Ignalina NPP Decommissioning Environmental Impact Assessment Programme

For A.1.1

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Issue 05

The Client of the Proposed Economical Activity is:	**State Enterprise Ignalina Nuclear Power Plant**
The Provider of the EIA Programme is:	**Ignalina NPP Decommissioning Project Management Unit**

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AMENDMENT RECORD

Issue	Description of Amendment	Originator	Checker	Approver	Date
1 Draft 1	For INPP review	B. Centner	J-C. Naisse	G. Sutherland	31/05/2002
1 Draft 2	Integration of the comments received on Draft 1 version	B. Centner	J-C. Naisse	G. Sutherland	15/10/2002
1 Draft 3	1) Integration of the comments received on Draft 2 2) Revision according Immediate Dismantling	V. Kachka	J-C. Naisse	B. Rodionov	27/02/2003
1 Draft 3	1) Integration of the comments received on Draft 2 2) Revision according Immediate Dismantling	V. Kachka	J-C. Naisse	B. Rodionov	27/02/2003
01	Formal Issue	V. Kachka	B. Centner	B. Rodionov	23/05/2003
02	Integration of the comments received on Issue 01	V. Kachka	J-C. Naisse	B. Rodionov	18/06/2003
03	Integration of the comments received on Issue 02	V. Kachka	J-C. Naisse	B. Rodionov	26/09/2003
04	Integration of the comments received on Issue 03	V. Kachka	J-C. Naisse	B. Rodionov	24/11/2003
05	Integration of the comments received on Issue 04	J.P. Tack / V. Kachka	J-C. Naisse	B. Rodionov	19/04/2004

PREFATORY REMARK

From the Lithuanian legal standpoint, the Decommissioning of Ignalina Nuclear Power Plant is to be considered as an economical activity for which an EIA process is to be performed in agreement with the relevant national Law.

This requires:

- timely information of the Public;
- successively, an EIA Programme and an EIA Report to be produced and approved.

To avoid confusion with usual EIA terminology (i.e. EU Guidelines), the reader should keep in mind that:

- present EIA Programme is to be considered as the "Scoping Study" for the decommissioning project and as such it identifies the issues to be tackled in the EIA Report, develops the structure of the EIA Report and already prepares some material to be used in the EIA Report;
- the EIA Report is to be considered as the "EIA Statement" to be written so as to provide the detailed analysis of the likely changes in the natural and man-made environment as a consequence of the decommissioning of Ignalina NPP

Table of Contents

List of Figures

Abbreviations

ALARA	As Low As Reasonably Achievable
ALS	Accident Localization System
DP	Decommissioning Project
EBRD	European Bank of Reconstruction and Development
EIA	Environmental Impact Assessment
EIAP	Environmental Impact Assessment Programme
EIAR	Environmental Impact Assessment Report
EU	European Union
FDP	Final Decommissioning Plan
HOB	Heat Only Boiler Plant
IAEA	International Atomic Energy Agency
IIDSF	Ignalina International Decommissioning Support Fund
INPP	Ignalina Nuclear Power Plant
INPP-DP	Ignalina NPP Decommissioning Project
INPP-DPMU	Ignalina NPP Decommissioning Project Management Unit
INPP-FDP	Ignalina NPP Final Decommissioning Plan
INPP-PDP	Ignalina NPP Preliminary Decommissioning Plan
ISFSF	Interim Spent Fuel Storage Facility
LLA	Long Lived Aerosol
RAW	Radioactive Waste
RFS	Reactor Final Shutdown
RPD	Radiation Protection Department
RSS	Rain Sewerage System
SAR	Safety Analysis Report
SB	Steam Boiler Plant
SF	Spent Fuel
SWMSF	Solid Waste Management and Storage Facility
TRU	Transuranics
VATESI	The State Nuclear Power Safety Inspectorate
WAC	Waste Acceptance Criteria

I Part. EIA Data and Results

Executive Summary

Ignalina NPP (INPP) decommissioning is to be considered as an economical activity for which performing an overall Environmental Impact Assessment (EIA) process is mandatory.

To comply with this requirement, and according the Lithuanian legislation, an EIA Programme and an EIA Report must be successively prepared and approved for projects for which an EIA is mandatory.

In the present case, the INPP decommissioning is split in several Decommissioning Projects (DPs). Each of these DPs is a process containing a scope, an identification of activities, an analysis of these activities that serve as input for programming activities, studying their safety related aspects and assessing their environmental impacts. Consequently, there is an EIA Report for each Decommissioning Project.

The EIA Programme identifies which issues should be addressed during the overall EIA process and adequately documented in detail in the EIA Report of each DP. It defines also the content of the necessary EIA Report.

The EIA Programme describes the INPP existing environment in a manner as this will be the baseline against which the environmental consequences of the decommissioning of INPP will be evaluated further in the EIA Reports.

In the EIA Programme, the decommissioning process is outlined in its main features focusing on environmental interfacing aspects; the reader is invited to refer to the document "INPP Final Decommissioning Plan" for further detailed information.

The EIA Programme **covers** the overall decommissioning process and forms the scoping assessment for EIA Reports of each main decommissioning phase as described in the Final Decommissioning Plan (FDP). Hence, it covers only buildings and installations to be decommissioned.

The present EIAP **does not cover** facilities to be erected that result from the implementation of the INPP Decommissioning (such as new energy production plants, new waste treatment and storage facilities to be erected), that are subject to their own EIA processes. However the present EIAP can serve as reference for these new projects, in their specific EIAs.

The main alternatives considered for the dismantling of INPP were Immediate Dismantling strategy and Deferred Dismantling strategy with 35 years of associated Safe Enclosure operation phase. During the comparison of those possible dismantling alternatives, EIA considerations did not come up with definitive arguments in favour or against one alternative or the other.

Having balanced the technical, financial, economical, social, political and environmental concerns of importance for INPP decommissioning (at local, regional and national levels), the Government of the Lithuanian Republic officially adopted the Immediate Dismantling strategy for INPP Unit 1 in November 2002.

Irrespective to the dismantling strategy, the most important aspects of INPP decommissioning can be summarized as follows:

1. INPP final shutdown will have socio-economic impacts at local and regional level due to dismissal of INPP employees from operational and maintenance activities. This will be partly balanced by the manpower needs linked to the performance of the decommissioning activities. Those aspects are out of the reach of INPP and its DPMU and are addressed separately by the concerned Lithuanian Authorities (among others the Ministry of Economy).

2. INPP final shutdown will require replacement of INPP electricity production capacity by possible new to be build organic fuel-fired plants. Associated environmental impacts are not to be covered by the INPP decommissioning EIA process but will be addressed by specific EIA processes related to the activities subject to licences, once the ways and means for alternative electricity production capacity will be decided and implemented.

3. INPP final shutdown will lead to ceasing the thermal heat discharges to the lake Drukshiai used as heat-sink for INPP. The functional and structural changes in lake Drukshiai biota are caused by thermal releases from INPP and chemical pollution, which main sources are waste waters of INPP and municipal sewerage, that are returned to Drukshiai lake, after being processed at the general household sewage water cleaning system (the former Skripki lake). After INPP Units final shutdown, the discharges of municipal sewerage will not change significantly (considering a status quo in the Visaginas population).

4. INPP Units staged shutdown will require securing availability of steam and hot water for both INPP decommissioning and Visaginas town needs. The new Heat Only Boiler (HOB) and Steam Boilers (SB) Stations to be implemented (which will be complemented by the renovated existing Heat Only Boilers) will contribute to the atmospheric pollution. The new HOB and SB plants will be constructed in strict compliance with the EU Council Directive 2001/80/EU of October 2001 related to the reduction of certain air polluting emissions from large combustion plants. Those plants were subject to an EIA Screening that concluded that environmental impact assessments of the proposed economic activities are not obligatory.

5. INPP decommissioning activities that will be realized in the contaminated areas of the installations are to be performed in tight enclosures kept under negative pressure with well identified and controlled outputs for dismantling waste streams, for sewages and exhaust air. It is expected that the radiological environmental impacts of INPP decommissioning activities will be contained to lower values than those relevant during operation of the Units.

6. Presently existing waste treatment and storage facilities that are intended for continued use along the INPP decommissioning are dully authorized. For waste treatment and storage facilities to be erected, specific EIA Programmes and Reports developed within relevant projects shall cover their environmental impacts; they will take into account pertinent elements of the present EIA Programme. The relevant inputs to the decommissioning EIA process will be taken into account.

7. Non-radiological environment impacts of INPP decommissioning activities will have also to be carefully analysed as they will lead to intensive dust, noise, waste production and require massive material transportation and storage.

The exhaustive and detailed Environmental Impact analysis of INPP final shutdown and dismantling and the associated findings will be provided in their respective EIA Report. The EIA Reports will also identify the measures required to prevent, minimise or mitigate the negative consequences of the decommissioning activities and to maximise associated positive aspects. The effects of those measures will be taken into account when assessing the residual impacts (those remaining even after the mitigation measures), which in their turn shall be demonstrated as being sustainable, in compliance with Lithuanian regulatory requirements and the ALARA-principle (As Low As Reasonably Achievable).

1 Introduction

The Seimas of the Republic of Lithuania approved the National Energy Strategy on 5 October 1999 (to be reviewed in 2004). One of the main elements of the National Energy Strategy is the plan for the decommissioning of Ignalina NPP.

In the Lithuanian Environmental Impact Assessment (EIA) process, the EIA Programme is the scoping phase during which are identified environmental impacts that are most likely to be significant and therefore require investigation during the EIA study (the result of which being an EIA Report).

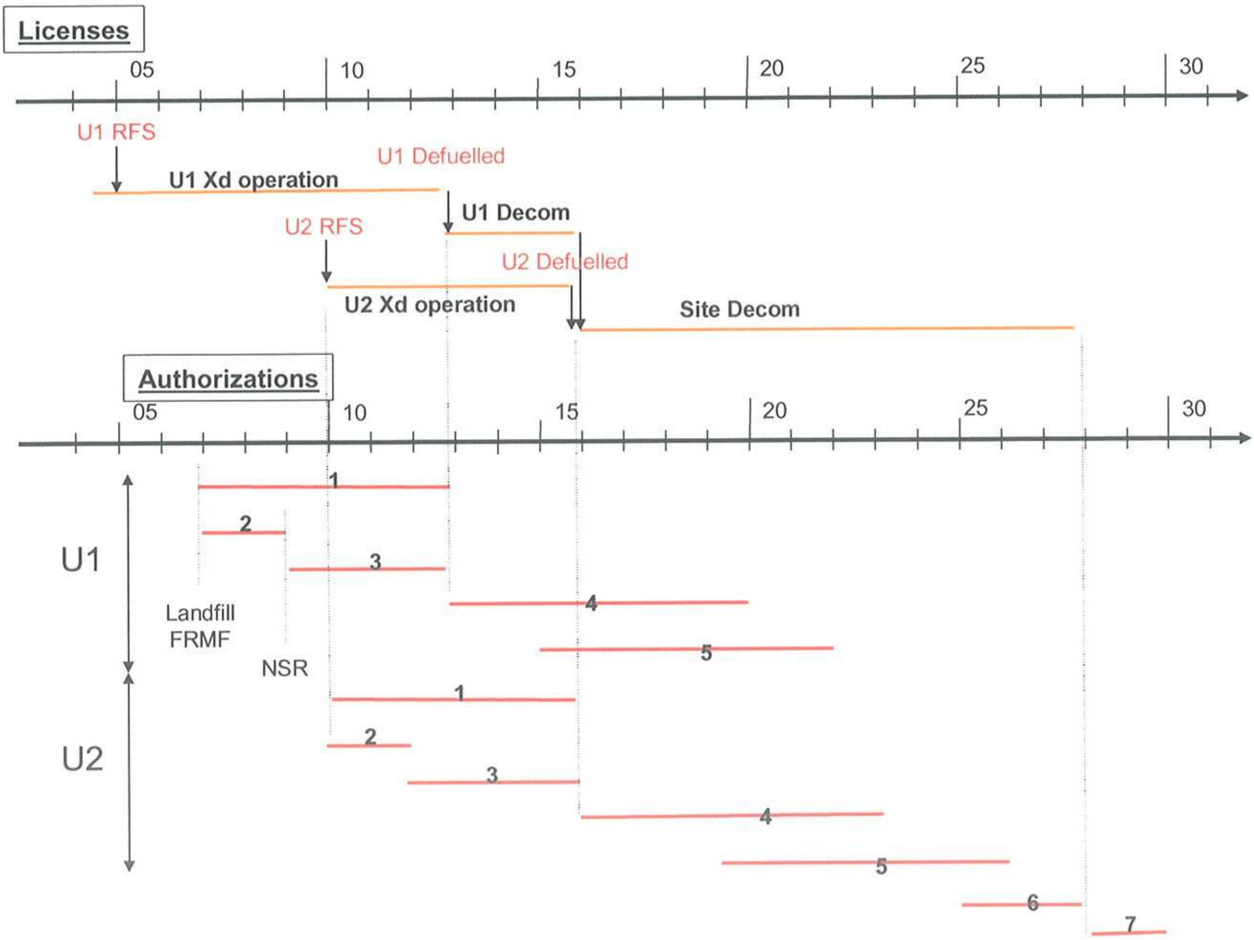
The EIA Programme is aimed at identifying the main issues and those issues perceived as being of importance in the eyes of the participants of the EIA process : the scope of the EIA is established during the preparation and ratification of the EIA Programme. An EIA report shall be established for each major stage of the INPP Decommissioning, as described in detail in the Final Decommissioning Plan (FDP, see Chapter 5): in the present case, the INPP decommissioning is split in several Decommissioning Projects (DPs). Each of these DPs is a process containing a scope, an identification of activities, an analysis of these activities that serve as input for programming activities, studying their safety related aspects and assessing their environmental impacts. The provisional schedule of projects is presented in Figure 1-1.
The organisation of the different DPs has been approved by VATESI in early 2004.

