PREPARATION FOR EARLY TERMINATION OF IGNALINA NPP OPERATION

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ABSTRACT

Seimas (Parliament of Lithuania) approved updated National Energy strategy where it is indicated that first Unit will be shutdown before the year 2005 and second Unit in 2009 if funding for decommissioning is available from EU and other donors. In accordance to *Ignalina NPP Unit 1 Closure Law* the Government of Lithuania approved the Ignalina NPP Unit 1 Decommissioning Program until year 2005. For enforcement of this program, the plan of measures for implementation of the program was prepared and approved by the Minister of Economy. The plan consists of two parts, namely technical-environmental and social-economic. Technical-environmental measures are mostly oriented to the safe management of spent nuclear fuel and operational radioactive waste stored at the plant and preparation of licensing documents for Unit 1 decommissioning. Social-economic measures are oriented to mitigate negative social and economic impact on Lithuania, inhabitants of the region, and, particularly, on the staff of Ignalina NPP by means of creating favorable conditions for a balanced social and economic development of the region. In this paper analysis of planned activities, licensing requirements for decommissioning, progress in preparation of the Final Decommissioning Plan is discussed.

INTRODUCTION

There is only one nuclear power plant in Lithuania - the Ignalina NPP (INPP). It is situated in the northeast of Lithuania near the borders of Latvia and Belorus, on the bank of the largest Lithuanian water-body, Druksiai lake. The Ignalina NPP is a vital component in Lithuania's energy balance because it is producing more than 70 % of the total electricity production in Lithuania. There are a variety of reasons for this high percentage, but the main is a significantly lower production cost at the present economical and technical circumstances in the Lithuanian power sector.

The INPP possesses two similar units of RBMK-1500 reactors. RBMK-1500 is the last and the most advanced version of RBMK-type reactor design series (actually only two units were constructed). Compared to the Chernobyl NPP reactors RBMK-1000, the Ignalina RBMK-1500 reactor is more powerful and is provided with an improved accident confinement system. The INPP reactors were commissioned in December 1983 and August 1987 respectively. The original design lifetime is projected to 2010-2015. After the accident in Chernobyl, the safety systems were re-evaluated and it was decided to decrease the maximum thermal power of the units from 4800 to 4200 MW. That limits

the maximum electric power to about 1250 MW per unit. There are no more nuclear facilities in Lithuania.

The RBMK reactor is channelized type reactor. This means that each nuclear fuel assembly is located in a separately cooled fuel channel (pressure tube). There are in total 1661 such fuel channels and the cooling water flow rate must be equally divided among associated feeder pipes. After crossing the core, these pipes are brought together to feed the steam-water mixture to the separator drums.

The RBMK reactors belong to the thermal neutron reactor category. Due to the large number of metal piping in the core of this type of reactor, the neutronic characteristics of the reactor are degraded. To improve the neutronic characteristics, the reactors use graphite to moderate the fast fission neutrons. This requires a large amount of graphite (about 1800 t in the unit), so that the graphite stack of the reactor becomes its dominant component, at least by volume.

The nuclear fuel assemblies of the Ignalina NPP are changed without shutting down the reactor. This is possible only for channel type reactors. Since there are many channels, it is possible to disconnect one of them at a time from the reactor cooling system, change the fuel assembly, and then reconnect the channel.

October 5, 1999 Seimas (Parliament of Lithuania) approved the National Energy Strategy where it was indicated that the first Unit of INPP will be shutdown before the year 2005, taking into consideration substantial long-term financial assistance from the EU, G7 and other states as well as international institutions. October 10, 2002 Seimas approved updated National Energy strategy where it is indicated that first Unit will be shut-down before the year 2005 and second Unit in 2009 if funding for decommissioning is available from EU and other donors.

May 2, 2000 Seimas adopted the *Ignalina NPP Unit 1 Closure Law*. This law indicates that:

- Preparation for decommissioning must be planned in such way that it should be finished till 1 January 2005;
- The Government taking into account implementation of the Decommissioning Programme and Decommissioning Plan, and future possibilities for financing from Lithuanian and international support sources will define exact date of final shutdown.
- Government of Lithuania is preparing and approving Decommissioning Program till 1 November 2000.
- Following the Decommissioning Program Government of Lithuania is approving the Final Decommissioning Plan for Unit 1 till 31 March 2002.

