druksiai and within 1 km to the INNP. Site No. 1 is situated east of

Ignalina NPP and Site No. 2 is situated west of the existing INPP switchyard. These two site alternatives have been screened and analysed following the IAEA (International Atomic Energy Agency) directives. Different topics have been considered and analysed showing how for some issues both sites are equally favourable, while for others there are differences between the sites. The conclusions of the screening show that both sites are suitable for the construction of the new installation, but Site No. 1 is considered preferable based on the available information mainly due to geological conditions and easier access to existing infrastructure. Moreover Site No. 1 has been prepared for construction of additional NPP Units in the late 1980's.

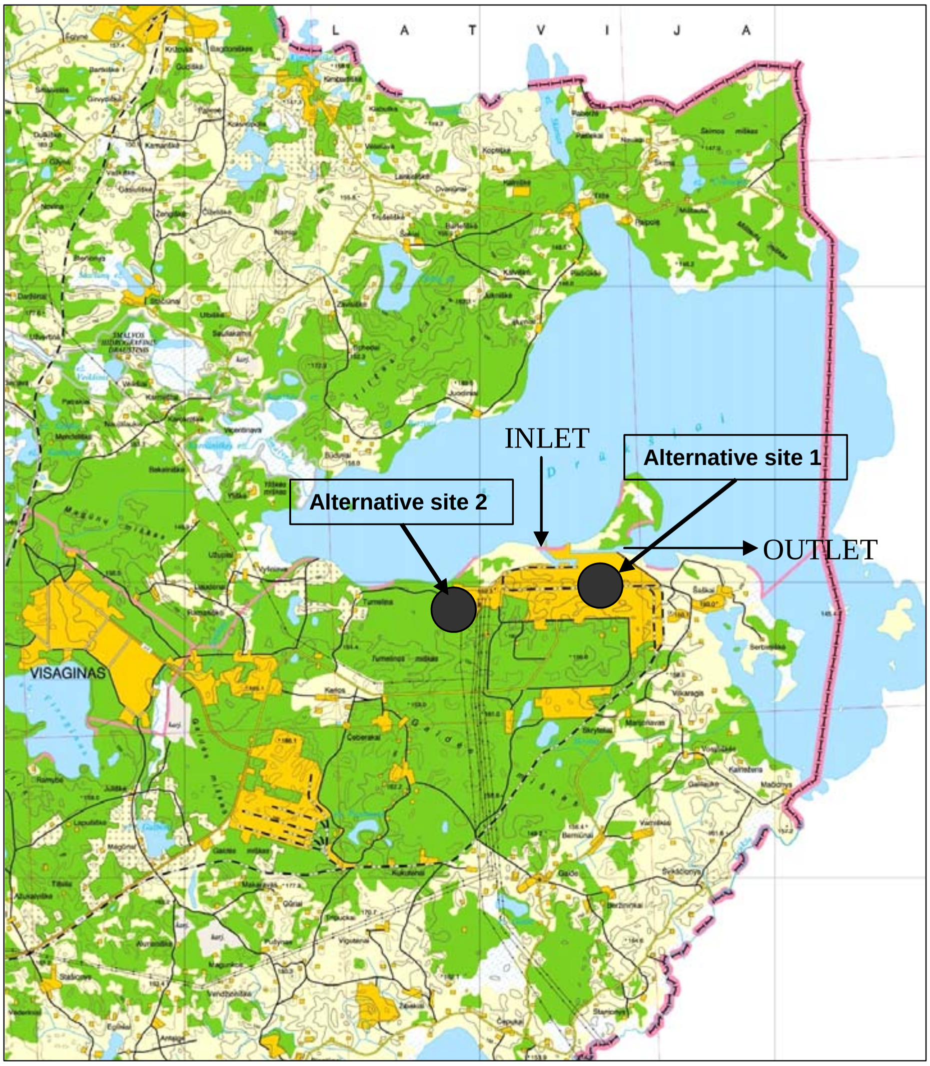

Figure 1.2-1. Location of Site No. 1 and Site No. 2 and present cooling water inlet and outlet.

The possible main technical alternatives of the new plant are: boiling water reactor, pressurised water reactor or pressurized heavy water reactor. These different alternatives would have different amounts of power installed and would cause partially different impacts on the surrounding environment. They have all been studied and described in the report.

The alternative locations of the cooling water outlet and inlet channels for the new power plant have been assessed as part of the study and presented in the EIA Report, including benefits and problems of the different solutions analysed. Moreover, the possibility of introducing cooling towers in the process has also been evaluated, presenting the limits for direct cooling without damaging the lake and the surrounding environment.

2 ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE

2.1 DESCRIPTION

During spring of year 2007, Lietuvos Energija AB started an Environmental Impact Assessment (EIA) procedure for the construction of a new nuclear power plant (NNPP) to be located next to the present Ignalina nuclear power plant (INPP). The EIA is a prerequisite for the construction of such an important installation. It has to describe how the plant will influence the surrounding environment and evaluate if the impacts of the project are environmentally and socially sustainable. Only after the EIA has been exposed to the local and international communities and is approved by the Lithuanian Ministry of Environment and Lithuanian government can the project proceed. Based on Lithuanian regulations, the EIA procedure first involves preparation of an EIA Program (EIAP), which has to give the structure of the EIA and a description of the topics that will be studied and the methods to be employed. Based on the EIA Program, terms set by the Ministry of Environment, and received comments, an EIA Report (EIAR) is prepared, which describes the environment and assesses the environmental and social impacts of the project. The EIA Program was published on July 26th, 2007, and it was ratified by the Lithuanian Ministry of Environment on November 15th, 2007 after extensive national and international commenting. The EIA Program was prepared by the same international consortium which prepared this Report, consisting of Pöyry Energy Oy and the Lithuanian Energy Institute (LEI) as commissioned by Lietuvos Energija AB. The preparation of the EIA Report began in February 2008 and the EIA Report was published and put on display for commenting on August 27th 2008.