This EIA Programme was agreed to be considered together with (and integrated in) the INPP Final Decommissioning Plan. It is related only to direct INPP Units 1&2 decommissioning activities (such as defuelling, dismantling, decontamination, decommissioning waste management, etc.).

In support to the pre-decommissioning and decommissioning activities, several new installations will be implemented: radioactive waste retrieval, conditioning and interim storage; interim spent fuel storage, new heat and steam plants. Separate EIA Programmes and Reports will be prepared for these new installations within relevant projects, taking into account the present EIA Programme.

In short, the Project to be considered in the present EIA Programme (= the scope of the EIAP) covers mainly the decommissioning activities of INPP Units 1 & 2. A link is made with supporting activities. The EIA Programme defines the scope of the EIA Reports.

Figure 1-1. The INPP Decommissioning Licensing Strategy and Schedule



Legend of Figure 1-1

Licenses:

- U1RFS = Reactor Final Shutdown of Unit 1
- U1 Xd Operation = INPP Unit 1 Extended Operation License
- U2RFS = Reactor Final Shutdown of Unit 2
- U2 Xd Operation = INPP Unit 2 Extended Operation License
- U1 Decom = INPP Unit 1 Decommissioning License
- Site Decom = INPP Site Decommissioning License

Authorizations to be given under the licenses:

Under the INPP Unit 1 (U1) Extended Operation License:

1: D&D Project 1: Dismantling activities in the turbine hall G1

2: D&D Project 2: Dismantling activities, in the reactor building A1 and in buildings V1 and 117/1, allowed while fuel is still present in the reactor

3: D&D Project 3: Decommissioning activities, in the reactor building A1 and in building B1, allowed while fuel is still present in the pools of Unit 1

Under the INPP Unit 2 (U2) Extended Operation License:

1: D&D Project 1: Dismantling activities in the turbine hall G2

2: D&D Project 2: Dismantling activities, in the reactor building A2 and in buildings V2 and 117/2, allowed while fuel is still present in the reactor

3: D&D Project 3: Decommissioning activities, in the reactor building A2 and in building B2, allowed while fuel is still present in the pools of Unit 2

Under the INPP Unit 1 Decommissioning License:

4: D&D Project 4: Decommissioning activities in Buildings A1, B1, V1 (reactor excluded)
5: D&D Project 5: Dismantling of the Unit 1 reactor activated components
Under the INPP Site Decommissioning License:
4: D&D Project 4: Decommissioning activities in Buildings A2, B2, V2 (reactor excluded)
5: D&D Project 5: Dismantling of the Unit 2 reactor activated components
6: D&D Project 6: Dismantling activities in buildings D0, D1, D2, in the remaining buildings on the site, and removal of the Units 1 and 2 stacks
7: D&D Project 7: INPP Buildings conventional demolition, for which VATESI is no longer the competent administration, it becomes the Ministry of Environment

Standard methods are typically used to help in the identification of impacts (scoping) during EIA process. Having identified the scope of the EIA Reports and potential impacts of the Project, the various impacts to be investigated will be predicted in detail during EIA Report preparation, in terms of their deviation from baseline conditions, and then assessed. Individual, direct and indirect impacts to be assessed can be of different intensity, cover regions of various sizes, and last for different periods of time. These criteria will therefore be taken into account, as well as the extent -local, regional, national, international- the environmental impacts will be significant. According to these considerations, various areas should be chosen for various aspects of analysis. Territories of investigation are proposed in the Chapter 5 of the present EIAP.

In assessing the importance of impacts, comparison with environmental standards and / or (when no applicable standards exist) appropriate reference limit values will be made where impacts can be quantified (example: releases of radioactive liquid and radioactive effluents, doses to the critical members of the public). For more subjective impacts (e.g. landscape impacts) qualitative assessments can be undertaken.

The central element of NPP decommissioning is made up of the activities of defuelling, dismantling, decontamination and restoration. One result of these activities is the production of wastes of various types, including radioactive wastes. The environmental impacts of the dismantling option, and the particular methods and techniques selected for any particular project will be partly determined by the possibilities for management of these wastes.

The EIA Report that will assess in detail the impacts generated by the dismantling will be considered together with (and integrated in) the INPP Decommissioning Project. The EIA Report provides information on the likely environmental consequences of the proposed project and mitigation measures that can be implemented in order to decrease or cease environmental consequences, with a view to informing the overall decision-making process. The EIA process provides a tool for the discussion of alternatives and for communication and consultation with the public. Because the results of the EIA process may play a role in defining and modifying the proposed development it becomes an essential part of the overall INPP Decommissioning. The EIA concerns are therefore incorporated into the overall project from the initial stage of conceptual design, not as a subsequent exercise to be superimposed on it.

The early stages of the EIA process require efforts to be made to identify and involve the key stakeholders, including the general public. A fundamental requirement is that the outcomes from the EIA process are applied to the ongoing design activity, e.g. so that stakeholder views and concerns expressed during the preliminary stages can be taken into account by project designers. The nature of public involvement will be a dialogue, i.e. a two-way flow of information, with the overall objective of developing and implementing a decommissioning that carries broad public support.

The characteristics of the main environmental components in the area of the INPP site (Economic Activities, Fauna and Flora (and Biodiversity), Soil, Geology, Geography and Demographics, Air Quality, Hydrology, Climate, Landscape, Material Assets and Cultural Heritage, Waste Management, Infrastructure, etc) are presented in Chapter 3.

Purposes and needs related to INPP decommissioning, main technical and operational characteristics of the INPP decommissioning pertaining to the environmental impact issues are analysed in the Chapter 4.

Evaluation of decommissioning alternatives from the environmental impact point of view is presented in the Chapter 5. This Chapter outlines the potential Environmental Impacts of the Decommissioning. The elements of the Decommissioning, which will generate impacts, the areas of the environment (including socio-economic areas to some extent), which may be affected, and the nature and likely extent of these impacts are described there. The detailed assessment of particular potential Environmental Impacts will need to describe fully the methodologies employed together with the assumptions and uncertainties included within the assessments. This will be done in the EIA Reports.

Radiological Environmental Impact is analysed in the Chapter 6. Key environmental criteria, impact prediction and assessment methods, evaluations of possible accidents/major accidents and extreme cases (possible forecast of accidents, accident elimination plans, etc.), radiological exposure of the critical members[1] of the public, solid waste production, characteristics and conditioning techniques with respect to the final disposal, radiological consequences for the critical members of the public of the postulated incidents/accidents as well as impact minimization and mitigation measures are presented in this Chapter.

Non Radiological Environmental Impact is analysed in the Chapter 7. It includes thermal releases from the plant, non radioactive liquid waste release including toxic and harmful waste, non radioactive waste released to atmosphere, production of solid waste, emission of noise related to the decommissioning activities, possible transboundary aspects, occupational hazards and industrial safety, visual impact of INPP decommissioning on the buildings to be maintained, to be demolished and to be erected and other non radioactive environmental impacts.

Impact minimization and mitigation measures are analysed in the Chapter 8. Although these measures, and others that might be specified for a particular project, will be incorporated into the Ignalina NPP Decommissioning Project, they will also be defined in the EIA Report to a degree of detail sufficient to demonstrate not only that attempts have been made to carry them out but also that further improvements would not be justified.

Chapter 9 describes the environment monitoring programme to be implemented during the different phases of the INPP decommissioning.

[1] A critical group of the public is a group of members of the public which is reasonably homogenous with respect to its exposure for a given radiation source and given exposure pathway and is typical of individuals receiving the highest effective dose or equivalent dose (as applicable) by the given exposure pathway from given source.

2 EIA Legislation and Participants

2.1 Information about the Client and the Developer of EIA Programme

The Client (organizer) of the proposed economical activity is:

Organisation:	State Enterprise Ignalina Nuclear Power Plant
Address:	Ignalina NPP, LT-4761, Visaginas, Lithuania
Contact person:	Mr. Saulius Urbonavičius
Telephone:	+37038624466
Fax:	+37038624387
E-mail:	us@mail.iae.lt

The Provider of the EIA Programme is:

Institution:	INPP-DPMU
Address:	Ignalina NPP, LT-4761, Visaginas, Lithuania
Contact person:	Mr. Mike Tyrrell
Telephone:	+37061006427
Fax:	+37038624387
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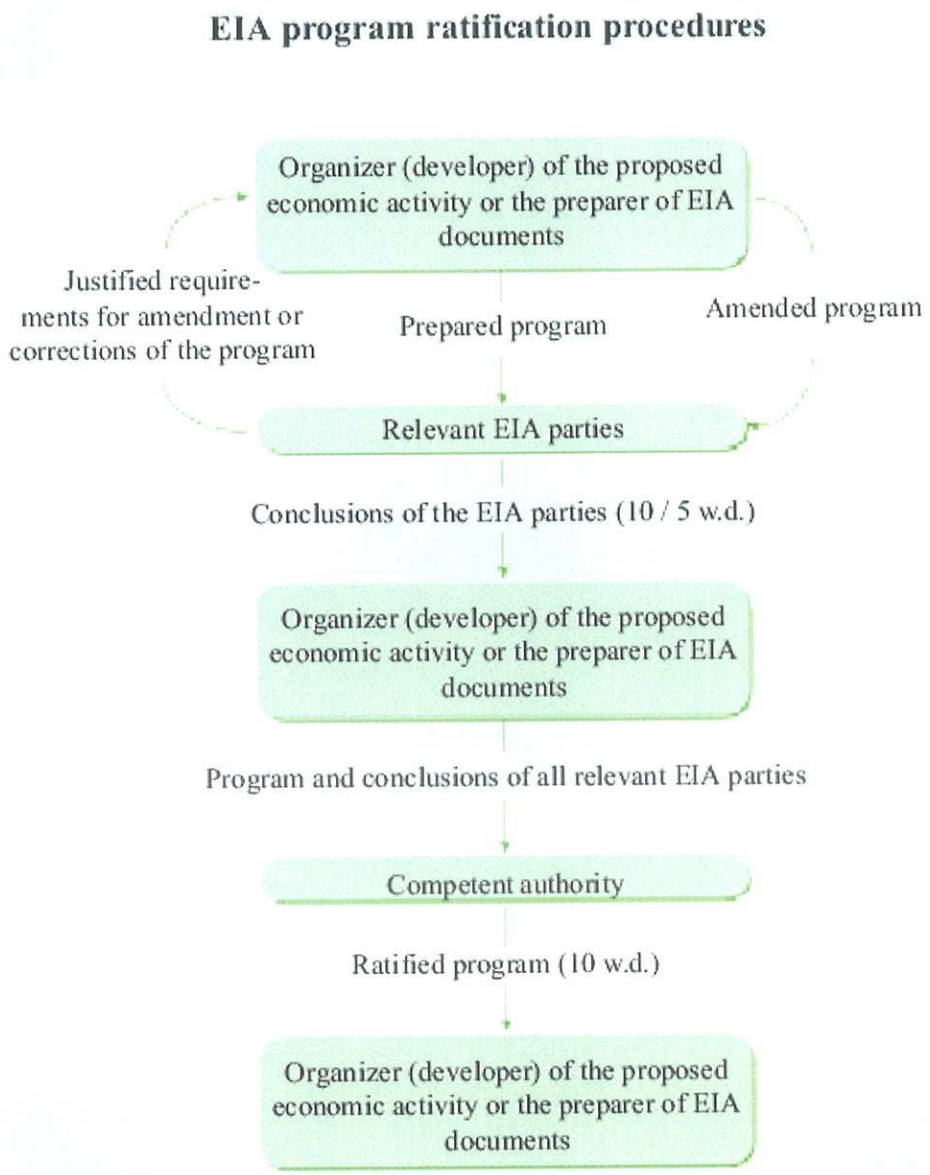
2.2 Applicable Lithuanian Legal Framework, the Applicable Standards and International Conventions

The INPP decommissioning Environmental Impact Assessment process will be carried out in accordance with Lithuanian legal framework as stated in "Law on Environmental Impact Assessment of the Proposed Economical Activities of Republic of Lithuania" [1] and in the corresponding regulatory documents [2, 3, 4, 5, 6]. The listed regulatory documents are in line with EIA regulations in the European Union, i.e. [7, 8], and with the European Commission guidelines [9].

Because INPP is located close to state borders of the Republic of Latvia and the Republic of Belarus, Transboundary Conventions [10] will be taken into account.

The following figure summarizes the general EIA programming process.

Figure 2-1. EIA program ratification procedure



The EIA Programme addresses the following elements:

- the determination of the contents of the EIA report, its scope and the topics that are investigated in it
- the main alternatives studied and an indication of their choice (BAT oriented);
- a description of the technical characteristics, technological process and materials planned to be used, as well as needed amount of natural resources and land use (*during the construction and operation phases*);
- a description of expected pollutants; a description of production, usage and processing of waste and other substances; a description of the components of the environment likely to be affected by the proposed economic activity;

- a **short** description of the likely environmental effects of the proposed economic activity taking into account potential interaction with other economic activities and making sure that only significant environmental impacts will be extensively investigated the report and that the report will include all information that is required to make a justified decision if the proposed economic activity by virtue of its nature and environmental impacts, may be carried out in the chosen site;
- a description of measures envisaged to avoid, reduce or offset negative environmental effects or to alleviate their consequences, as well as alternatives in the early stage of the planning of the economic activity;
- the identification of possible emergencies (accidents) and accident-avoidance and emergency measures;
- the methods that will be used to predict and assess the effects on the environment, to determine their significance and for their assessment;
- a plan to facilitate further procedures of project preparation and p lanning that shall be performed by the organizer (developer) of the proposed economic activity and to ensure that the relevant parties of the environmental impact assessment can participate in the process and provide their conclusions in proper time.