DECOMMISSIONING PROGRAMME FOR UNIT 1

In accordance with the *Ignalina NPP Unit 1 Closure Law* the Government of Lithuania, by its Resolution No 172 of 19 February 2001, approved the Ignalina NPP Unit 1

Decommissioning Program [1]. In this Programme the decommissioning for Unit 1 of Ignalina Nuclear Power Plant is foreseen in the following stages:

Stage 1 – preparation for decommissioning (2000-2004);
Stage 2 – preparation for dismantling of the facilities or for the long-term storage period (depending upon the selected strategy) (2005-2010);
Stage 3 – dismantling of facilities and buildings immediately/after the long-term storage (depending upon the selected strategy) (2011-2030/2080).

The present programme has been drafted for the measures of stage 1 to be implemented within the period 2001-2004. Separate programmes will be elaborated to implement measures of stages 2 and 3 when more detailed information is available as well as experience of stage 1 has been taken into account.

Ministry of Economy shall be responsible for the implementation of the Programme together with a Commission, established under Decree No 231 dated 29 February 2001 for the purpose of coordinating the implementation of the INPP-related provisions of the National Energy Strategy. The Ministry of Economy and the said Commission will coordinate activities of institutions which take part in the programme implementation, assess the impact of the programme implementation and duly inform the government on the progress of the programme.

For enforcement of this program, the plan of measures for implementation of the program was prepared and approved by the Minister of Economy by his Order No 145 of 25 April [2]. The plan consists of two parts, namely technical- environmental and social-economic measures. Technical-environmental part lists the legal, organizational, financial and technical measures, which need to be in place to support the closure of Unit 1. Social-economic part includes the preparation of laws and plans related to social and economic problems associated with the closure of Unit 1. The Decommissioning Programme forms the basis, and gives the milestones, for the preparation of the Unit 1 Decommissioning Plan.

The Programme is financed from the International INPP Decommissioning Fund, international support, National INPP Decommissioning Fund, State Budget, and the INPP funds, special targeted assignations to municipalities of INPP region, and the resources of the Support Fund to public institutions belonging to the INPP protection zone. Other sources of financing are also possible. An international Support Unit under the Ignalina NPP Decommissioning Service will administer funds allocated by EBRD from International INPP Decommissioning Fund and targeted to finance technical measures. Part of the social-economic measures of the Programme will be financed under a separate programme, which is foreseen under the State Budget, the remaining part will be financed from international contributions.

The Commission to Co-ordinate the Implementation of INPP-Related Provisions of the National Strategy alongside with Ignalina NPP Regional Council considers the progress of Programme implementation, on a regular basis. The Council shall, on a regular basis

and at least once a year, account to the Government on the progress made in the Programme implementation. On the basis of decisions of the Commission, the plan of measures of the Programme implementation will be revised annually by taking into account the need for new initiatives and possible means of financing. In addition, annual plans of activities will be drafted which will also indicate the institutions in charge, the deadlines and sources of financing.

Organisational and legal measures

The most important organisational and legal measures indicated in the implementation plan are:

- The Ministry of Economy, Ignalina NPP, regulating institutions (State Nuclear Power Safety Inspectorate (VATESI), the Ministry of Environment, Radiation Protection Centre and other technical assistance organisations have to be duly prepared for additional workload that will ensue with the implementation of the Programme.
- Supplement the existing nuclear legal framework, adopt necessary laws and delegated legislation necessary for an appropriate regulation of decommissioning process.
- Draft standards and norms regulating radiation safety and environmental impact during the decommissioning process.
- Set up Ignalina NPP region under the procedure of Regional Development Law.
- To set up an executive body in Ignalina NPP region – the Ignalina NPP Regional Development Agency – to organise and implement social-economic projects.
- To restructure Ignalina NPP for the purpose of improving the management and safety culture as well as for the preparation for decommissioning and participation in the liberalised electricity market.
- In accordance with the procedure prescribed in the Law on Radioactive Waste Mangement and for the purpose of radioactive waste disposal, set up a state agency on radioactive waste management.
- Carry out scientific research related to safety as well as environmental and human impact of decommissioning of INPP.
- Draft and provide, on a regular basis, information on the implementation of the Programme to foreign states – financial donors.

Technical measures

Technical-environmental measures are mostly oriented to the safe management of spent nuclear fuel and operational radioactive waste stored at the plant and preparation of licensing documents for Unit 1 decommissioning. Some most important technical measures are presented below.