2.2 INTERACTION

One of the objectives of the EIA procedure is to increase availability of information of the proposed economic activity and improve the opportunities for citizens' participation. The competent authority, the Lithuanian Ministry of Environment, is responsible for the coordination of the EIA procedure. The Ministry of Environment also approves the final EIA Report.

Different stakeholder groups were consulted when needed during the preparation of the EIA Report and the supporting studies.

The EIA Report will be available for public display. The motivated (justified) proposals, that will be received, will be registered, evaluated and attached as appendixes to the approved EIA Report. Public information and discussion events will be organized in the countries concerned.

The review of the EIA Report by relevant parties, including governmental institutions, responsible for health protection, fire-prevention, protection of cultural assets, development of economy and agriculture, and municipal administrations, has an important role in ensuring the quality of the EIA procedure.

Environmental impact assessment in a transboundary context is regulated by the Law on the Assessment of the Impact on the Environment of the Planned Economic Activities and by the United Nations Convention on Environmental Impact Assessment in a Transboundary Context (*Espoo Convention*). The Ministry of Environment is responsible for the practical organization of the environmental assessment procedures in a transboundary context. The Ministry of Environment has informed the respective authorities of Latvia, Estonia, Poland, Belarus, Finland, Sweden and Russia about the commenced environmental assessment process of the new nuclear power plant in Lithuania and inquired about their intent to take part in the environmental assessment procedure. Austria, Belarus, Estonia, Finland, Latvia and Sweden gave their comments on the environmental impact assessment of the new NPP. The comments mainly concerned transboundary impacts, but also various other subjects were touched in the comments.

The international comments concerned, among others, the site selection process and criteria, disposal of spent nuclear fuel, more detailed information on the reactor types considered, transboundary radiological impacts during normal operation and accidents, application of safety standards, the impacts of the non-implementation alternative, waste handling and storage, the monitoring system, impacts on Lake Druksiai, safety issues, risk assessment and prevention of accidents, methodology of modelling of accidental releases, the baseline conditions of the environment and cumulative impacts with other activities. The comments have been taken into account in the preparation of the EIA Report.

Information about the EIA procedure is provided at Lietuvos Energija AB’s website - http://www.le.lt and the new NPP project website http://www.vae.lt. The websites provide up-to-date information on the progress of the EIA procedure. The EIA Program and EIA Report are available in the Lithuanian, English and Russian languages on the website.

3 RADIOLOGICAL STATE OF THE PROJECT AREA

Radioactive liquids and gases generated in a nuclear power plant are collected, delayed to reduce radioactivity, and filtered. Even after filtering, minor amounts of radioactive substances are released into the atmosphere and water. Atmospheric releases occur through the ventilation stack while discharges into Lake Druksiai take place after radiation control through release tanks and discharge channels of the plant unit. Water released into the lake is mixed into the cooling water flow in the discharge channel.

According to the existing practice, the Ministry of Environment issues permissions for Ignalina NPP for releases of radioactive material into the environment. Radioactive releases from Ignalina NPP into atmosphere and water are continuously monitored. The releases are and have been far below the permissible values indicated in the valid permission of the Ministry of Environment.

Many years' tests (1994–2007) of radionuclide activity in terrestrial flora and its soil in the Ignalina NPP region have shown that the greatest impact on the radioecological state of flora of this region and its soil is due to ^{137}Cs, the activity of which in these components during the entire period of testing has not decreased, but ranged in similar limits. However, in terrestrial flora of Ignalina NPP region activity of ^{137}Cs and also ^{90}Sr, was similar or lower than in flora of other regions of Lithuania. Based on data of the performed analysis, it may be stated that the radioecological state of flora and its soil at Ignalina NPP region is quite good.

During the entire INPP operation period no cases of radionuclides originating from INPP spreading in groundwater close to the industrial site have been established.

Traces of radionuclides originating from the INPP have been found in the surface water of Lake Druksiai. However, the impact on humans and ecosystems is considered insignificant.

According to existing practice, samples of some fish species are continuously investigated by Ignalina NPP. In EU member states the cesium concentrations of edible wild products on the market should not exceed the total of 600 becquerel/kg. The total radioactivity of the fish in Lake Druksiai is 0.1–0.6 % of this recommendation value, i.e. very low.

The Republic of Lithuania regulations require that the average annual effective dose to the critical group members due to operation of a nuclear facility, including anticipated short-time operational increase, shall not exceed 0.2 millisievert/year (mSv/year). If several nuclear facilities are located in the same sanitary protection zone, the same dose limit value shall envelope impacts from all operating and planned nuclear facilities.

Different release routes (e.g. into air and water of the environment) can lead to doses for the same or different critical group members. Therefore, the dose limit value used for each route should be half of the total dose limit (i.e. 0.1 mSv per year). The actual annual dose to critical group members of the population due to existing releases of the Ignalina NPP has been about 1 % of the established dose limit.