As such, the EIA Programme phase is essentially a Scoping process, which aims at:

- Identifying the most likely significant environmental impacts
- Identifying the most important issues for the participants in the EIA process (including the public)
- Determining the environmental impacts, viable alternatives and mitigation measures to be further analysed in the EIA Report
- Specifying the impact prediction and assessment methods, realistic boundaries for the assessment and key environmental criteria to be addressed

Once the EIAP is approved, the developer may launch the EIA Report process, which is :

- Made in accordance with the Programme
- That contains:
  - An exhaustive examination of all the issues provided for in the Programme
  - An analysis of the alternatives examined in the Programme
  - A plan for environmental monitoring
  - A summary
- To be amended according justified proposals made during a public hearing

In the present case, the INPP decommissioning is split into several Decommissioning Projects (DPs). Each of these DPs is a process containing a scope, an identification of activities to be carried out, an analysis of these activities that serve as input for their programming, the study of their safety related aspects and assessing their environmental impacts. **Therefore it is proposed to draft an EIA Report for each DP**, as the environmental assessment must be based on reliable and detailed information on the decommissioning project that will be available along with the progress in the INPP decommissioning. Each subsequent EIA Report shall take into account the results of the previous one, so that a "building up" EIA Report is created and maintained, with an up-to-date assessment of environmental impacts of the on-going decommissioning. By doing so, mitigation measures are more specific and adapted to the evolution of the Project, than in a single, general EIA for the whole INPP Decommissioning.
For further information on the overall planning and the sequence of the DPs, see the Final Decommissioning Plan (FDP).

2.3 The Participants of the EIA Drafting and Acceptance Process

The following organisations and individuals will be included in the EIA drafting and acceptance process:

- State Enterprise Ignalina Nuclear Power Plant;
- INPP-DPMU;
- Ministry of the Environment;
- VATESI;
- Ministry of Health Protection;
- Lithuanian Fire and Rescue Service;
- Utena Regional Environmental Protection Department of the Environment Ministry;
- Heritage protection department;
- Utena county administration;
- Visaginas municipal administration;
- EBRD[2];
- The public[3].

2.4 Functions and Responsibilities of the Different Organizations Involved in the NPP Operation and Decommissioning

a) INPP, as plant owner and legally in charge for the decommissioning, takes responsibility for the preparation of the EIA Programme and the EIA Reports, respectively. INPP submits both, the Programme and the Reports to the relevant parties for review and to the competent authority for ratification.

b) INPP-DPMU, as the developer of the EIA Programme and EIA Reports, identifies, characterises and assesses the potential environmental impacts of INPP decommissioning;

[2] EBRD was involved at the beginning of the INPP decommissioning EIA process when defining the table of content of EIA Programme and EIA Reports. Further involvement of EBRD will be at EIA Report stage by reviewing the document and making it electronically available on their website and by paper copy at EBRD premises in London and Vilnius.

[3] The public consultation process is described in section 2.5 hereafter. In addition, once the EIA Programme will be approved, the Ministry of Environment will ensure the required:

- Publicity among the interested parties (local residents, NGO's, trade Unions, ...);
- Transboundary contacts with neighbouring countries Latvia and Bielorussia.

c) The Lithuanian Ministry of Environment, as a competent authority, co-ordinates the EIA process and ratifies the EIA Programme and EIA Reports. It also examines the pleas of the public and conclusions issued by other relevant parties regarding the EIA Programme and the EIA Reports and accordingly issues a justified decision about the performance of the proposed economic activity;

d) VATESI, the Lithuanian Ministry of Health Protection, the Lithuanian Fire and Rescue Service, Utena Regional Environmental Protection Department of the Environment Ministry, Utena county administration, Heritage protection department, the Ignalina regional and the Visaginas municipal administrations, as relevant parties of the EIA with respect to their competence, examine the EIA documents and provide conclusions regarding the EIA Programme and the EIA Reports;

e) EBRD, as manager of IIDSF, will supervise the compliance of the EIA Process with the valid EU regulations;

f) Scientific Institutes are consulted to give advise on the EIA Programme and subsequent EIA Reports;

g) The public may provide substantiated comments and proposals regarding the potential environmental impacts of a proposed activity in accordance with the order stated in [5].

2.5 Public Consultation Process

The framework of public participation in EIA process is given in [5].

INPP, as responsible provider of the EIA documents, has informed the public by announcing information about the upcoming EIA on decommissioning in the national press and in the regional press of Visaginas, Ignalina and Zarasai in June 2002. No comments were received following this information of the public. See Part II of this EIA Programme.

After finalisation of the EIA Report, INPP will organise a public meeting and will invite the public through national and local press no later than 10 working days before the public meeting is planned to be commenced. INPP will register proposals of the public that are received in written form before or during this meeting, by using the form provided in [5]. Following this the preparer of the EIA documents will evaluate the public proposals using the form provided in [5] and will amend the EIA Report taking into account all reasonable and justified public proposals.

2.6 List of References

1. Law on Environmental Impact Assessment of the Proposed Economical Activities of Republic of Lithuania;

2. Regulations on preparation of the Environmental Impact Assessment programme and Report. Ministry of Environment, June 30, 2000, No. 262;

3. The order of investigating the Environmental Impact Assessment documents at the Ministry of Environment and subordinate institutions. Ministry of Environment, August 7, 2000, No. 333;

4. Guidelines on the quality control of the Environmental Impact Assessment of the proposed economic activity. Ministry of Environment, July 17, 2000, No. 305;

5. The order of informing the public and public participation in the process of Environmental Impact Assessment. Ministry of Environment, July 10, 2000, No. 277;

6. List of the Main Legal Acts Regulating Nuclear Power Safety in the Republic of Lithuania, VD-VP-01-2001;

7. Study on the Current Regulatory Status in the EU Member States and Applicant Countries concerning EIA for decommissioning of Nuclear Installations. Draft Final Report – Vol.2 Appendix 1-Guidelines for Undertaking an EIA of Proposals to Decommissioning a Nuclear Power Plant – EC Contract B4 – 3040/99/MAR/C2;

8. Commission Recommendation on the application of Article 37 of the Euratom Treaty (of 6 Dec. 1999). Annex 2;

9. Environmental Impact Assessment for the Decommissioning of Nuclear Installations. Final Report – Vol.2. Guidance for Undertaking an EIA of Proposals to Decommissioning a Nuclear Power Plant – EC Contract B4 – 3040/99/MAR/C2;

10. Convention on Environmental Impact Assessment in a Transboundary Context (ESPOO, 1991).

3 The Environmental baseline around the Ignalina NPP

3.1 Introduction

This chapter describes the characteristics of the environment in the area of the Ignalina NPP site.

"Environment" is considered in an EIA process as being "Geography and Demographics, Economic Activities, Climate, Hydrology, Fauna and Flora (and Biodiversity), Soil, Geology, Air Quality, Landscape, Material Assets and Cultural Heritage, Waste Management, Infrastructure".

The description of the environmental baseline must describe the environment as it exists prior to performance of the decommissioning project in sufficient detail for it to serve as a basis for assessment of the project's potential impacts [1]. The environment territory to be considered for description and impact assessment is the area of influence of the INPP Decommissioning activities. Therefore the territories to be considered are mainly located around the INPP, their extent being in function of the range of significant effects (air, water pollution, visual impact, radiological influence, etc.): in fact, one must consider a specific territory of assessment for each component of the environment.

This description is aimed at determining, in function of the environmental aspects of the project, which territory the EIA should cover and which environmental impacts have to be further investigated in the EIA Reports. In this perspective, the "existing environment" relates to the environmental baseline as it results from activities in the region up to 2003. One should bare in mind that the purpose of an EIA for a project covers foreseeable impacts from the project. It usually does not cover environmental impacts of past activities (except for licence renewal) or activities that do not relate to the present decommissioning project.

The Ignalina Nuclear Power Plant was built in the late seventies, and operates since 1983 (Unit 1) and 1987 (Unit 2).

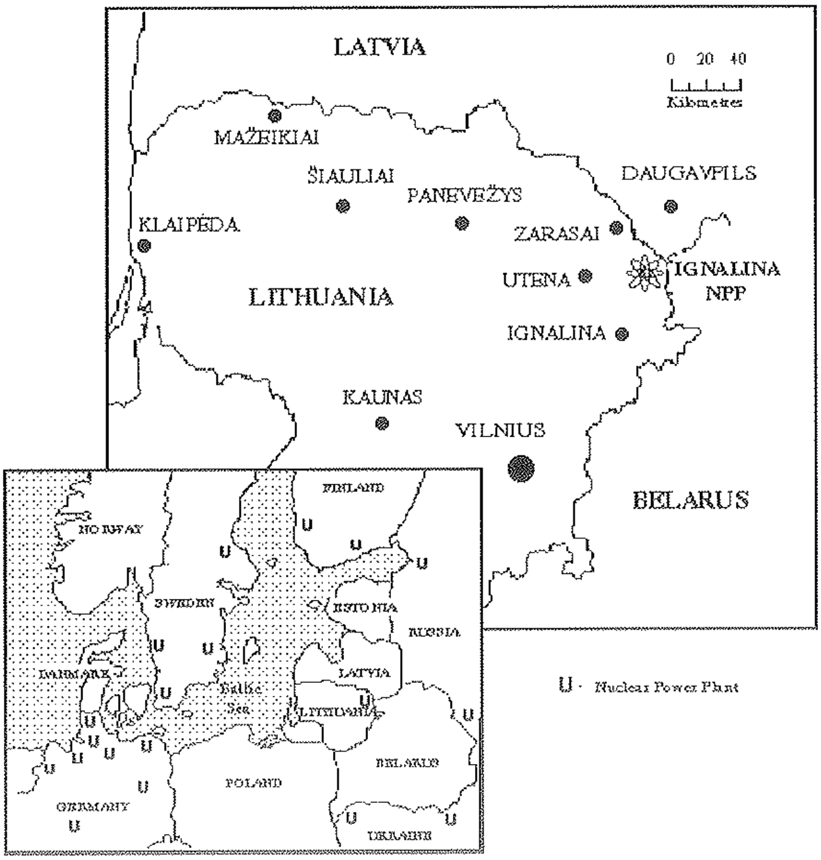
The site of the nuclear power plant covers an area of about 2644 ha. The buildings take up about 22 ha. The Ignalina NPP possesses two similar units of RBMK-1500 reactors. The main buildings of the plant are situated about 400-500 m from the banks of lake Drukshiai.

The EIA Report(s) shall focus on the environmental baseline on which the project considered presents potential significant impacts, on the basis of existing information and data that can be gathered without excessive costs or delays. The table of contents of the EIA Report will follow the EIAP table of contents and can be adapted if considered necessary (e.g. as described in [1]).

3.2 Geography and Demography

The Ignalina NPP is located in the north-eastern part of Lithuania, close to the borders of Belarus and Latvia. The plant is built on the southern shores of lake Drukshiai, 39 km from the town of Ignalina (see Figure 3-1).

Figure 3-1. Location of the Ignalina NPP (wide scale)



Following lakes and rivers are in the vicinity of the Ignalina NPP:

- lake Visaginas,
- lake Drukshiai,
- lake Apvardai and lake Alksnas, located respectively 8 km and 13 km to the south from the Ignalina NPP,
- lake Dysnai and lake Smalvas, located respectively 16 km to the south and 11 km to the west from the plant,
- river Daugava passes 30 km to the north of the Ignalina NPP.

Visaginas was part of the Ignalina district. Since 1995 the town of Visaginas is a separate self-governing unit (since 2003 : with expanded territory of 49.5 km²). The construction of the nuclear power plant has had a big impact on the demography in this region. In 1979 the total population of the Ignalina district was 37,800, then in 1989 it rose to 59,700, while the population in the countryside decreased from 21,600 to 18,200 [2].

The main cause of the increase of population in Ignalina district was the migration to Visaginas. The plant is located in an area free of activities in a radius of 3 km. The closest inhabitants are located at about 3.5 km south-west from the site.

Land use in the surrounding area is made of: lakes =15%, swamps = 15%, farming land = 40% and forests = about 30%.

Studies were carried out on the social evolution of the region and the socio-economic consequences of the INPP Decommissioning [see for example 3, 4].

The EIA Report(s) shall summarize the geographical context and the historical evolution of demography linked to the INPP and subsidiary activities that can be affected by the decommissioning.

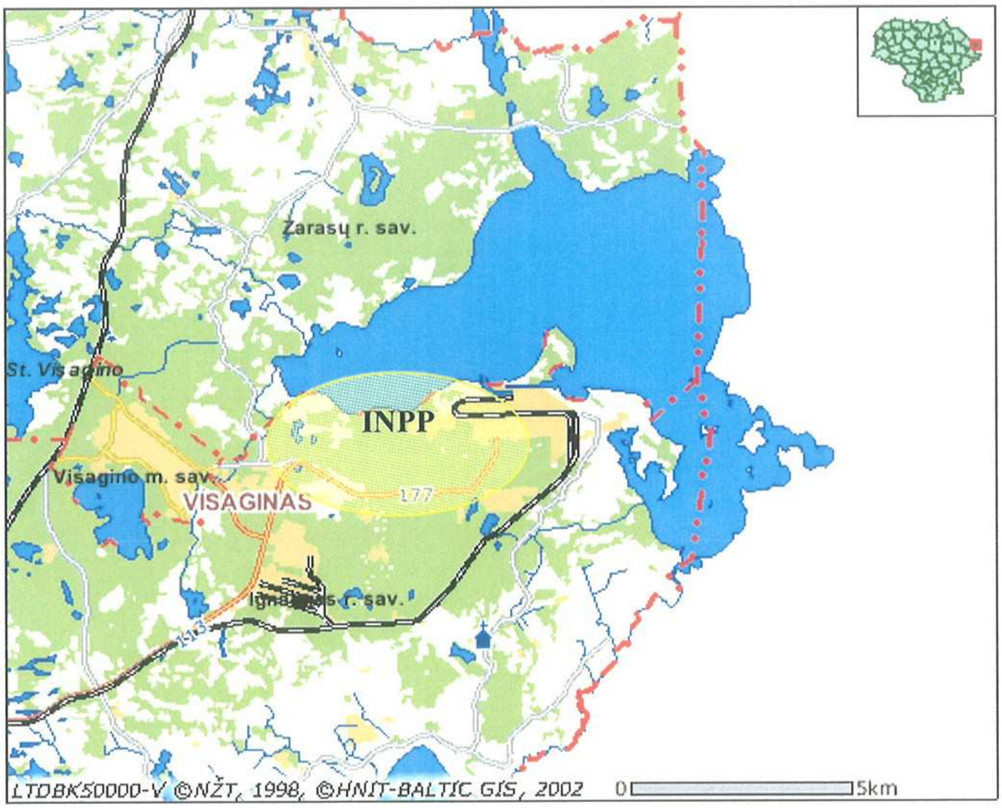
3.3 Social and economic issues

3.3.1 Population distribution

The distribution of population is important for nuclear activities, as potential radiological impacts may affect wide areas.