Implementation of:

- Interim Spent Nuclear Fuel Storage Facility.
- Solid Waste Management and Storage Facility
- Cement Solidification Facility for Spent Ion Exchange Resins

Transfer of partially burnt fuel from Unit 1 to Unit 2
New Heat and Steam Plant
New Technical Archive

Preparation of:
Safety Assessment for a Single Unit Operation
Final Decommissioning Plan for Unit 1
Decommissioning Project and SAR for first phase of decommissioning
Radwaste Management Strategy for Lithuania.

Social – economic measures

Social-economic measures are oriented to mitigate negative social and economic impact on Lithuania, inhabitants of the region, and, particularly, on the staff of Ignalina NPP by means of creating favorable conditions for a balanced social and economic development of the region. They are structured into organizational, legal, business development, employment and labor markets, social policy, Ignalina NPP and the public relations measures. The major aims of these measures are:

Keep the qualified staff as a guarantee of safety and quality during the decommissioning of Unit One and operation of Unit Two.

Elaborate and implement the Ignalina NPP regional development plan.

Carry out social-economic monitoring of Ignalina NPP region.

Work out and execute projects for the mitigation of social impact related to the decommissioning of Unit One of INPP.

In order to create an economically attractive image of INPP region and draw investment, to analyse and present business/ investment opportunites in the INPP region, carry out campaigns on public information and cooperation with non-governmental organisations.

REGULATORY ISSUES

According to the Article 25 of the *Law on Nuclear Energy* (November 14, 1996) decommissioning of the nuclear power plant is subject to VATESI (Regulatory body) license. According to the Article 9 of the *Ignalina NPP Unit 1 Closure Law* (May 2, 2000) operator is responsible for the decommissioning of INPP Unit 1.

General Requirements for Decommissioning of Ignalina Nuclear Power Plant [3] is the main document regulating decommissioning activities at Ignalina NPP. Decommissioning of the Ignalina NPP (decommissioning) is defined in this document as the legal, organisational and technical actions taken to put Ignalina NPP in order it is decided that it will never again be used for the purpose for which it was intended. Some most important requirements for the preparation of decommissioning extracted from these requirements are presented bellow.

Requirements for the Decommissioning Plan

It is defined that at the stage of the final shutdown and during the decommissioning period the decommissioning plan will be the principal document serving to prepare detailed plans (projects) of decommissioning activities.

It is indicated that Final Decommissioning Plan must be approved by VATESI (regulatory body). It must include:

A description of INPP and INPP area which could be affected by the decommissioning process;
INPP's operating history and the use to be made of its installations and site during the decommissioning process and thereafter;
A list of the norms, regulations and other statutory instruments forming the legal framework of the decommissioning process;
The chosen decommissioning strategy and the supporting arguments of such choice;
A description of the proposed decommissioning activities and their timetable;
A conceptual safety and environmental impact assessment, including the impact of ionising radiation and other effects on the public and the environment;
A description of the environmental monitoring programme proposed for the decommissioning period;
A description of the decommissioning organisation: its responsibilities, resources, qualifications and the skills of its personnel;
The opportunities for using various engineering, management and decommissioning methods, as well as dismantling, decontamination, and cutting techniques, and an assessment of the remote control equipment which will be needed for safe decommissioning;
A description of the proposed methods of waste management;
A description of the safety and radiation safety procedures to be used during decommissioning;
A description of the quality assurance program;
Descriptions of other important administrative and technical requirements, such as IAEA safeguards, physical protection, emergency preparedness etc.;
Monitoring programmes intended to confirm that the site complies with clearance criteria, including their description, equipment and methods to be used;
An estimate of decommissioning costs, including the cost of waste disposal, existing funds and other sources.

Requirements for ensuring nuclear safety during the decommissioning period

Normal operations specified in the operating license may be carried out during the final shutdown. They include unloading and removal of spent fuel, waste management and conventional decontamination of components.

Other waste management procedures, for instance those relating to waste that cannot be routinely disposed of (some active media, such as graphite, metal smelting etc.) must be included in the decommissioning project and licensed.

During the decommissioning period safety must be ensured as long as INPP qualifies as a nuclear installation or there exists a real possibility of unplanned spread of radioactive and other hazardous substances and of damage to the population and the environment. All decommissioning operations must be conducted in accordance with project requirements, limits and conditions.