4 IMPACTS DURING CONSTRUCTION

The construction of the power plant will require a vast amount of workers in the area. It is estimated that up to 3 500 workers will be needed for the construction, while around 500 employees will be needed during the operational phase, depending on the technology chosen and the operational procedures. Foreign workforce will be required during the construction phase.

The new labour force needed for the construction of the power plant will affect the economics and demography of the region. The NNPP region in Lithuania and Latvia will for 5-7 years have to host an exceptional amount of people. This will lead to a significant demand for goods and services and very significant positive socioeconomic impacts.

The construction works have to be accurately organized, since they will involve a large amount of labour force in the vicinity of the decommissioning project of INPP.

Attention will have to be paid to the problems that the vicinity of these activities can create to each other in terms of traffic and congestions.

The first step of the works will involve excavation works, with the removal of up to 1.4 million cubic meters of excavated materials. Disposal areas will be required for this amount of soil. The construction works will increase the amount of traffic (especially cars and trucks) on the roads connecting Visaginas with the power plant construction site. It is estimated that 1 800 cars, 100 trucks and 60 buses will drive back and forth every day, producing emissions and noise. The traffic will however not have long term impacts on the air quality. Dust will also be generated, but will only affect the area of the construction site.

The waters of Lake Druksiai as well as groundwater will not be significantly affected by the construction of the NNPP because of implementation of an appropriate waste water system. Any direct discharge of untreated and polluting or hazardous material in the lake's waters will be strictly forbidden.

A significant amount of ordinary waste will be generated in this phase, including recyclable waste, waste suitable for energy production and hazardous waste. The shares and proportions will depend on the ability of the project implementation company to minimize the waste amounts and maximise recycling of the waste.

The noise level during the construction years would increase, but the construction site is located in an uninhabited area.

There will be no radioactive releases or radioactive waste during the construction phase.

5 IMPACTS DURING OPERATION

5.1 STATE OF WATERS

The new NPP will use either direct cooling with water from Lake Druksiai or cooling towers, or a combination of these two solutions for heat dissipation. The cooling water will be warmed up approximately ten degrees when passing trough the nuclear power plant. The quality of the cooling water will not change in any other way. Model computations of the impact of releases of warm cooling water to Lake Druksiai were carried out with a three-dimensional hydrodynamic model. The effects of different thermal loads and different NNPP cooling water inlet and outlet locations on the water temperature of Lake Druksiai were investigated. The thermal loads are not directly related to the power plant size, because in addition combining different cooling methods and reducing plant effect are possible methods to reduce thermal load into the lake e.g. during warm weather periods.

The impacts of different thermal loads on Lake Druksiai were investigated using two sets of criteria. First, the same criterion for lake warming as is today applied for Ignalina NPP was used, in other words a maximum of 20 % of the lake surface is allowed to warm up to a maximum of 28 degrees. Secondly, a criterion of preserving the present ecological state of Lake Druksiai was used.

As a result, when having a thermal load level roughly corresponding to the thermal load from the present Ignalina NPP, no significant harmful impacts on the lake ecosystem are expected compared to the current situation.

At load levels essentially above this, utilizing the lake for direct cooling, the adverse impacts on the lake ecosystem start to be clear and significant. On the other hand, stopping the thermal load totally by using only cooling towers, might even have negative impacts on the state of the lake allowing ice cover to form and thus accelerating the deterioration of the oxygen situation of the lake. In every case, further restriction of the oxygen consuming nutrient load to the lake from sources other than NNPP is the most important way to preserve or even improve the state of the lake. Figure 5.1-1 presents an example of the modelling results.