The nearest major cities to the plant are Vilnius at 130 km with about 550,000 inhabitants, and Daugavpils in Latvia at 30 km away with 126,000 inhabitants. The city of Visaginas, about 30,000 inhabitants and residence of the Ignalina nuclear power plant personnel, is located at 6 km from the plant (see Figure 3-2).

Figure 3-2. Location of the Ignalina NPP (local scale)



The main information about the population distribution in the region of 30 km is presented in Figure 3-3 and Figure 3-4 [5].

Figure 3-3. Population distribution (thousands)

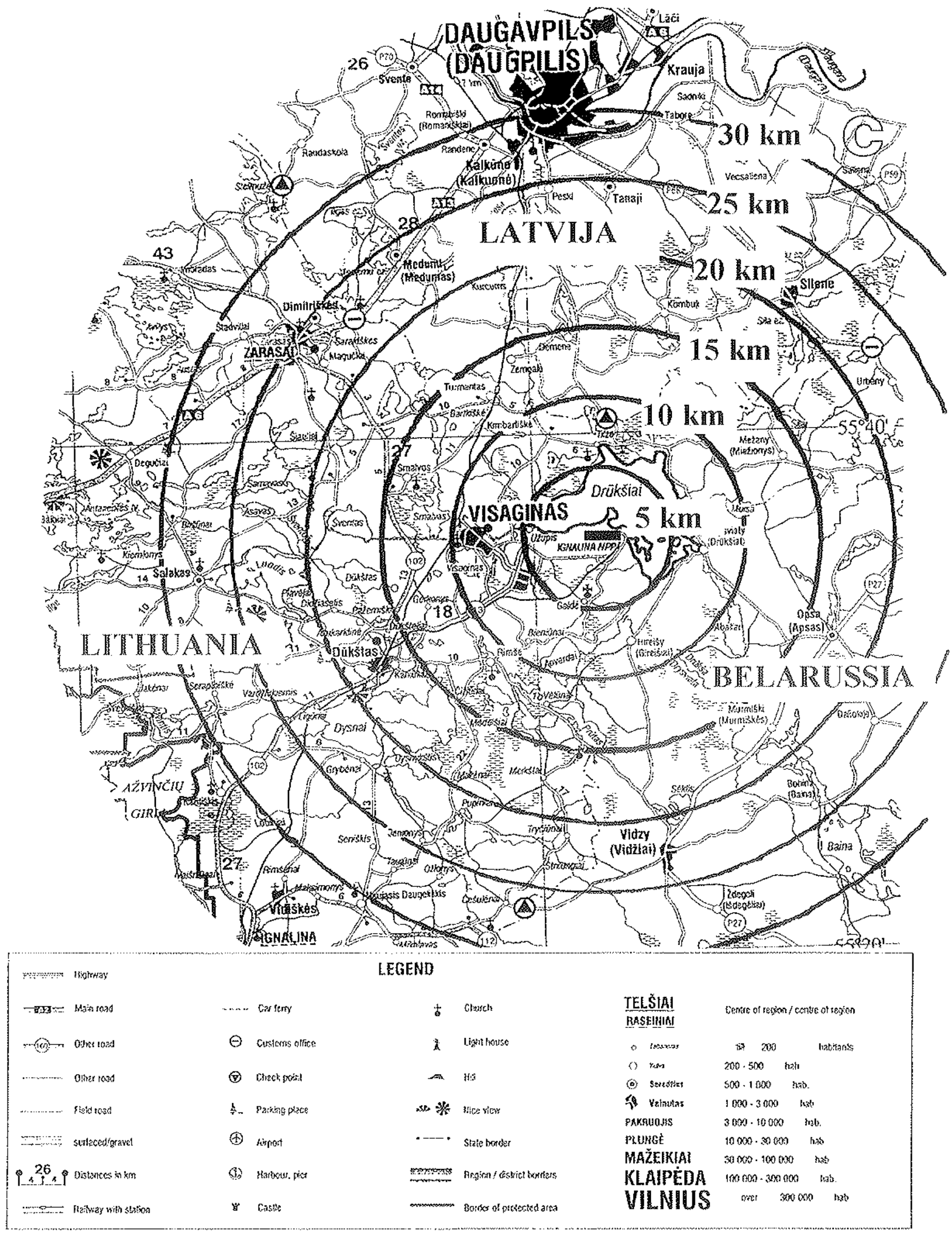
Direction of segment / Radius of circle	N	NE	E	SE	S	SW	W	NW	Amount of inhabitants	
									in the ring	in the circle
30 km	38.9	0.8	8.8	1.4	1.8	2.4	2.3	0.9	57,3	135.9
25 km	1.4	1.1	2.5	2.6	4.7	1.6	1.4	8.7	24.0	78.6
20 km	0.5	0.4	1.4	1.3	1.3	2.9	0.9	0.7	9.4	54.6
15 km	0.6	0.8	1.0	0.9	0.9	1.3	0.4	1.0	6.9	45.2
10 km	0.5	0.6	0.7	0.5	1.0	0.5	34.0	0.3	38.1	38.3
5 km	-	-	-	-	0.1	-	-	0.1	0.2	0.2
3 km	-	-	-	-	-	-	-	-	-	-
Amount of inhabitants in the segment	41.9	3.7	14.4	6.7	9.8	8.7	39	11.7	Total 135.9	

About 38 thousands of inhabitants of Daugavpils (Latvia) have to be included into the 30 km radius zone because 30% of territory of Daugavpils stretch at a distance from 27 to 30 km from INPP (Fig. 3.3). Within the 30 km radius the density of population is about 48 people/km^2. This is lower than the nominal density of population of 56.7 people/km^2 in Lithuania. In fact, population density in the INPP region is one of the lowest in Lithuania.

Apart the city of Visaginas itself, made essentially of multi-level buildings, there are some small villages in the vicinity of the plant, such as Mačyonis and Vyšniava.

Within the sanitary protected zone (established for emergency planning purposes, R = 3 km) there are neither farmsteads nor inhabitants.

Figure 3-4. Population distribution in 5, 10, 15, 20, 25 and 30 km zones [5]



3.3.2 Social aspects linked to the INPP

Ignalina NPP region encompasses the territories of three local governments: that of the town of Visaginas, as well as the territories of Ignalina and Zarasai districts. The region under consideration forms a part of Utena County. This is the territory within the protection zone of Ignalina Nuclear Power Plant (data of 2003):

- the municipality of Visaginas – 59 square kilometres, 30 thousand inhabitants
- the Ignalina district – 1 496 square kilometres, 23 thousand inhabitants
- theZarasai district – 1 334 square kilometres, 23 thousand inhabitants

As many as 2.3 per cent of the population of the country lives in this region. From the economic point of view it is an insufficiently developed region in Lithuania (the town of Visaginas makes the exception). Agriculture and forestry of low intensity dominate in the region (for example, the intensity of cattle breeding is about 1.4 times lower than on the average in Lithuania). No important minerals (with the exception of quartz sand) are found in the region. The turnover of the retail trade in the region is 1.5, and the volume of services is more than 2.5 times lower than on the average in the country.

The site was chosen near the railway line Leningrad – Vilnius – Kuznica, which was of paramount importance at the time of the Soviet regime. Currently this railway line is not too busy.

Construction of the town of Visaginas was started in 1975 as a settlement for the employees of Ignalina NPP. In 1983, when half of the first residential area of the town of Visaginas was built, a second residential area was begun to be built. In 1994 Visaginas was granted the status of town. Visaginas was built as a multi-storied town.

There seem to remain some social and cultural isolation from other parts of the country, due to Visaginas localization in the country and leading to some self-isolation [6].

The socio-economical issues were addressed already by several authors. Some references are given, see [3], [7] and [8].

The EIA Report(s) shall take into account the population distribution and evolution with time (growth, movements and main activities –e.g. expressed as in the primary, secondary or tertiary sector) in the influenced areas, while assessing impacts from the decommissioning activities. Studies carried out on the social-economic aspects of the INPP Decommissioning shall be taken as reference.

3.4 Economic Activities and Infrastructures

3.4.1 Transport

The nearest highway passes 12 km to the west of the Ignalina NPP. This highway joins the city of Ignalina with those of Zarasai, Dukstas and has an exit to the highway connecting Kaunas - St. Petersburg. The entrance of the main road from the Ignalina NPP to the highway is near the town of Dukstas (see Figure 3-5). The extension of the road from Ignalina NPP to Dukstas is about 20 km.

Figure 3-5. Road and railway network

The main railroad line Vilnius - St. Petersburg passes 9 km to the west of the Ignalina NPP. A single track extends from Visaginas to Dukstas.

3.4.2 Economic activities

Within the 10 km radius (see Figure 3-4) there is no large commercial retail centre. At the 5 km distance to the southwest direction with respect to Ignalina NPP there is the former construction-industrial establishment. In the vicinity of this establishment there are, among others, the training centre of frontier guard and the fire protection service.
Neither chemical nor oil process industries exist in the vicinity of the Ignalina NPP.

3.4.3 Amenities

Water supply of INPP is made by Drukshiai lake which provides for service water. Drinking water used on the site is produced from underground water wells of Visaginas.
In the vicinity of the INPP, there is a treatment plant for sewage water. It is located one km to the south from the Ignalina NPP. Household effluents from INPP and Visaginas arrive in this plant. Next to it are ponds used as biological treatment. The treated (yet containing pollution) water is released in the Skripki lake, which is nowadays considered as a secondary source of organic

contamination of water which is then released in the Lake Drukshiai through the Vosyliškiai streamlet.

The EIA Report(s) shall describe the nearby economic activities and infrastructures that may be significantly affected by the project.

3.5 Climate and Air Quality

Lithuanian climate is characterised by middle climatic zone. The INPP region concerned is located in the continental East Europe climate area. In comparison with other Lithuanian areas, this area is marked by big variations of air temperature over the year, colder and longer winters with abundant snow cover, and warmer, but shorter summers. Average precipitation is also higher.

The most useful climatic and meteorological data used for EIA Programme are based on measurements performed by Ignalina NPP meteorological station, located approximately at a distance of 5.5 km to the west of INPP site.

3.5.1 Wind Regime

Western and southern winds predominate. The strongest winds have western and south - east directions. The average annual wind speed is 3.5 m/s, and maximal (gust) speeds can reach 28 m/s. No-wind conditions are observed on the average of 6 % of the time and last no more than one day (24 hours) in the summer, and no more than two days in the winter [9].

Wind rose at INPP region is presented in Figure 3-6.

Figure 3-6. Wind rose (average values for the 1997 – 2000 period) reported on the road map

Prevailing winds are western and southern.
The strongest winds occur in these directions as well [10].

The average annual wind speed is about 3 – 3.5 m/s. Winds with speeds below 7 m/s dominate – recorded events constitute more than 90% of the total number of observations. Recorded events with wind speeds above 10 m/s are not frequent – less than 10 events per year [10].

3.5.2 Hurricanes and Spouts [11, 12]

Spouts in the vicinity of the Ignalina NPP do not exceed class F-2 according to Fujita classification [13].

The following data is normally used for calculations:

a) maximal rotation speed of the spout wall is 105 m/s;
b) pressure differential between centre of the funnel and the fringe region of the spout is 135 kPa.

3.5.3 Air Temperature

Monthly average temperatures in the INPP region are given in the Figure 3-7.

Figure 3-7. Monthly averaged air temperatures (°C) for the INPP region

Meteorological station and observation period	Month (s)												01 - 12
	01	02	03	04	05	06	07	08	09	10	11	12	Average
Dukstas, 1961 - 1990	-6.8	-5.9	-1.9	5.2	12.1	15.5	16.8	15.9	11.2	6.2	0.9	-3.8	5.5
Utena, 1961 - 1990	-6.0	-5.2	-1.2	5.5	12.2	15.6	16.8	15.9	11.4	6.6	1.4	-3.2	5.8
INPP, 1988 - 1999	-2.5	-2.2	0.3	6.6	12.4	16.5	17.9	16.5	11.3	6.0	-0.1	-3.1	6.6
INPP, 2000 - 2003	-3.5	-3.5	0.7	7.5	12.9	15.5	19.6	17.3	11.8	6.2	2.0	-4.2	6.9

The last decade (1988-1999) monthly averaged air temperature variation in the warm season (April-October) and the beginning of the cold season (November-December) does not differ from long-term (1961-1990) observations. However the second half of the cold season (January-March) during the last decade was warmer and the average air temperature for this period is higher by 4.3-2.3 °C. The average monthly temperatures on the period 2000 – 2003 seem to indicate a slight increase from March to November. The seven successive warm winters (1988/1989 to 1994/1995) are identified as a unique climatic phenomenon for Lithuania [14].