The objective is not to carry out any decommissioning operations until spent nuclear fuel has been unloaded from the reactor and spent fuel pools. Licensed procedures must be used to unload and remove the fuel. Otherwise, the proposed activities must be analysed for their safety in relation to fuel safety.

After spent nuclear fuel has been unloaded from the reactor and the spent fuel pools, some safety requirements may be relaxed, but the relaxation shall come into force only after a safety assessment has been carried out and VATESI's agreement has been obtained.

Requirements for the management of the decommissioning

It is indicated that Ignalina NPP must ensure that all phases of the decommissioning process an organisation responsibility for the decommissioning management is in operation. It must include properly qualified and experienced personnel, whose duties, responsibilities and interactions are clearly defined. The decommissioning management aim at involving of management structures and methods established during operation, while taking into account new tasks arising during the decommissioning process. The objective is to retain an internal document structure similar to that used during operation. The principal document that must be used as a guide in ensuring the stability of INPP is the Operating Manual. Final shutdown should be based on the Operating Manual compiled while the facility was in operation, and as decommissioning starts, this Manual should be changed in line with the nature of the decommissioning operations and their completion. Other decommissioning documents should also be prepared, such as procedures, instructions, methods, personal instructions and others. INPP personnel should be familiar with these documents and use them in their work.

The number of systems necessary for final shutdown will be based on the Operating Manual and on instructions on the management of the shutdown facility. The number of systems can be reduced or their power decreased only in the prescribed manner, by modifying the Operating Manual.

Requirements for the radiation protection

The existing radiation protection procedures and the organisation established during the operating period should be used as a basis, but special attention must be paid to potential

radioactive contamination due to the production and release of dust, aerosols and liquids during decommissioning processes. When planning and carrying out the decommissioning INPP must:

- Ensure that optimisation and limitation principles are applied
- Predict the labour content and the associated collective and individual dose for workers for each decommissioning activity
- Predict the collective dose for members of the public for each decommissioning phase
- Monitor the exposure of employees and work places and exposure during work with specific decommissioning tools or instrumentation, and analyse the resultant data, striving to optimise the work and reduce exposure to a minimum.
- Evaluate and determine the radiological situation at the beginning and at the end of every decommissioning phase
- Predict the quantity of radioactive waste generated during each decommissioning phase and asses exposure during handling
- Releases of radioactive contaminants into the environment, emission control and keeping discharges within authorised limits, establishing control levels and optimising environmental pollution
- Ensure proper use of clearance principles and clearance levels in relation to materials released for unrestricted use, or removed from INPP under conditional or unconditional clearance.

To ensure that these radiation protection measures are properly implemented, INPP should prepare a radiation protection programme.

Requirements to obtain the license

To obtain a decommissioning licence, INPP or the decommissioning organisation must submit an application to the State Nuclear Power Safety Inspectorate (VATESI). INPP may apply for one licence covering all decommissioning activities or for a licence covering a single phase of operations. The application must be accompanied by the administrative, financial and technical documentation. In addition, the following documentation must be submitted:

- Safety Analysis Report;
- The Decommissioning Project:
- Results of State Complex Project Expertise;
- Natural resources user's permission and the emissions permission;
- Radiation protection programme;
- Waste management programme;
- Environmental monitoring programme;
- Safe enclosure plan and other associated documentation (if this decommissioning phase is foreseen)
- Organisational structure of the decommissioning organisation;
- Decommissioning and surveillance regulations;

Emergency preparedness plan;
Physical security plan;
The experience and skills acquired during an earlier decommissioning phase, the lessons learned and their implementation during preparations for licensing of the next decommissioning phase.

Requirements for the Safety analysis report

The aim of the safety analysis report is to demonstrate that INPP can be decommissioned safely. To demonstrate this, it must be proved that both individual decommissioning activities and methods used during operation, the use of equipment and tools and the decommissioning process as a whole is safe. The safety analysis report should consider:

Major prerequisites on which the INPP decommissioning project is based
The proposed conditions which, if met, would ensure that INPP can be safely decommissioned, and any risk factors which could affect INPP
The parameters of safe decommissioning, such as ionising radiation levels on the INPP site and outside it, releases etc.
The status of INPP or its unit (including its radiation status) at the start and end of decommissioning (or of an individual decommissioning phase)
Methods used in dismantling and decontamination, equipment and tools and their operating parameters, any new methods, equipment and instrumentation to be used, and tests associated with their use, and an assessment of the effectiveness of decontamination activities
Safety-significant systems and components
The decommissioning process and a preliminary sequence of operations
The safe enclosure period (if included in the decommissioning project)
Common equipment used on the second operating unit, and the impact of decommissioning on the unit remaining in operation
Organisational and technical measures ensuring radiation protection
Administrative aspects of decommissioning (procedures, control, monitoring etc.)
Other important administrative and technical requirements, e.g. IAEA safeguards, physical security, emergency preparedness etc.
Waste and decommissioning residue management
Clearance of the site, buildings, structures and materials
The design process, its criteria, methods and models, and the boundary conditions and assumptions used in the models

Requirements for the Decommissioning Project

INPP or the decommissioning organization must submit the entire decommissioning project or a project covering one or more decommissioning phases to the State Nuclear Safety Inspectorate. The project must cover the decommissioning activities for which a State Nuclear Safety Inspectorate license is being sought. The decommissioning project must include:

A description of the INPP site, buildings, structures, systems and components, drawings, and the systems required for decommissioning.
A description of the status of INPP or the unit (including its radiation status) at the start or at the end of the decommissioning process
The experience and skills acquired during the preceding decommissioning phase, the lessons learned and their implementation in the design
A description of the methods and technologies of dismantling and decontamination, a description and the conditions of use of equipment and tooling, and of other equipment and devices used in the decommissioning process, automated systems and remote control equipment, screening methods, containers, ventilation equipment and auxiliary equipment
A description of the decommissioning activities (process pit and room clearance, dismantling and disposal of main and auxiliary equipment, systems and components, decontamination of parts of the reactor, decontamination and dismantling of protective barriers, dismantling and putting into conservation buildings, structures, systems and components etc.) and the order in which they are to be performed
Design solutions relating to safe enclosure (if it forms part of the decommissioning programme)
Design solutions for dealing with the radiation effects of accidents or incidents occurring at INPP or the unit
Inventory of radioactive and hazardous materials
Radiological protection map, controlled zones, marking, barriers, checkpoints, recreation areas, radiation monitoring regulations, calculations of occupational and population dose-rates
A description of organisational and technical measures ensuring radiation protection during the following decommissioning phase
Decommissioning residue, radioactive and other waste management methods, equipment, facilities, measuring instrumentation, and technical and organisational solutions to ensure continuous collection of radioactive waste and residues as they arise, and their transfer to processing, final processing, storage, disposal or burial, inventorying of waste and residues, the places of their accumulation, transport routes, project solutions aimed at minimising contamination of unmonitored zones and of the site during transportation
The application of clearance procedures, conditional and unconditional clearance levels, the use and removal of materials generated by the clearance procedures
A description of safety-significant systems and components and of the corresponding procedures
A description of other significant administrative and technical requirements, such as IAEA safeguards, physical security, emergency preparedness etc, and the associated project solutions
Design conditions, a list of standards, rules, regulations and other statutory instruments on which the design is based.

STRENGTHENING THE INFRASTRUCTURE TO SUPPORT THE DECOMMISSIONING OF IGNALINA NPP

To ensure the effective preparation for decommissioning of Unit 1 the Decommissioning Service was established at INPP. To strengthen the capacities of this service the International Support Unit (International Consortium NNC- Belgatom- SweedPower) was created as a part of this Decommissioning Service. So, on-site Engineering Decommissioning Project Management Unit (DPMU) was created that will adopt an integrated approach to project management, engineering design, planning, procurement, safety and licensing activities at the INPP site. The DPMU will assist the INPP management in the implementation of the pre-decommissioning and decommissioning projects. Ignalina NPP is undertaking a program of decommissioning support projects, financed by grants from the International Ignalina Decommissioning Support Fund, administered by the European Bank for Reconstruction and Development. This program comprises also the implementation of investment projects in a number of pre-decommissioning facilities including the management of radioactive waste and spent nuclear fuel.

State Enterprise Radioactive Waste Management Agency (RATA) has been founded in 2001 implementing the resolution of the Government. The Government also approved the Agency activities program for 2002–2004. The capabilities of regulatory bodies VATESI, Radiation Protection Center will be increased in relation with decommissioning of INPP.