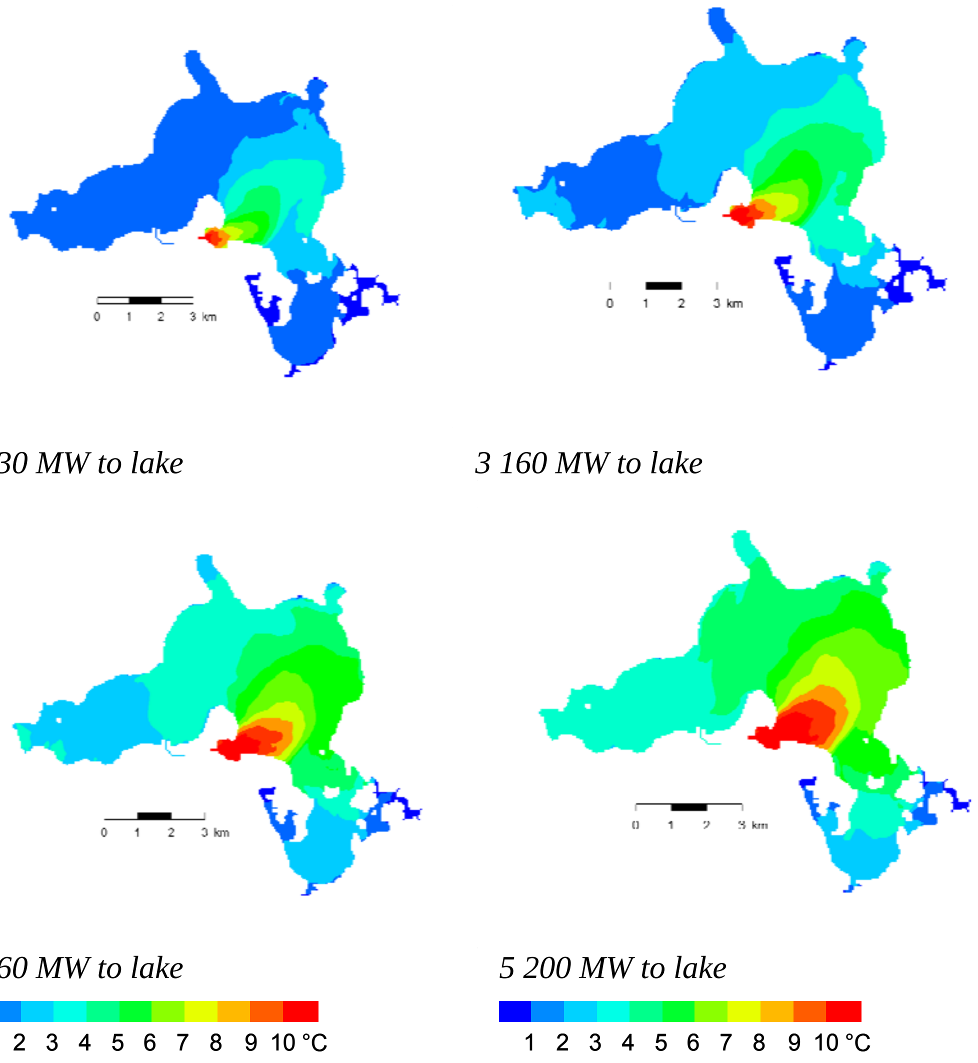

Figure 5.1-1. Average lake surface temperature rise for thermal loads of 2 230, 3 160, 4 460 and 5 200 thermal load MW into the lake.

The main hydrological impact of the operation of the new NPP is the evaporative losses created when the heat is transferred into air either via the lake or via cooling towers. However, according to water balance calculations the water resources will be adequate for the operation of the NNPP also during dry years without causing the water level of Lake Druksiai to fall below the allowed minimum of the present regulation scheme. During normal hydrological years the average lake level is not expected to fall below the normal mean water level. The added evaporation would affect the discharges out of the lake so that when the full 3 400 MW would be in operation, the mean discharge would decrease up to 28 % compared to the present level affected by the operation of INPP.

All the waste waters from the new NPP will be treated according to regulations. The nutrient and other load from the NNPP will be small compared to the total load to Lake Druksiai coming from other sources.

5.2 CLIMATE AND AIR QUALITY

The operation of the new NPP will cause very limited emissions, mainly from the back up diesel engines and traffic. These emissions will not have a significant adverse impact on the ambient air quality of the Visaginas region, also taking the background contamination into account.

5.3 GROUNDWATER, SOIL AND GEOLOGY

The groundwater conditions have been assessed for both NNPP sites. The potential risks for contamination of groundwater and water wells will be prevented through different mitigation measures described in the EIA Report.

The proposed sites for the new NPP are located in the industrial area of the operating Ignalina NPP. The soil surface and natural soil of the sites have been changed during the Ignalina NPP construction period. This is why substantial impacts on soil already took place about 30 years ago and the recent state of the soil is not natural. The main impacts on soil will occur during the construction stage and will be typical of any construction project. These include excavation works, relocation of soil, generation of dust from the movement of heavy vehicles and also from soil movement (dust clouds can develop especially during dry periods). These impacts will be mainly temporary. However, some of the soil needs to be permanently relocated.

The last comprehensive geological mapping performed in 1995, at a scale of 1:50 000, also covered part of the territory of the Latvian Republic and part of the Republic of Belarus. The geological structure presented in the EIA Report characterizes also the geology of these neighbouring countries. A geological structure analysis was performed in the EIA Report for both sites, showing how Site No. 1 can be considered as preferable from this point of view.

No essential impacts on geological conditions, soil or groundwater are expected during operation of the NNPP in either site alternative.

5.4 BIODIVERSITY

The biodiversity values were studied around the new nuclear power plant by both field-work and literature. Since the power plant location is near Belarusian and Latvian borders, also the values within Belarus and Latvia were clarified, even though significant negative impacts were not anticipated. The most significant impacts are expected to concentrate within the immediate vicinity of the nuclear power plant and

Lake Druksiai area. The construction and later the operation of the new nuclear power plant is presumed to potentially influence the natural environment mainly through traffic, noise, vibration, direct construction impacts, and aquatic environmental characteristic change in Lake Druksiai (water temperature, eutrophication, water flow, ice coverage). Since the thermal output to Lake Druksiai was determined to be the main impact factor, different impacts with different output levels and location options were analysed.

Lake Druksiai and several other areas in the region are included in a European Union network of protected areas named “Natura 2000” and certain values of these areas are therefore to be preserved under specific regulations of the EU. The main focus of biodiversity impact assessment has been on the Lake Druksiai Natura 2000 –area. Lake Druksiai has been included in the Natura 2000 network based on both the EU Birds Directive and the Habitat Directive.

The impact assessment concentrates on the favourable conservation status of the Natura 2000 designation values. The designation values are the specific species or habitats which are the reason for including a certain area into the Natura 2000 -network. Favourable conservation status can be described to be a situation where a habitat type or species is doing sufficiently well in terms of quality and quantity and has good prospects of continuing to do so in the predictable future. Species must remain as viable components of their natural habitats on long-term basis, the natural range of the species (or habitats) is not reduced or is not likely to be reduced in the foreseeable future and there will be sufficient conditions to maintain habitats or populations on long-term basis. Considering these previous factors, any significant negative impact towards the favourable conservation status by the NNPP project (project alone or the sum of influences with any other project in progress now or now in planning) must not be caused to any Natura 2000 designation value.