3.5.4 Atmospheric Precipitation

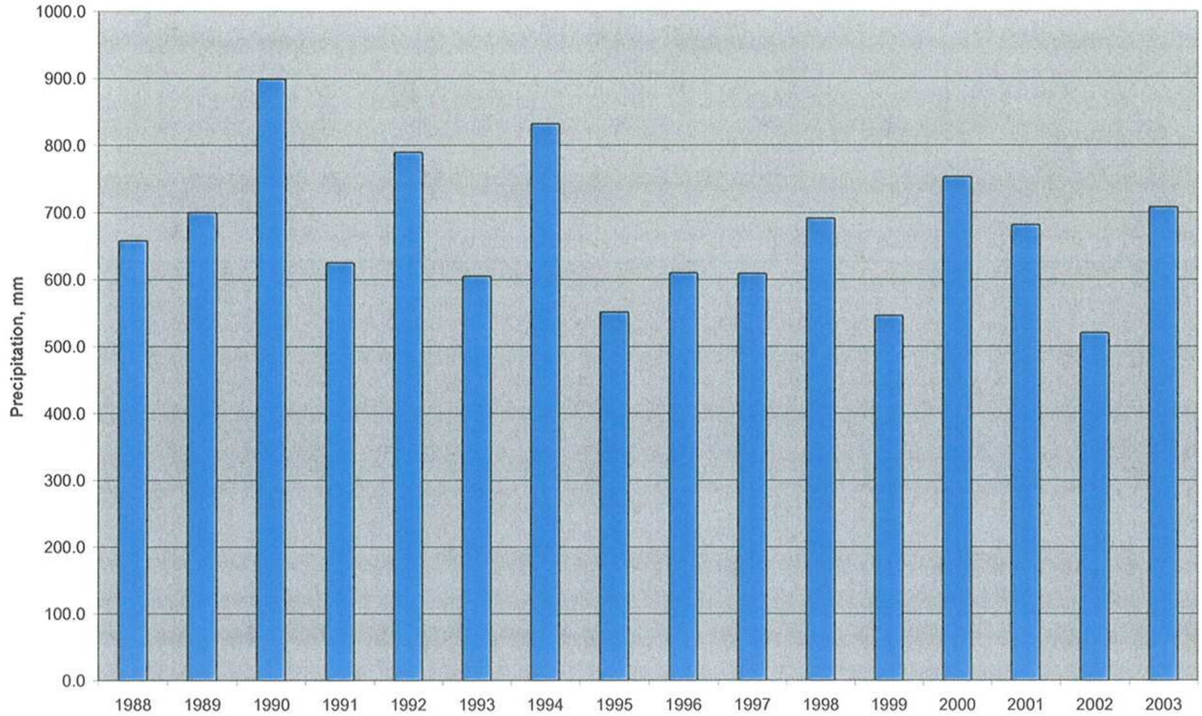
Monthly averages of precipitation for the INPP region in the long-term observation period (1961-1990) [15], pre-operational monitoring period [10] and last years (1988-2003) period [16–22] are presented in Figure 3-8. The last decade annual precipitation and average annual variation of precipitation monthly averages for INPP meteorological station are presented also in Figure 3-9.

Figure 3-8. Monthly averaged precipitation (mm) for the INPP region

Meteorological station and observation period	Month (s)												Total for months		
	01	02	03	04	05	06	07	08	09	10	11	12	01-12	11-03	04-10
Dukstas, 1961-1990	32	25	28	43	58	69	75	66	64	50	42	40	592	167	425
Utena, 1961-1990	39	31	37	47	53	69	73	75	66	50	57	53	650	217	433
Zarasai, 1961-1990	45	36	39	42	59	72	75	66	66	55	60	56	671	236	435
INPP, 1988 - 1999	41	41	46	33	55	84	60	64	70	66	58	57	676	244	432
INPP, 2000 - 2003	43	43	39	46	57	79	92	72	32	59	59	44	665	229	437

Results in the period 2000-2003 at INPP do not show significant differences in precipitations compared to the 1988-2000 period.

Figure 3-9. Annual precipitation at INPP for 1988-2003



Average annual precipitation in the INPP region is about 650 mm. As shown on Figure 3-9, there are important variations from year to year in the region. About 65 % of all precipitation takes place during the warm period of the year (April-October), and about 35 % during the cold period (November-March). Minimum precipitation occurs in January-March (40 mm per month) and maximum in June-August (70 mm per month).

Recorded extremes (maximum per-day precipitation for individual months) are presented in Figure 3-10. Average per-day maximum for the INPP region is about 50 - 60 mm.

Figure 3-10. Maximum-recorded per-day precipitation (mm) for individual months

Meteorological station	Months												Max
	01	02	03	04	05	06	07	08	09	10	11	12	
Dukstas	18.8	13.2	23.4	19.2	52.4	42.4	28.6	48.8	35.2	30.7	20.2	11.4	52.4
	1989	1976	1979	1985	1980	1987	1987	1979	1978	1974	1983	1988	
Utena	17.1	18.1	24.2	34.7	45	99.0	54.2	67.6	37.9	41.6	36.2	23.0	99.0
	1958	1950	1930	1979	1982	1950	1960	1948	1953	1974	1960	1945	
Zarasai	22	21.6	34.3	40.7	55.9	52.6	55.5	82.7	60.1	44.3	46.8	23.7	82.7
	1959	1957	1979	1985	1955	1980	1955	1962	1950	1974	1930	1925	

The snow cover in the region is present for about 120 days per year. Permanent snow cover usually starts in the second half of December and ends in the second half of March. Average snow cover thickness is about 40 cm [23], [10].

3.5.5 Fog and Oscillation of Atmospheric Impurities

In the Ignalina NPP area, fog can be observed any day of the year. The average number of days with fog is 45 and the maximum – 62 days. Fog absorbs different impurity (noxious gases, smoke, dust) and, combined with high humidity, increases corrosion intensity, reducing the distance of visibility and impeding transportation [24].

The maximum dusting is observed in May, and the minimum – in December. The oscillations of the total sulphur compounds in the atmosphere have the following annual distribution: the lowest values are observed in the summer and autumn, and highest ones – during the cold period of the year [24].

3.5.6 Ground Freezing

The freezing of the ground usually begins in the first part of December and lasts to the middle of April. The average depth of the frost line reaches about 50 cm, and with a maximum extending to 110 cm depending on the composition of the ground and its humidity.

3.5.7 Microclimate

The development of a microclimate is linked to the presence of the lake, whose evaporation can increase local humidity which can causes more fog episodes and increase the air temperature locally. A near shore microclimate is reported [25].

As the temperature of the lake increased with thermal releases from the INPP, with subsequent increase in evaporation and local temperature, it is possible that the microclimate linked to the lake has changed since the INPP operation.

3.5.8 Air Quality

As the region is not industrialised and because of its low population density, the air quality is supposed to be good, in terms of classic air pollutants (dust, sulphur dioxide, nitrous oxides, heavy metals, etc.). Radiological issues are presented in section 3.11.

No air quality measurements for classic pollutants are carried out by INPP or other bodies in the vicinity. Hence, INPP does measure atmospheric effluents from its Heat Only Boiler (used as support for the heating of installations). Measures indicate that authorized limits (set up for carbon monoxide, nitrogen oxides, dust and sulphur dioxide) are respected.

The EIA Report(s) shall take into account the meteorological data, as exposed here above, and complete them as far as it is relevant for impact assessment.

3.6 Site Hydrology

The lake Drukshiai serves as a natural water reservoir and constitutes the heat sink for INPP. It is the biggest lake in Lithuania, lying on the northeast border between Lithuania and Byelorussia at an altitude 141.6 m above the Baltic Sea level. The catchment basin of the lake is located near the foot of the east slope of the Baltic ridge, which is bordered by Svencionys upland from the south and by Latgal upland from the north. Such watershed location influences its hydrologic regime [4].

Total area of the lake, including nine islands, is about 49 km^2 (6.7 km^2 in Belarus, 42.3 km^2 in Lithuania) [26]. This area can be subject to changes, as the level of the lake can be influenced by the hydro-engineering complex of a former hydroelectric power plant located on river Prorva [9]; observations in the past showed that the area was about 45 km^2 [27].

The maximum depth of the lake is 33.3 m, with an average of 7.6 m, and a dominant value of 12 m.The length of the lake is 14.3 km, the maximum width is 5.3 km, and the perimeter is 60.5 km. Drainage area of the lake is small, only 613 km^2 [28]. Total volume of water is about 369x10^6 m^3. Some characteristics of the lake are given in Figure 3-11.

Figure 3-11. Main data of hydrologic and hydrothermal regime of water cooling reservoir of the INPP [24]

1.	Drukshiai lake drainage area, km^2	613
2.	Water area of lake at NAL, km^2	49
3.	Multiyear flow rate of water from lake, m^3/s	3.19
4.	Multiyear discharge from lake, m^3/year	100.5x10^6
5.	Multiyear quantity of atmospheric precipitation, mm/year	638
6.	Multiyear value of evaporation from water surface, mm/year	600
7.	Normal affluent level of lake, m	141.6
8.	Minimum permissible lake level, m	140.7
9.	Regulating volume of lake, m^3	43x10^6
10.	Permissible drop of lake level, m	0.90

The hydrographical schematic of lake Drukshiai is presented in Figure 3-12.

There are a lot of lakes in the area of the Ignalina NPP. Their total area of water surface is 48.4 km^2 (without lake Drukshiai). The net density of rivers is 0.3 km/km^2.

Nearly all surface discharge (74%) flows to the south part of lake Drukshiai by way of two rivers Ricianka and Drukse, the rest of the surface discharge goes to the west ridge from the tributaries of the rivers Smalve and Gulbine. Discharge from the lake goes by way of the river Prorva through the south ridge of the water reservoir. Warm coolant water of the NPP is discharged into the same place. So, the most intensive water exchange takes place in the south part of the lake.

The water regime of lake Drukshiai is formed by correlation of natural and anthropogenic factors. The main natural factors are the climatic conditions of the region: precipitations onto the surface of the water reservoir and natural evaporation from lake surface and watershed. The anthropogenic factors, which have an influence on INPP operation, are the control of discharge by the hydro-engineering complex and water circulation in the lake because of the needs for cooling of the NPP equipment.

A sketch of anthropogenic water releases is presented in Figure 3-13.

Figure 3-12. Configuration of lake Drukshiai and location of the Ignalina NPP [29]