To support decommissioning planning February 6, 2002 Lithuanian Government approved Strategy on Management of Radioactive Waste. It defines activities for management of solid and liquid radioactive waste, and spent nuclear fuel at Ignalina NPP as well as radioactive waste from small producers.

SKB-SWECO International-Westinghouse Atom Joint Venture with participation of Lithuanian Energy Institute has prepared a reference design of a near surface repository for short-lived low and intermediate level radioactive waste. This reference design is applicable to the needs in Lithuania, considering its hydro-geological, climatic and other environmental conditions and is able to cover the expected needs in Lithuania for at least thirty years ahead. It is planned to start sitting activities of this facility in 2003.According to the Lithuanian strategy, it is foreseen to perform necessary investigations and draft recommendations on construction of a near surface repository until 2005.Landfill repository for very low level waste is also planned to be implemented at Ignalina NPP site. Activities in this area also will be started in 2003.

PREPARATION OF THE FINAL DECOMMISSIONING PLAN

The *Ignalina NPP Unit 1 Closure Law* and Decommissioning Programme form the basis, and gives the milestones, for the preparation of the Unit 1 Final Decommissioning Plan. The Final Decommissioning Plan will be a document setting forth the actions for the final shutdown, implementation of the decommissioning strategy, the decommissioning costs

and the sources of financing and safety implications and requirements. Requirements for the Final Decommissioning Plan have already been presented in the previous chapter.

In order to produce a decommissioning strategy in a final decommissioning plan, practical reality requires that a preliminary decommissioning plan is prepared. This preliminary plan should identify and evaluate strategy options that can be used as a basis in preparing the final decommissioning plan.

A Preliminary Decommissioning Plan, covering both Units of the INPP, was prepared by the European Commission under the PHARE Project [4]. It contains a preliminary cost analysis of the different strategy options. It was revealed that there is no big difference in cost (up to 15 %) between different dismantling strategies. The Immediate dismantling strategy is the most expensive in the short term, since the main work of dismantling in the reactor area begins considerably earlier than in case of the other options. The estimated cost for this strategy is 928.74 millions Euro during 25-30 years. But the Later dismantling with maximum safe enclosure is the most expensive strategy of all and Entombment strategy is the cheapest one (duration more than 200 years).

The decommissioning process requires not only a long period of time but also a rather big number of highly qualified personnel (1000 – 2000 persons during more than 20 years). So the cost of the decommissioning becomes very much dependent on the labour cost. The cost of 928.7 thousands Euro is for the actual labour cost at the Ignalina NPP. But it is about 10 times smaller than the labour cost in western countries. As it is indicated in [4] with labour cost of western countries and optimising the number of staff, the decommissioning cost of the INPP would increase up to 3 000 millions Euro. Though it is very difficult to predict how the labour cost will change in time in Lithuania but of cause it is necessary to take this into account when comparing different decommissioning strategies

At the request of the Vice-Minister of Economy, the IAEA agreed to start a project in 2000 with the objectives of providing technical advice and training in connection with the decommissioning of the Ignalina NPP, and specifically reviewing the provisions and resources for the planned decommissioning activities. One of the expected results was the recommendation of a strategy, including technical aspects, for the decommissioning of Ignalina Unit 1 based on the Preliminary Decommissioning Plan results.

Based on Preliminary Decommissioning Plan detailed analysis by IAEA experts group was performed of such aspects as impact of cost, waste, social, regulatory, safety and technology on the reference decommissioning strategy [5].The summary statements from [5] for every mentioned aspect are presented below:

> Based on the cost criteria, immediate dismantling is the best reference strategy, principally because it gives a boundary to the cost and is more robust to uncertainty.
>
> Based on the PDP document and other information collected during the mission, it can be concluded that there is no significant impact of the waste arising and treatment on the proposed selection of the strategy even including the graphite

issue. Since there are no significant benefits in reducing the amount or types of waste with deferred strategies, it can be concluded that immediate dismantling is the recommended strategy based on the waste issues.

In countries with a robust nuclear power program, social issues, although important, are not generally critical decision criteria. Workers terminated from a shut down nuclear plant can usually find employment at other nuclear power plant sites or in related industries. However, because Lithuania with only one nuclear power plant containing two nuclear reactors and the skills of nuclear workers are unique, shut down and decommissioning of the INPP has significant national and local impacts. On the basis of the considerations, the immediate dismantling strategy is preferred. It maximizes the use of existing personnel, and takes advantage of technical expertise and language skills. Immediate dismantling provides more jobs for more workers in the short term.