The main focus has been on the possible water temperature change in the lake due to cooling water discharge, and the potential impacts of this on biodiversity values. With a thermal load level roughly corresponding to the thermal load from the present Ignalina NPP, no significant harmful impacts on Lake Druksiai Natura 2000 –area designation values, or other biodiversity values of the lake compared to the present situation are expected.

At load levels essentially above this, utilizing the lake for direct cooling, adverse impacts on biodiversity values are possible. On the other hand, stopping the thermal load totally by using only cooling towers might even have negative impacts on especially the bird fauna of the lake as an ice cover would be allowed to form during winters, which would at times make it impossible for migrating or wintering birds to forage and rest on the lake.

Noise and the presence of workers, as well as direct construction measures destroying habitats will cause impacts on other biodiversity values as well in both site alternatives. Direct construction impact on terrestrial fauna could be relevant in the territory covered by construction and in its immediate vicinity. These impacts can, however, be mitigated to an acceptable level.

5.5 LANDSCAPE, LAND USE AND CULTURAL HERITAGE

The assessment of the landscape of the area shows how it already has been damaged by the construction and operation of the INPP. The NNPP project would not cause further particular damages to the landscape. Photomontages showing possible impacts on the landscape including both sites and the cooling towers option from the most significant viewing points have been prepared and are provided in the EIA Report. A photomontage prepared utilizing an aerial photograph is shown in Figure 5.5-1.

Figure 5.5-1. Photomontage of site 1 with two NPP units and cooling towers.

No impact on cultural heritage values is expected in either site alternative.

5.6 SOCIOECONOMIC ENVIRONMENT

A significant positive impact on the socioeconomic environment of the NNPP region is expected. The new activity would reduce the adverse effects of the closure of the INPP, which would let the region without its main employment source. A need for a large workforce, in the order of up to 3 500 workers, will occur during the construction phase. This workforce will to a significant extent utilize the services of the region in both Lithuania and Latvia, which will bring significant positive socioeconomic impacts to the region. About 500 employees would work permanently in the NNPP. The assessment considers also the impacts of traffic, noise and vibrations.

A demographical study of the area was performed. Density and distribution of the population were assessed as well as the age distributions, creating indicators essential for an appropriate analysis of the present situation and future developments. The present economic activities in the territory were also considered before assessing the impacts of the new power plant.

A resident survey was performed in the area of the town of Visaginas and its surroundings as part of the EIA. The results show how the attitude towards the NNPP project of the great majority of inhabitants is favourable.

5.7 PUBLIC HEALTH

The potential adverse impact on air quality caused by the NNPP and related traffic will be so minor that it will not affect public health. The levels of noise in the vicinity of the NNPP will stay below allowable limits. The main positive impacts of the NNPP on public health occur through improved economy and social security.

There will be no radiological impact on the population during the operation of the NNPP. Total annual exposure of the critical group members of population due to releases of radioactive effluents (both airborne and liquid) into the environment from the NNPP varies in the range from 8.7 to 50.7 μSv depending on the reactor type, capacity and total number of units. This is well below the dose constraint established for the protection of the health of members of the public, which is 200 μSv per year.

Besides the new NPP, the exposure of the population is also caused by existing and planned facilities of Ignalina NPP. It is forecasted that for 2015 (when the new NPP is planned to be built) the annual effective dose due to airborne emissions and liquid discharges from the existing and the new nuclear facilities of Ignalina NPP at the boundary of existing SPZ (3 km in radius) will be below 0.02 mSv. Direct exposure from facilities at the boundary of the existing SPZ is insignificant. Therefore, total estimated maximum annual dose of the critical group members of population caused by the new NPP and facilities (existing and planned) of Ignalina NPP will be about 0.05 mSv. This value is about 4 times less than the dose constraint of 0.2 mSv (200 μSv) per year.

Doses at the borders of Belarus and Latvia are insignificant and therefore no radiological impact on the population of these countries is expected.

The noise caused by the construction and operation phases, including transportation activities, was also studied in the EIA Report. The noise maps concerning the construction and operation phase for both sites are presented in Figure 5.7-2 and Figure 5.7-2.

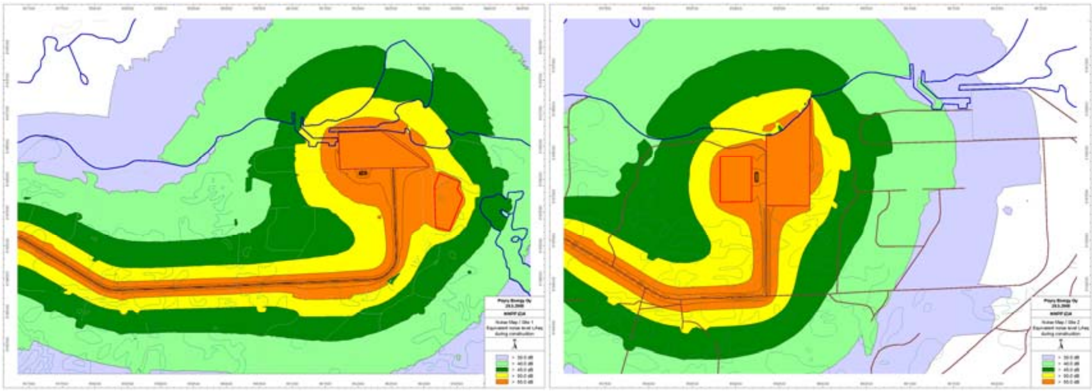

Figure 5.7-1. Noise map for Site No. 1 and Site No. 2 during construction phase.