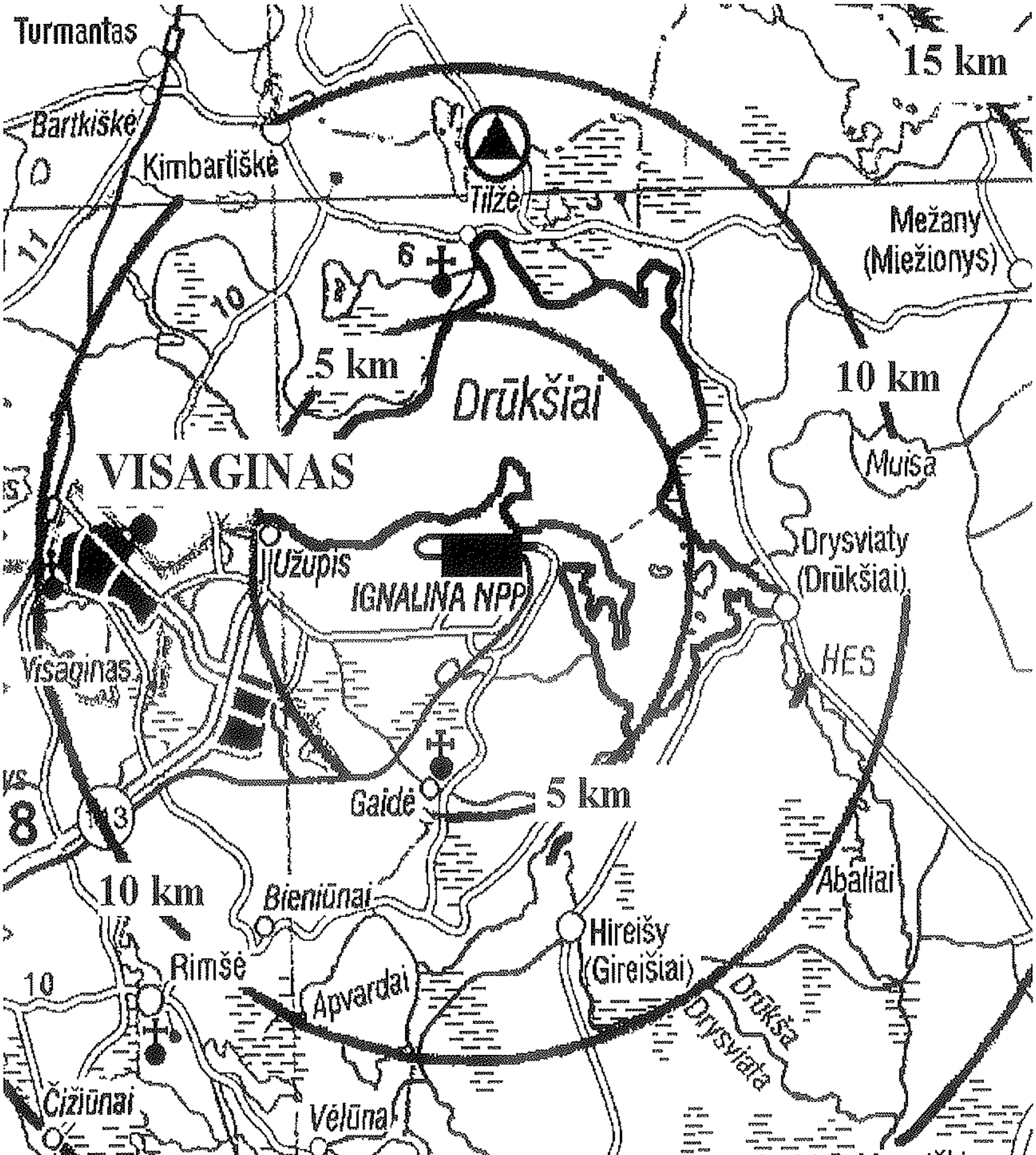
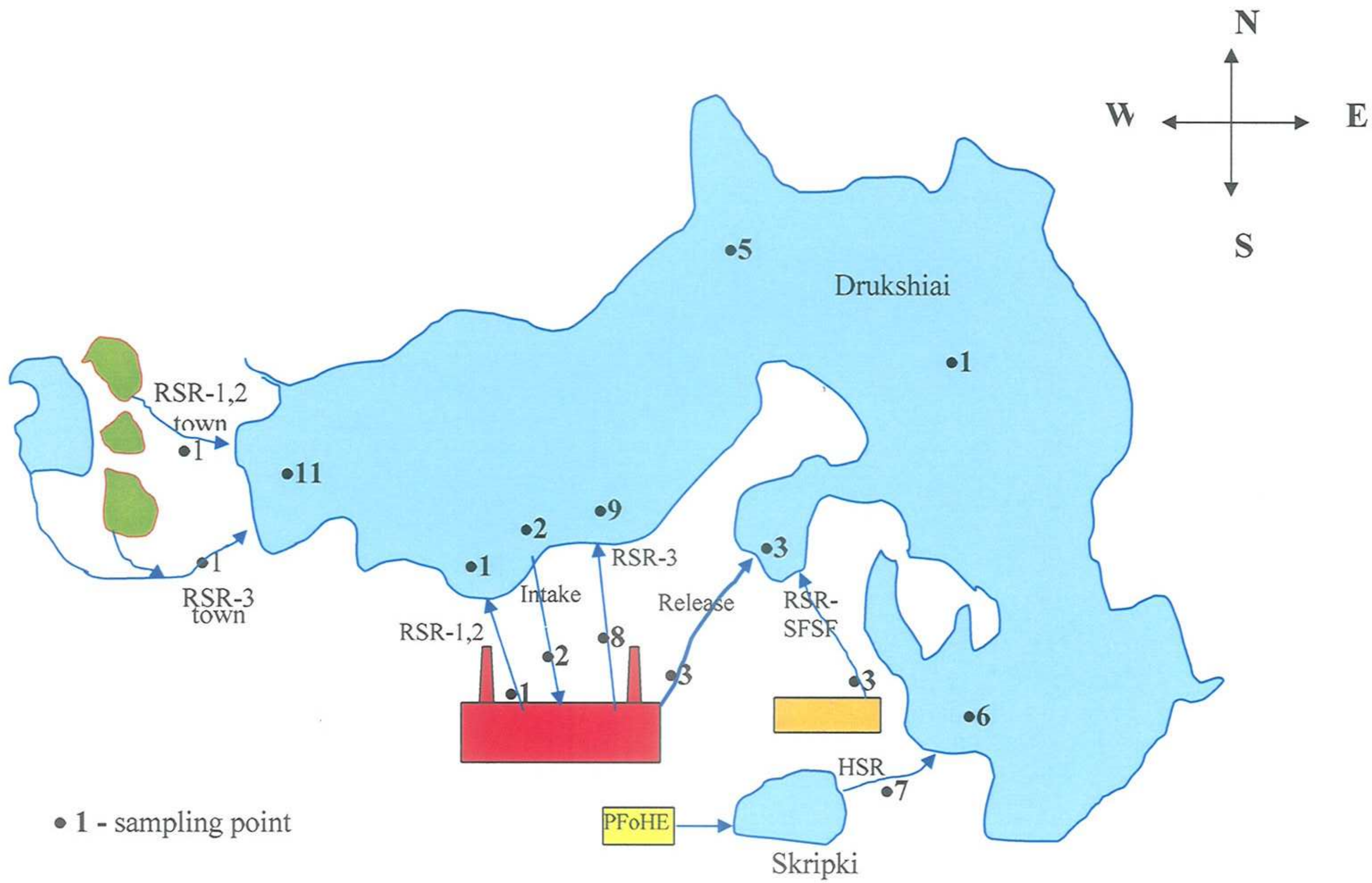


Figure 3-13. Inputs of cooling water and household wastewaters in Lake Drukshiai



Legend:

RSR – rain sewage release, Intake - cooling water intake, Release - cooling water release, PFoHE - purification facility of the household effluents of INPP and Visaginas, HSS – household sewerage release after biological treatment, SFSF - Spent Fuel Storage Facility.

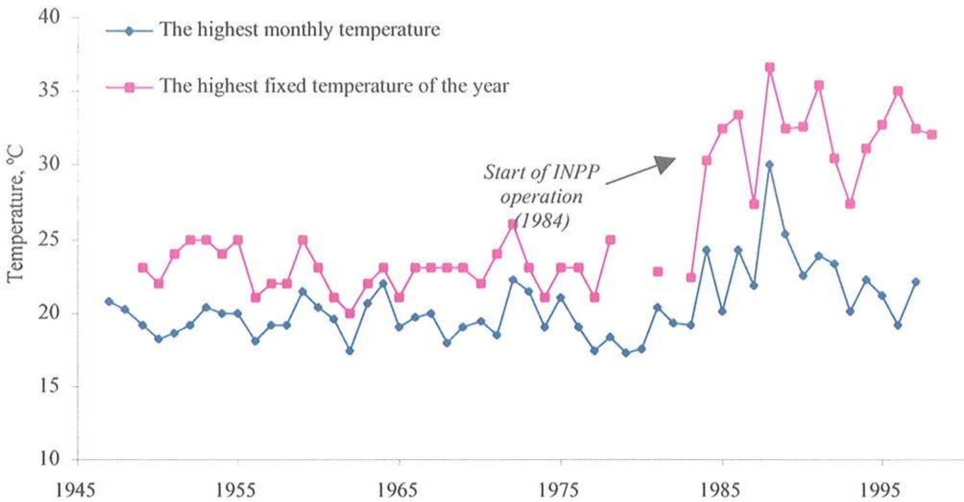
The Ignalina NPP operation has no visible influence on the amount of atmospheric precipitation and on the water inflow into the lake. The NPP power has an influence on the evaporation from the water surface. The evaporation processes from the water surface of lake Drukshiai are very important. The net losses of water from the lake depend on the amount of evaporation. In conditions of limited water resources, this amount can limit the power of the NPP. For this reason the natural and additional evaporation from the water surface are monitored carefully.

3.6.1 Thermal aspects

During the operation of one unit, the heat load to the lake amounts to 2770 MW at the maximum allowed power of 4200 MW(th), and 5540 MW during the operation of two units.

The hydrothermal regime of lake Drukshiai has changed when it became the heat sink for the Ignalina NPP. The Figure 3-14 shows the influence of the INPP operation on highest temperatures. Discharged effluents raise the average monthly temperature of the lake by 3-4 degrees. The distribution of the overheated water is uneven, and it depends on the particular conditions.

Figure 3-14. Surface water temperatures of lake Drukshiai before and after Ignalina NPP started to operate



Despite this, the thermal releases remain acceptable in comparison with the Lithuanian standard "Norms of admissible warming up of the lake Drukshiai and temperature monitoring technique", which amounts to 24.5 °C : investigations on water temperature in July – August 1993-1997 showed that the mean temperature in upper surface water layers was 23°C [6].

Since the time when the first turbine started operation, the NPP cooling water began adding heat to the lake, this intensified the evaporation from the water surface. With the increase of power of the Ignalina NPP and the gradually rising water temperature of the lake, there were additional losses of water by evaporation [30].

The other side of the effect of Ignalina NPP to the amount of evaporation from the surface of lake Drukshiai is the lengthening of the active evaporation time, because of the extended period during which no ice forms on lake Drukshiai. During the cold period the evaporation process persists in the zone, which is adjacent to the mouth of discharge channel.

During the entire season of the year 1984 evaporation was 36×10^6 m^3, in 1985 - 48×10^6 m^3, in 1986 - 45.7×10^6 m^3, in 1987 - 50.8×10^6 m^3, and in 1988 - 52.2×10^6 m^3. These values exceeded the multi-year average values of evaporation (600 mm) by 14 % in the year 1984 during the operation of one turbine of Ignalina NPP with power of 750 MW, and by 72 % when the power was increased to 2500 MW [30].

3.6.2 Chemical and biological aspects

As presented on Figure 3-13, the Lake Drukshiai receives household wastewater from INPP and Visaginas.

INPP's household sewerage system is intended for organized collection of household water and subsequent cleaning at purification facility of the household effluents of INPP and Visaginas (owned by the Municipality of Visaginas), where an former lake (Lake Skripki) is used as a biological pond for additional purification. After that those effluents are released to the Lake Drukshiai.

Multi-year average (1991-2000) indicators of the chemical composition of Drukshiai water were compared with multi-year average values of concentration in the start-up period (1979-1983) and in post-commissioning period (1984-1990). The results are summarized in Figure 3-15. According to the summary results of the Drukshiai chemical composition investigation in INPP pre-start up and commissioning periods the following changes occurred:

- The total water mineralization increased;
- The concentration of phosphorus and dissolved orthophosphates, total composition of organic matter, biological oxygen demand (BOD) for its biochemical oxidation increased;
- The concentration of chlorides, sodium, potassium, sulphates, magnesium increased.

Figure 3-15. Multi-year average long-term values of the chemical composition of Drukshiai water [6]

No.	Indicators	1979-1983	1984-1988	1989-1993	1994-1997
1.	pH	8.2	8.0	8.4	8.1
2.	Ammonium nitrogen (mgNH_4^+/l)	0.22	0.35	0.21	0.20
3.	Nitrites (mgNO_2/l)	0.001	0.002	0.002	0.003
4.	Nitrates (mgNO_3/l)	0.05	0.06	0.07	0.08
5.	Total nitrogen (mgN/l)	1.29	1.53	1.14	1.26
6.	Dissolved orthophosphates (mg/l)	0.002	0.005	0.015	0.018
7.	Total phosphorus (mgP/l)	0.061	0.050	0.072	0.146
9.	Permanganate oxidation (mgO/l)	5.5	6.1	6.9	11.0
10.	BOD (mgO_2/l)	1.34	1.63	1.97	1.75
11.	Chlorides (mgCl^-/l)	8.8	9.9	10.7	9.8
12.	Sulphates (mgSO_4^{2-}/l)	8.9	12.6	18.6	19.3
13.	Calcium (mgCa^{2+}/l)	39.3	35.8	36.8	35.8
14.	Magnesium (mgMg^{2+}/l)	10.0	10.9	12.9	13.8

15.	Sodium (mgNa$^+$/l)	4.6	6.3	7.0	6.9
16.	Potassium (mgK$^+$/l)	1.8	2.7	3.0	2.9
17.	Dissolved carbonates (mgHCO$_3^-$/l)	160.5	150.4	157.6	159.4
18.	Dissolved oxygen (%saturation)	100	100	106	105
19.	Total Dissolved Salts (mg/l)	233.9	228.6	246.6	247.9

These changes of the lake Drukshiai chemical composition were caused by:

- the increased evaporation of water due to the water warming up,
- the release of secondary pollutions to Drukshiai from the pond of additional biological purification of sanitary wastewater,
- the discharge of neutralization effluents from the demineralization process (regeneration of demineralised water production lines), containing sulphates (from sulphuric acid) and sodium (from soda)
- the input of effluents of Visaginas sewerage system,
- the discharge of biogenous components from agricultural facilities to the lake.

The increased temperature of the lake and the subsequent decrease of cold water volume and transparency, had an influence on the colour of the water, showing the progressive tendency to stimulate acceleration of eutrophication of the Lake Drukshiai, with an increase in the amount of thin sedimentary materials settling (in thickness and area). The lake changed in 20 years (period 1979-1999) from mesotrophic to almost eutrophic type lake; the most polluted area is in the south-east part of the lake [6].

Following a survey made by the Institutes of Botany and Geography, recommendations were made to optimize the neutralization processes at INPP, so that the releases of sulphates and sodium could be reduced.

The EIA Report(s) shall take into account the monitoring data (and other pertinent data if existing) in order to highlight the evolution of water quality. The evolution from the INPP start-up could indicate how water quality can evolve from now on, with the units' shutdowns.