Based on regulatory issues, immediate dismantling is the best reference strategy. It provides the most continuity between operations and decommissioning by allowing the use of experienced plant and regulatory agency staff. Strategies that defer the decommissioning will require the rehiring and retraining of both the plant and regulatory agency staffs.

The safety of Unit 2 must be considered in the Unit 1 decommissioning strategy. In order to ensure the safety of Unit 2 will not be affected by Unit 1 decommissioning activities, and should Unit 2 continue to operate greater than five years after Unit 1 shutdown (the time period assumed in the PHARE report), additional work and cost will be required in order to ensure that the safety of Unit 2 will not be affected by Unit 1 decommissioning activities. Continued Unit 2 operations can take place and does not have to affect the overall strategy, but will require modification of the Unit 1 decommissioning schedule and costs for all strategies.

It has been shown that dismantling a power plant is feasible with current technology, in a reliable, safe and economical way. There are no expected significant technological advantages that would warrant delaying the dismantling.

The general conclusion was done in [5] that based on the information provided the expert team through the numerous discussions with various Lithuanian organizations and the European Commission PHARE report, the recommended decommissioning strategy for the Ignalina Nuclear Power Plant Unit 1 is **immediate dismantling**.

Also it was stressed that an ongoing, iterative process that considers any other relevant inputs should be performed to ensure that the reference strategy is still acceptable based on new information that may become available or developed under the requirements of the Decommissioning Programme.

Decommissioning Project Management Unit (DPMU) at Ignalina NPP was working on better characterisation of the waste streams and updating of other input data for decommissioning cost and other process data estimation. This additional analysis was presented to Lithuanian Authorities as a support document for selection of the decommissioning strategy [6]. After discussions immediate dismantling strategy was

selected. November 20, 2002, Lithuanian government approved **immediate dismantling strategy for Unit 1.**

DPMU is continuing to work on preparation of the Final Decommissioning Plan. It is already possible to indicate some most important milestones in the planning:

Final shutdown of the Unit 1 on 2004.12.31 and of Unit 2 on 2009.12.31;
Reactor free of fuel in Unit 1 on 2008.12.31 and in Unit 2 on 2010.12.31;
Removal of all fuel from Unit 1 till 2010.09.30 and from Unit 2 till 2015.12.31;
Dismantling of less contaminated components in Unit 1 till 2012.12.31 and in Unit 2 till 2017.12.31;
Dismantling of reactors and most contaminated components in reactor area in Unit 1 till 2025.12.31 and in Unit 2 till 2030.12.31

When planning these millstones it was assumed (based on existing practice at INPP) that spent nuclear fuel will be stored in the pools for five years before it can be loaded into interim storage containers. The planned recycling of about 1300 fuel assemblies (from total of 1661 assemblies in the core of the reactor) from Unit 1 in Unit 2 (the transfer from Unit 1 core directly to the core of Unit 2) will lead to postpone any activity concerning the reactor main coolant circuit (circuit isolation and decontamination, removal of thermal isolation), the reactor safety circuits and the reactor ancillary systems by 3.5 years after reactor final shut-down of Unit 1.

It is possible to expect that Final Decommissioning Plan is finished in first quarter of 2003 and than Ignalina Decommissioning Project Management Unit will concentrate on the preparation of the Decommissioning Project and SAR for the first stage of decommissioning of INPP that are necessary for to get license for decommissioning.

REFERENCES

1. The Decommissioning Program for the Unit 1 of State Company Ignalina Nuclear Power Plant. Governmental resolution No. 172, February 19, (2001).
2. Plan of Implementation Measures for the Decommissioning Program for the Unit 1 of State Company Ignalina Nuclear Power Plant. Approved by the Ministry of the Economy, April 25, (2001).
3. General Requirements for Decommissioning of Ignalina Nuclear Power Plant, issued by VATESI. VD-EN-01-99, (1999).
4. Preliminary Decommissioning Plan for the Ignalina NPP, Phare Project, (December 1999).
5. Selection of the Decommissioning Strategy for the Ignalina Nuclear Power Plant. Report Prepared by an IAEA Expert Working Group. Vienna, Austria. (March 2001).
6. Technical and Financial Arguments for Selection of Decommissioning Strategy for Ignalina NPP. Prepared by Ignalina NPP DPMU, (2002).