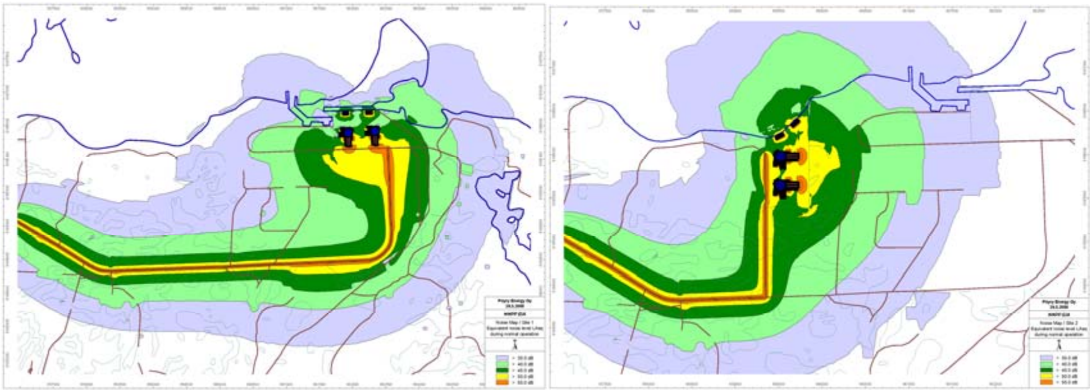

Figure 5.7-2. Noise map for Site No. 1 and Site No. 2 during operation phase.

The noise, during both construction and operation, will not adversely affect the health of the workers and the population of the surrounding areas.

6 NUCLEAR FUEL PRODUCTION AND TRANSPORTATION

Fuel for the new power plant will be Uranium Dioxide and it will be procured from the international nuclear fuel market. The uranium market would operate regardless of the implementation of the NNPP.

Uranium mining, processing and transportation are performed following national and international regulations and agreements, prepared in order to minimize the damages to the environment and the exposure of the workers to radioactivity.

Nuclear fuel would be transported to the NNPP either by train or by truck.

7 WASTE

Radioactive waste is the main by-product of a nuclear power plant, and the amounts can differ significantly with the different available technologies. Annual solid radioactive waste amounts generated at the new NPP would range from about 160 to 940 m^3, depending on reactor type. The basis of nuclear waste management is the permanent isolation of waste from the environment. To ensure long-term safety, the disposal of nuclear waste will be designed and implemented in a way that does not call for continuous supervision. The basis of the waste management of the new plant is to utilise existing solutions at the INPP (designed or already in use) to maximum extent. The capacity of these solutions is extended when necessary.

Annual generation of spent nuclear fuel (SNF) at the new NPP would range from 47 to 370 tons, depending on reactor type. Spent nuclear fuel is initially cooled down in pools contained in the power plant unit to decrease its radioactivity. Afterwards it has to be stored and for this purpose there are different options available, which have to be further discussed in a separate EIA study. The capacity of the INPP spent nuclear fuel storage facility is almost full and the facility would not be able to store spent nuclear fuel or radioactive material from the new NPP. The importance of the topic makes further studies and EIAs focused on this necessary, in order to find the best solution, considering the regional, national and international conditions. Long-term storage and disposal of SNF will be a subject of an own EIA procedure in the future and this issue is not a subject of this EIA Report.

Most of the waste produced during normal operation is low in radioactivity. This waste mostly includes typical maintenance waste, such as isolation materials, paper, old working clothes, machine parts, plastics and oil. The intermediate-level waste mainly consists of the ion exchange resin from the purification system of the circulating water and the evaporator bottom from sewage water treatment.

The NNPP produces solid, liquid and gaseous radioactive waste, which have been studied and forecasted in the EIA Report considering the different technological options. The operation of the NPP will cause no negative impact due to radioactive releases or any radioactive contamination because of the waste produced.

The NNPP will also produce conventional and hazardous waste. The NNPP operator will establish internal operations to enhance recycling and set agreements with licensed waste management companies, able to dispose this waste amounts safely without any harm for the environment.

8 MONITORING SYSTEMS

Environmental legislation requires parties responsible for projects and operations affecting the environment to carry out environmental monitoring. The Ministry of Environment of the Republic of Lithuania controls implementation of environmental monitoring, quality of monitoring data and information, and compliance with the standards and other normative legislation. The monitoring system for the new NPP will be designed to fulfil all the requirements of the Lithuanian legislation and regulations, the IAEA recommendations and obligations under the United Nations Conventions.

The existing INPP monitoring system will be utilized where applicable. All the monitoring systems and devices applied will however be modernized to meet the current requirements on preciseness and periodicity. The monitoring sites and objects will be kept unaltered when possible to assure the comparability of the existing INPP monitoring data with the new system.

9 NUCLEAR SAFETY AND RISK ANALYSIS

9.1 NUCLEAR SAFETY

High safety culture and special safety principles and regulations are required in the design and operation of nuclear power plants. The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation. All the most relevant principles of nuclear safety are clearly presented in the EIA Report, together with all the well-established procedures for minimizing any risk of accident. The use of nuclear power in Lithuania requires a license and it is regulated by law. The authorities involved in the safety of the nuclear installations in Lithuania are the State Nuclear Power Safety Inspectorate (VATESI), the Ministry of Health (via the Radiation Protection Centre), the Ministry of the Economy, the Ministry of Environment and the Ministry of Internal Affairs.