3.7 Geological Characteristics and Seismology, Hydrogeology

3.7.1 Geological characteristics

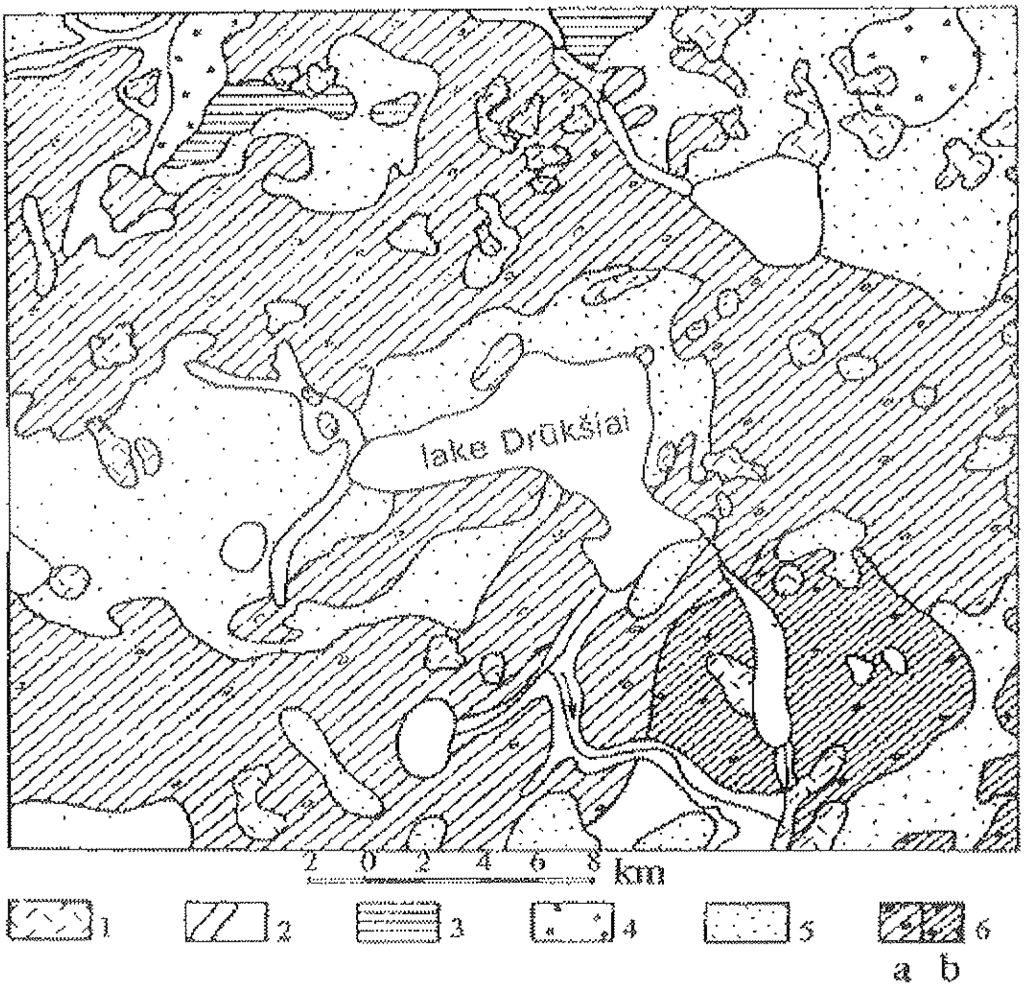
Geological, tectonic and hydrogeological conditions considerably vary in Lithuania. Especially high heterogeneity of genesis and lithological composition of the Quaternary deposits is reflected in drastic changes both in vertical and lateral distribution of sediments.

The surface of the Ignalina NPP area is rough. Their absolute elevation-marks change from 150 m to 180 m and more. At the surface exist glacial Quaternary sediments within a depth from 60 to 200 m, which are supported from below by Pre-Quaternary, Devonian, Silurian, Ordovician, Cambrian and Upper Proterozoic sediment variety. At the depth 700-750 m exist imbedded metamorphic and Crystal sediments of Upper Proterozoic and Archei.

In the area of Ignalina NPP the surface sediments are very inhomogeneous. They were formed during the retreat of the last glacier, as results of different glacial and water-glacial processes. Later on, alluvial, marsh and lake-sediments were formed.

The lithological structure, the filtration and engineering-geological properties of separate genetic types of surface sediments are not equal. Most prevalent, are the permeable water-glacial sediments, which are located in direct proximity of lake Drukshiai and the Ignalina NPP (see Figure 3-16). All surface sediments contain underground water, which range in depths from 0.2 to 7 m. The marsh, lake-marsh, lake-glacial and water-glacial sediments are located near the surface and at the level of the building foundations and other constructions. By lithological classification, this is peat, sand, gravel, sandy soil, sandy loam and clay [24].

Figure 3-16. Glacial accretions of the ground-cover in the Ignalina NPP area



1 - swampy accretions (peat, slimy sand), 2 - alluvial accretions (sand, gravel, pebble, sandy soil), 3 - limno-glacial accretions (clay, alevrit, sand), 4 - fluvi-glacial accretions (sand, gravel, pebble), 5 - water - glacial accretions of local formations (sand, gravel, pebble, sandy soil), 6 - glucagon accretions of local formations (sandy soil, sandy loam) of late (a) and early (b) stage of last glacier.

The complexity of engineering-geological conditions of the platform in question consists of:

a) Heterogeneity of grounds;

b) Availability of weak grounds, especially, peat;

c) Availability of numerous cradles, lenses and interbeds in the sand-gravel sediments;

d) Availability of swamps.

All these factors have an influence to the settlement of buildings and constructions. The deformation of the split slabs can be considerable-from 50 to 1000 mm – and can be highly irregular. This is of importance for new constructions to be made as support systems for the INPP Decommissioning. This is out of the scope of the present INPP Decommissioning EIA process, as specific EIA processes will be carried out for these support systems (Interim Storage Facility for Spent Fuel, new Heat Only Boiler, etc.).

The EIA Report(s) shall take into account the local geological context. Recommendations shall be made in order totake the geological context into account while carrying out the decommissioning works.

3.7.2 Seismology

The Ignalina NPP is located in the area of the East-European platform, on the joint connection of two large structure elements: Baltic syncline and Mazur-Belarus anticline. Therefore, the crystal bedding and sediment beds have got fissures induced by tectonic system's cracks. The area of the Ignalina NPP is situated within the limits of the Daugavpils seismic zone. The zone is encountered by the isoseismal line that indicates the intensity of the seismic events (earthquakes) of 7 grades (according the MSK-64 scale).

The EIA Report(s) shall take into account the risks associated to seism for the stability and safe operation of activities programmed in the INPP Decommissioning. Recommendations shall be made in terms of alert and emergency organization.

3.7.3 Hydrogeology

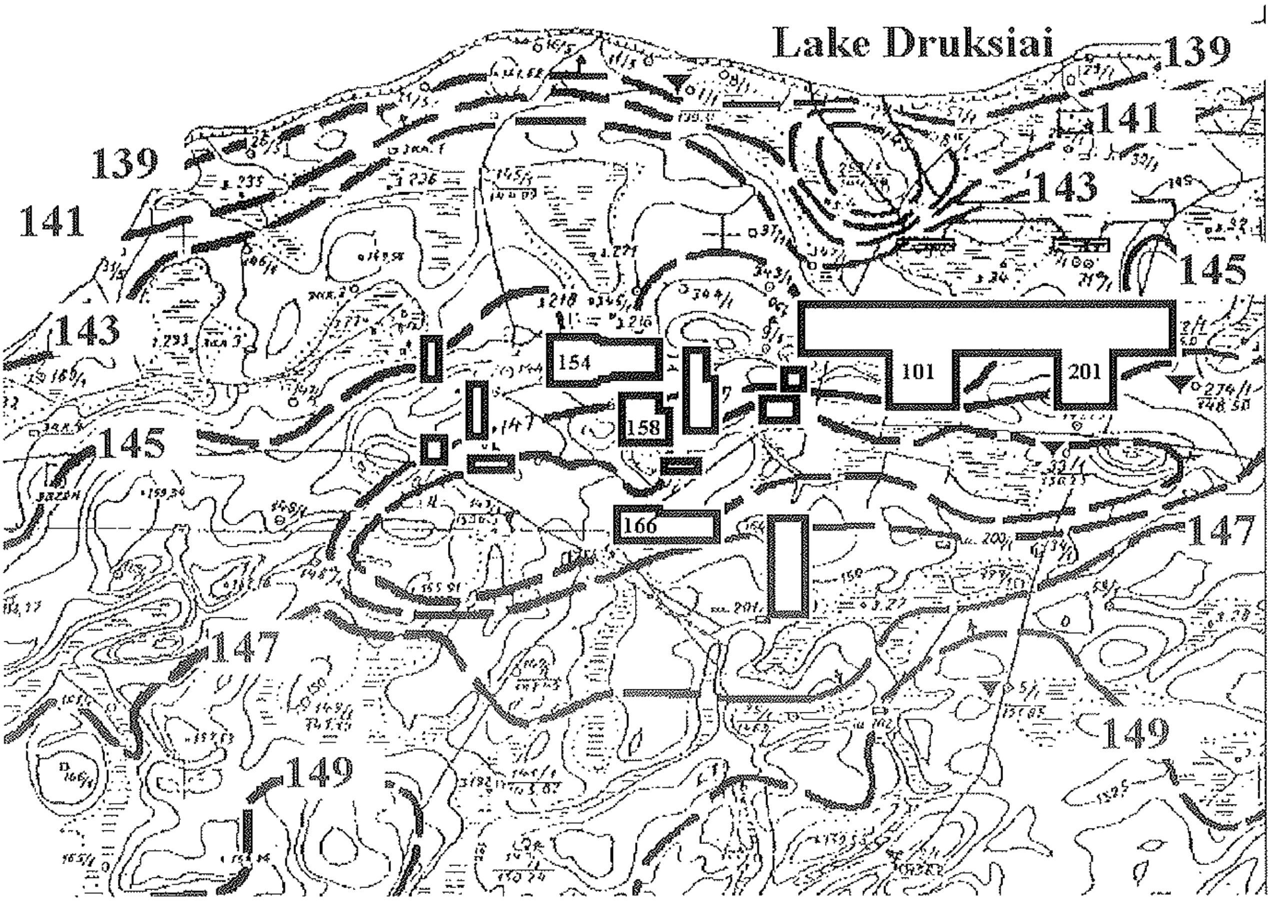
The area of INPP is in the recharge area of the Baltic artesian basin. The Quaternary aquifer complex contains one unconfined and six confined intertill aquifers. Thickness of unsaturated zone varies from several centimetres to thirty meters. Unsaturated zone is lithologicaly composed from clay loam and sandy loam, sand, clay, peat and silt.

The construction and operation of the Ignalina NPP essentially widen the spectrum of technogenic influence on the geologic environment. The character and scales of the consequences depends on the geological situation: filtration and capacitive properties of its variety and from drainage conditions of underground aquifer. From this point of view the territory of Ignalina NPP is located in unfavourable conditions. The depth of aeration zone is from 1-2 m to 5-8 m and is insufficiently safe to protect the underground waters. It is composed of fine sands, the filtration coefficient of which is 5-20 m/day, the water-yield coefficient is 0.05-0.35, and for sandy loam, the filtration coefficient of which is 0.01-2 m/day, the water-yield coefficient is 0.001-0.1 [24].

The groundwater level in boreholes 10 m deep, which were established during the investigation of the site in 1973, was only 0.75-1.75 m below the soil surface. The groundwater flow of upper water-bearing horizons is directed to the north and northeast towards lake Drukshiai (see Figure 3-17). The relief of the site was changed in the process of smoothing away during the construction of Ignalina

NPP. The swampy accretions (peat, slimy sand) were shovelled away, the relief was made even and large amount of ground and gravel was transported into the site. This is the main reason for which the groundwater level is slightly deeper now than in 1973. Rainwater drainage and other systems constructed in the site are another reason for this [29].

Figure 3-17. Schematic chart of absolute groundwater levels of the site in 1973 (before construction of INPP)



The circulation of surface and underground water linked to Lake Drukshiai is as follows :

- Outflow of an average of 3.4 m³/s into the river Prorva,
- Inflow or rivers Rycanka, Smalva and Gulbine,
- A lot of aquifers are present (up to 20, based on lithologic-genetic and stratigraphic criteria), with exchanges of groundwater vertically (up to a 250 m thickness) through the Quaternary and Upper-Middle-Devonian formations,
- Lateral exchanges with other groundwater catchments,
- Intake and release of cooling water for the operation of INPP,
- Outflow of underground water to surface water,
- Extraction of water in the Visaginas town waterwork (that also feeds the INPP with drinking water), that reduces underground flows in the rivers of about 10% (considering an extraction of 25 000 m³/day); the used water comes back into the Lake; in case of intensive extraction of underground water, it was shown that Lake Drukshiai feeds groundwater aquifers, at a very slow inflow rate (0.1 to 0.7 m³/s) and a vertical velocity of 0.1 to 0.5 m per year [31].

These considerations are important for the prognosis of the water circulation after RFS of Unit 1 then of Unit 2.

This is also to be taken into account for new facilities to be build (for the assessment of radionuclides transport within groundwater); let us remind that these issues are out of scope of the present EIA process.

The EIA Report(s) shall develop the hydrogeological context and take into account the risks of pollution and instability during the decommissioning works, associated to the small depth of underground water. Recommendations shall be made in terms of aquifer protection and works environmental management.

3.7.4 Radioactivity in the soil

Anthropogenic nuclide content in the soil of INPP region is determined mainly by presence of ^{137}Cs and ^{134}Cs (=not considering naturally existing nuclides): in the year 2000, the average concentration in the region of nuclides in the soil was 6.7 Bq/kg. The total average concentration of nuclides (considering also naturally existing ones) was the same year about 700 Bq/kg [19]. Therefore, the soil in the region of INPP presents only little technogenic contamination compared to natural radioactivity. Moreover, the radiocesium background is also due to the Chernobyl accident fallout [6]. Some observations indicate local anomalies of radionuclides activities in soil near the INPP, caused by the leakage from sanitary wastewater sewerage.

The general conclusion based on the radiological investigations in the INPP region [19] is that radiological conditions in the region are determined by large by natural background and operation of INPP has insignificant effect (less than 1%). The same result is expected after INPP Units final shutdown.

The EIA Report(s) shall determine the expected evolution of radioactivity in the soil during all phases of INPP decommissioning and recommend appropriate measures to avoid contamination.

3.8 Fauna and Flora

3.8.1 Introduction

Under this paragraph must be considered local surface and lake habitats, as both are influenced by INPP operation and decommissioning.

The main causes that can modify lake ecosystems are:
- Thermal releases from the INPP,
- Radioactive releases from the INPP,
- Other inputs, such as the municipal waste water or other activities' waste waters.

Since 1979, when the construction of Ignalina NPP started, a group of specialists from Lithuanian research and academic institutions began to investigate both the lake Drukshiai and the neighbouring area. The investigations were aimed not only at monitoring the environmental consequences of Ignalina NPP operation but also at forecasting changes of the ecosystems [6].