A nuclear power plant must be designed in accordance with nuclear energy legislation and regulatory guidelines on nuclear safety in order to ensure the safety of its operation. Nuclear power plants have been developed and are continuously being developed in many ways to improve their safety and operational reliability. The latest safety requirements will be taken into account in the planned new power plant so that it can survive even the most severe accidents without causing significant consequences in its surroundings.

Reactor safety requires the availability of three factors in all functions:

- managing the chain reaction and the power it produces
- cooling the fuel after the chain reaction has ended, also known as decay heat removal
- isolation of radioactive substances from the environment.

The fundamentals of safety include three barriers for radioactive substances and the “defence in depth” -principle of safety. The principle of three barriers means that there is a series of strong and tight physical barriers between radioactive substances and the environment, preventing the substances from entering the environment in all circumstances. The tightness of any single barrier alone is enough to ensure that no radioactive substances can enter the environment. The “defence in depth” -principle refers to the prevention of occurrence of accidents and control of accidents and mitigation of their consequences. Lithuanian authorities inspect the analyses related to the plant’s safety and ensure that the plant is built and operated in accordance with the safety requirements and that the employees have sufficient qualifications.

The EIA Report dedicates a section to the development of safety in the most advanced technologies, and through models analyzes the radiological dispersions and doses both in case of operation and accident.

9.2 RISK ANALYSIS

A risk analysis of potential, but very unlikely accidents resulting from the proposed economic activity has been done according to the recommendations of normative document “Recommendations for Assessment of Potential Accident Risk of Proposed Economic Activity” as part of the EIA. Accidental releases from the NNPP and their impacts on the environment and public have been considered for two scenarios: design basis accident (DBA) and severe accident. Loss-of-coolant accident has been chosen as the DBA to be assessed since it envelopes the consequences of all DBA's. For the severe accident case the source term for release into the environment has been estimated based on a 100 TBq release of Cs-137. The risk of a design basis accident is greater than 1 % over the life span of the plant (about 60 years), whereas the risk of a severe accident is less often than once during 1 000 000 years of reactor operation.

The dispersion of accidental releases in these situations has been simulated with Air Quality and Emergency Modelling System SILAM of the Finnish Meteorological Institute (FMI). The approach applied is based on brute-force multi-scale computations of dispersion using actual meteorological data from weather archives. To cover all realistic meteorological conditions several cases in different meteorological conditions during the years 2001 and 2002 have been simulated.

The assessment of doses received by the public as a result of accidental releases is based on the results of the dispersion simulations and it utilizes empirical coefficients and methodologies for converting the modelled concentrations in air and depositions to doses. The exposure of the environment and people depends on the specific meteorological conditions during the accident and the geographical location of the receiving point and thus the results of the study are given as 2-dimensional maps of the exposure levels, which are not exceeded with a certain probability for any realistic meteorological conditions.

The results of the dispersion modelling and dose estimation have showed that the dose for the members of public caused by the Loss-of-coolant accident is less than 10 mSv as required by the Lithuanian Regulation. According to modelling and dose estimations some short period restrictions of some foodstuff will be needed in case of both severe accident and Loss-of-coolant accident. In case of severe accident it is possible that these restrictions would extend several hundred kilometres from the NNPP.

To mitigate the consequences of an accident to the public, the power plant and rescue service authorities maintain emergency preparedness. The Lithuanian nuclear energy legislation sets requirements for civil defence, rescue and emergency response actions.

10 POTENTIAL IMPACTS OUTSIDE LITHUANIA

10.1 ENVIRONMENTAL IMPACTS DURING CONSTRUCTION AND OPERATION

The transboundary impacts are mainly socioeconomic or linked to the impacts on Lake Druksiai. Radiological transboundary impacts will not occur during normal operation of the NNPP.

A significant positive impact on the socioeconomic environment in the foreign parts of the NNPP region is expected, mainly in Latvia through the need for workforce, accommodation and services. No significant negative socioeconomic impacts are expected as the NNPP will be constructed next to an existing NPP, to which the surrounding areas have adjusted.

The warming impact of thermal load could affect also the parts of Lake Druksiai situated in Belarusian territory. However, no harmful impacts on aquatic or terrestrial ecosystems compared to the present situation are expected to occur in Belarusian territory with a thermal load level roughly corresponding to the thermal load from the present Ignalina NPP. At load levels essentially above this, utilizing the lake for direct cooling, the adverse impacts on the lake ecosystem could start to be clear also in Belarusian territory.

Evaporation of water by cooling the NNPP would reduce the mean discharge out of overall volume of water in Lake Druksiai, thereby impacting the quantity of water discharged to River Prorva. When having the full 3 400 MW in operation, the mean discharge would decrease up to 28 % compared to the present level affected by the operation of INPP. The decrease of mean flow would impact the approximately 50 km long stretch of River Prorva before the confluence of River Dysna. The minimum allowable discharge in River Prorva will remain at the present level in all cooling scenario alternatives.

All the possible implications that the new NPP would have on the international electricity market and on the market of fossil fuels were not part of the scope of the EIA.

10.2 IMPACTS OF A SEVERE ACCIDENT

In the extremely unlikely event (less often than once during 1 000 000 years of reactor operation) of a severe nuclear accident at the new NPP despite the preparedness for severe accidents and mitigation of the consequences the need for some protective actions could occur outside the new NPP area.

Sheltering is not necessary in Lithuania or abroad in case of a severe accident, neither is evacuation, temporary relocation or permanent resettlement. The main protective actions in case of a severe accident are iodine prophylaxis and restrictions on the use of foodstuffs, milk and drinking water.

Based on criteria for ^{131}I deposition, iodine prophylaxis may be needed for the population living up to a distance of 250 to 600 kilometres from the new NPP

Based on criteria of ^{131}I deposition food may be banned up to a distance of 100 to 250 kilometres; milk and drinking water may be banned up to a distance of several hundred kilometres. Based on criteria of ^{137}Cs deposition food may be banned up to a distance of 50 to 100 kilometres; milk and drinking water may be banned up to a distance of 20 to 50 kilometres.

It should be noted that, because the longest distances for protective actions are due to deposition of ^{131}I, the iodine prophylaxis and restrictions on the use of foodstuffs, milk and drinking water are temporary, since the half-life of ^{131}I is 8 days and activity of ^{131}I deposition reduces rapidly. Activity of ^{137}Cs deposition is lower than ^{131}I. However ^{137}Cs has a half-life of 30 years, therefore based on criteria defined for ^{137}Cs distances for restriction on the use of foodstuffs, milk and drinking water would be lower (up to 100 km in case of severe accident), but restrictions would be long-lasting.

An emergency response plan would be implemented during an emergency or recognition that a serious problem may be evolving at the plant. The measures needed in an accident and the civil defence actions will be described in the emergency plan. The plan is designed for the protection of personnel as well as confinement and mitigation in the case of a radiation accident at the nuclear power plant. This basic document provides instructions for the organisation of engineering, medical, evacuation and other actions which may be required.

Should an off-site release of radioactivity occur, the Ministry of Environment of Lithuania shall first of all present information regarding the nuclear accident to VATESI. VATESI then provides information regarding the accident to the IAEA and neighbouring countries, including; time, exact place and nature of accident, possible or determined causes of the accident, general characteristics of environmental release and the quality, composition and height of the radioactive release. In case of a nuclear accident the Department of Civil Defence will provide information to the municipal civil defence subdivisions about the accident via an automatic management and notification system. Civil defence structures of neighbouring countries will also be informed about an accident by the department of Civil Defence using inter-state means of communication, and civil defence structures of Latvia and Belarus also via the local warning zone of the nuclear power plant.

11 DECOMMISSIONING

It is expected that the new NPP will operate about 60 years. After this time period the decommissioning process of the NPP will start. This process will generate radioactive and non-radioactive wastes of various physical states (solid, liquid, chemical and radiological properties). Since design lifetime of the existing INPP waste management facilities will be expired, the decommissioning waste of the new NPP will be processed in new appropriate waste management, treatment and storage facilities. Part of the resulting conditioned waste will be freely released; disposed of into the landfill, near-surface repositories or temporarily stored on site.

During the design stage of the new NPP an initial decommissioning plan will be prepared before the operating licence is issued. The initial decommissioning plan should state in general terms that the plant can be taken out of service, and provide an outline of decommissioning methods and technologies. The initial decommissioning plan must specify the likely quantity of waste and provide an estimate of decommissioning costs. The decommissioning plan shall be periodically updated.

If a decision is made to decommission the nuclear power plant or one of its units it is obligatory, five years in advance, to submit to VATESI a decommissioning program and final decommissioning plan after co-ordinating it with the Ministry of Economy, the Ministry of the Environment, the Ministry of Health, the Ministry of Social Security and Labour, the county governor and the local authority of the territory which, in its entirety or in part, is within the facility sanitary protection zone. The Program should contain information about dismantling and conservation of equipments, management of radioactive materials and radioactive waste as well as later control and supervision of the object.

Decommissioning of the NNPP will undergo appropriate EIA in due time.

12 PROJECT SCHEDULE

The EIA procedure is scheduled to be completed by early 2009. It is planned that at least the first unit of the new nuclear power plant would be in operation not later than 2015. Typical construction time of a new NPP unit is 5–7 years and operation time is 60 years or even more Figure 12-1. The decommissioning times depend on the design of the reactor and on different other factors.

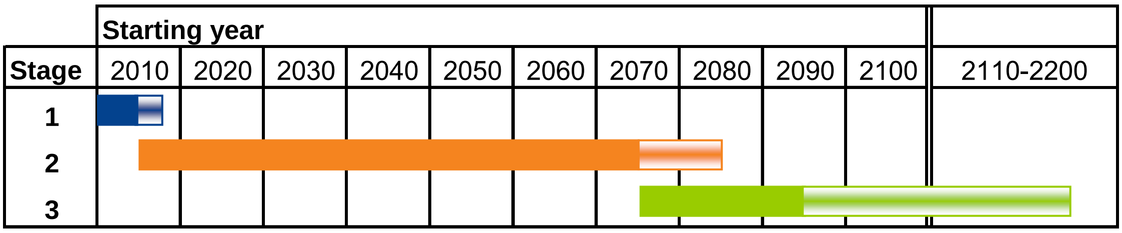

Figure 12-1 The estimated durations of the three main stages of the NPP project in case of one reactor.

In case of two or more reactors, it is assumed that construction work for the reactors would start two years after the previous one. In case of two reactors this would mean two years delay in all the different stages of the project.

13 CONTACT INFORMATION

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