The hydrochemical monitoring of lake Drukshiai was started in 1979. Pollution of this water basin with municipal waste water from town Visaginas began even earlier. Thermal pollution began in 1984 and it accelerated the processes of chemical pollution. In consequence to it, some essential changes took place in lake water between 1984-1997. The complex pollution of lake Drukshiai was the main reason of its trophic status changes : during 20 years it has changed from mesotrophic to almost eutrophic type lake. The changes of the annual mean of the N_{total}/P_{total}

ratio from 21:1 (1983) to 8:1 (1997) show hydrochemical corroboration of eutrophication. In the prestarting period of Ignalina NPP operation the situation of pollution of lake Drukshiai with organic matter was low. It is medium at present.

For what concerns radionuclides accumulation in biota, the Lithuanian State Research carried out in the period 1993-1997 [6] indicates, for the Lake Drukshiai, that:

- Bottom sediments reflect better permanent integral radioecological state of the lake system,
- ^{137}Cs is the main radionuclide found in the sediments (together with ^{134}Cs, ^{54}Mn, ^{60}Co, ^{90}Sr, presenting less activity),
- the radioecological situation of the lake is not stable, depending on sources of radionuclides getting into the lake and their quantity, which is changing constantly as a result of thermal and chemical pollution which disturbs biological processes of radionuclide migration and changes their distribution in the ecosystem,
- the largest amounts of radionuclides as products of INPP get into the lake with heated water and industrial-rain sewerage outflows,
- samplings of $^{239,\ 240}Pu$ in sediments and water plants indicated some bioaccumulation though the activities measured remain by far lower than those of ^{137}Cs, which the main significant radionuclide to be considered.

As a conclusion, it was determined that the source of ^{137}Cs in plants is the atmosphere and in most cases it was related to the global fallout.

For what concerns terrestrial habitats, a large part of the lake Drukshiai and some territories (a part of the Smalvos hydrographical protected territory and two areas along the Drukša river) are proposed as Natura 2000 zone (see Figure 3-18). Other such zones are also proposed (not yet approved by EU Commission at this stage), but they are located far from INPP (the Smalvos landscape protected territory – at a bout 10 km from INPP, and the Pusnies protected territory – at about 12 km from the INPP).

The proposed Drukshiai Natura territory covers 3 612,33 ha, in which the various habitats are described in the Figure 3-19. Species of ornithological importance are:

- As qualifying species: the Bittern (*Botaurus stellaris*),
- As additional Annex I species: *Gavia arctica*, *Circus aeruginosus*, *Porzana porzana*, *P.parva*, *Chlidonias niger*, *Luscinia svecica*,
- As of national importance: 18 breeding species; *Phalacrocorax carbo*.

The threats mentioned are the overgrowing of the islands present on the lake, predation and recreational developments.

Figure 3-18. Natura 2000 proposed by the Lithuanian Government to the European Commission (perimeters in red)

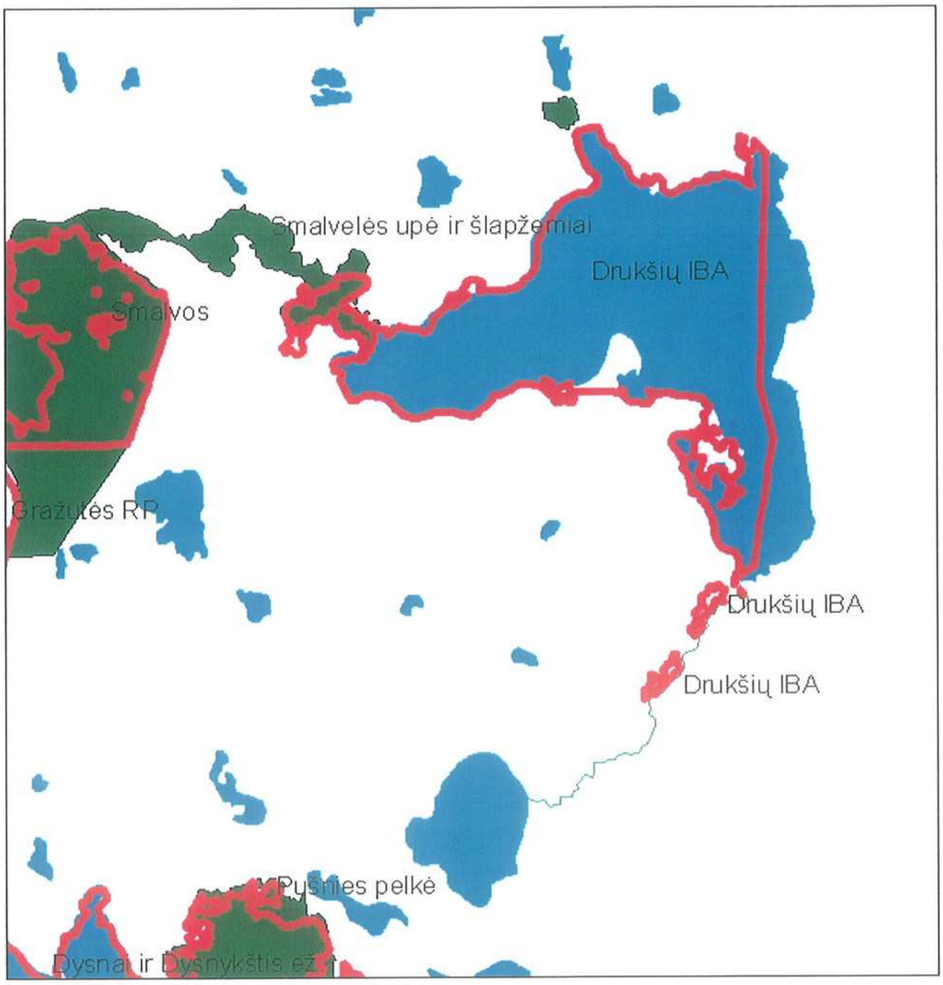


Figure 3-19. Habitats in the Drukshiai Natura 2000 Territory

Corine Code	Land cover	ha	%
2.1.1.	Non irrigated arable land	10.87	0.30
2.4.2.	Complex cultivation patterns	7.75	0.21
2.4.3.	Land principally occupied by agriculture, with significant areas of natural vegetation	26.79	0.74
3.1.1.	Broad leaved-forest	17.92	0.50
3.1.3.	Mixed forest	34.68	0.96
3.2.4.	Transitional woodland-scrub	69.02	1.91
4.1.1.	Inland marshes	4.63	0.13
5.1.2.	Water bodies	3440.66	95.24

3.8.2 Lake habitats

According to the complex hydrobiological investigations on lake Drukshiai about the great changes in planktonic organism community, tendencies of those changes in different ecological zones were evaluated in 1993-1997 [6]. The normal seasonal succession of planktonic organisms' abundance and biomass became undetermined because of anthropogenic impact.

The amount of species of most dominant planktonic organisms in 1993-1997 decreased 2-3 times in comparison with that before Ignalina NPP operation: phytoplankton – from 116 to 40-50, zooplankton – from 233 to 139. The amount of benthic algae species in littoral zone was 215.

The primary production of phytoplankton in lake Drukshiai increased from 22-50 mgC/m^3/day in 1993 to 470-590 mgC/m^3/day in 1997. The highest intensity of primary production (1290 mgC/m^3/day) was determined in the south-eastern part of the lake, eutrophicated by Visaginas town municipal waste waters. The amount of chlorophyll "a" increased as well and reached 70-113 mkg/l in 1996-1997. There is a large scale fluctuation in amino acids and organic acids material, indicating instability in the ecosystem.

69 water macrophyte species were found during the investigations of lake Drukshiai in 1996-1997. Among them 58 *Angiospermae*, 8 *Charophyta*, 2 *Bryophyta* and 1 *Sporophyta* species were listed. 16 species were not found in this lake earlier.

Stripes of helophytes (presented by *Phragmiterum australis, Scirpetum lacustris*), potameids (*Potamogetonetum lucentis*, *Potamogetonetum perfoliati*, *Potamogetonetum friesii* and *Ceratophylletum demersi*) and limneids (*Nitellopsidetum obtusae*) develop very well in the littoral of the lake. The communities rare for Lithuanian water bodies were found as follows: *Scolochloetum festucaceae*, *Nitelletum opacae* and *Zanichellietum palustris*.

Abundance of filamentous green algae was registered. Sometimes macrophyte communities are being shocked by these algae. In comparison with the data from the earlier investigation, macrophyte species content has not changed extremely but a significant decrease of areas covered by charophytes and an increase of areas overgrown by helophytes and potameids was observed.

The biggest changes in macrophyte vegetation were noticed in the littoral of lake Drukshiai near Ignalina NPP were *Charophyta* are totally extinct and just species common to eutrophicated water bodies (*Phragmites australis*, *Glyceria maxima*, *Ceratophyllum demersum*, *Myriophyllum spicatum*) are still growing.

The rates of fish community successional transformations were ten times in excess of those of the given process in natural lakes. Exchange of the dominant species took place: abundance of stenothermal cryophilic fish has decreased significantly, but abundance of euritherms and euribionts has increased. Due to Ignalina NPP operation cold water masses volume decreased and trophical level increased, but those parameters did not gain the level when elimination of stenothermal cryophilic fishes was taking place. Vendace population partially adapted to the changed environmental conditions and its abundance in few recent years is quite high and constant. During last years the lake fish community has changed insignificantly. The partially stable state of the lake fish community is fragile and in most cases depends on the Ignalina NPP operation regime. As a result, different ecological zones have formed in Lake Drukshiai.

The biological effects caused by the ecological changes in lake Drukshiai were evaluated on the basis of bioindication methodology. Moreover, the comparison of results on lake Drukshiai bioindication analysis with changes of comparable biomarkers which were obtained from other water systems of Lithuania, Switzerland, Sweden and Poland, including those with active nuclear power plants in their environment was carried out. It was determined that the functional and structural changes in lake Drukshiai biota are mostly caused by chemical pollution. It was found out that the frequency of cytogenetic damage, emerged as a specific radionuclide-caused effect in aquatic organisms inhabiting lake Drukshiai, is slightly above the background level and is 5 times lower than the same damage in Swiss Murten lake in the surroundings of which there are 2 nuclear power plants in function.

The effect of Ignalina NPP on reproductive system of fish inhabiting lake Drukshiai is much lower than it is in fish from the environs of Forsmark and Oskarshamn NPPs in Sweden. According to the values of studied ecotoxicity parameters lake Drukshiai belongs to the category of weak toxicity water bodies, where biological effects can be compensated by the adaptation mechanisms of living organisms.

The research data of many years (1989-1996) on biotesting of Ignalina NPP waste waters, the water of lake Drukshiai and its bottom sediments have shown that discharges waters entering the lake are more or less harmful to hydrobionts. The wastewater of municipal sewerage and industrial-rain sewerage are the most polluting. The toxicity of lake Drukshiai water depends not on radioactive but chemical substances constantly entering with waste waters.

The ecotoxicological state of Lake Drukshiai is becoming worse. The tendency of water toxicity increase in Skripkai lake (which is polluted by municipal wastewaters), as well as in its outflow – the Vosyliškiai streamlet which falls into Lake Drukshiai – shows that this lake is gradually becoming a secondary pollution source of Lake Drukshiai.

After INPP Units final shutdown the thermal heat discharges will be ceased to the lake, but discharges of municipal sewerage could not change significantly (depending on the evolution of Visaginas during and after the decommissioning process).

3.8.3 Surface habitats

The land flora in Ignalina NPP region is being represented by 617 plant species belonging to 81 families. These species form communities belonging to 13 classes and 24 alliances. Valuable objects for nature conservation were found in 4 protected areas and in several landscape standards of the region. 27 species enlisted into the Red Data Book of Lithuania were found: 5 of them belong to the 1st, 18 – 2nd, 4 – 3rd categories.

The research [6] shows negative changes in the vegetation of the Ignalina nuclear power plant region. Anthropogenous changes were observed: the invasion of alien plant species showing instability of native communities; many places overgrown with pyrogenic and ruderal flora were noticed instead of former natural meadows and forests. These changes were mostly registered in the surroundings of Lake Drukshiai. The state of ligneous vegetation is turning to bad in the surroundings of Vosyliskes and Grikiniskes. There were noticed defoliation and drying of trees, especially among 50 year old spruce woods. Very damaged underbrush was registered in forests near Vosyliskes and Tilze. There was obvious degradation of *Sphagnum* cover in some swamps around lake Drukshiai.

During the first years op operation of INPP the abundance and diversity of species at the edges of the lake increased 2.5 – 3.5 times and the insect species content increased 2 – 8 times compared with the prestarting period of INPP. This diversity dropped back to the level of prestarting operation after 10 years of INPP operation. Then, the formation of monodominant thermophylic zoocenoses was observed at the edges of the lake.

During the interval of 10 years, the abundance of microarthropods and diversity of species in the soil of the low lying marshlands (Tilze, Saskai, Vosyliskes) by the lake were significantly affected.

10-15 years after the start of the INPP operation, an increasing activity of soil microorganisms is found in the ecosystems of dry land. They have increased in number, the structure of domination of bacteria groups has changed, and the structural-functional relation has shifted in the direction of mineralization. Especially, pronounced changes are noticed in biotopes which are close to the INPP waste canal: the pine forest of Saskai and in the low lying marshland. Within the zone of the INPP activity the increasing abundance of microorganisms in the biotopes of pine forest ecosystems is accompanied by increasing similarity between the parameters of their structural composition and functional relations and the structure of microorganisms typical of mixed forests. The least changes in the abundance of microorganisms and their structural-functional composition was observed in the deciduous forest ecosystem (Vosyliskes).

The genetic variability of two species of small rodents was investigated with some breaks during more than ten years from 1984 through 1996 at the environs of INPP. Based on these data the conclusion was drawn that the genotoxical impact of power station environment on local animal populations during the period 1984-1996 was slight and did not change significantly.

The EIA Report(s) shall, based on existing data and studies, summarize the evolution of surface and lake ecosystems around the INPP, in order to highlight changes occurred since the start of operation of INPP.
It should be kept in mind that the INPP decommissioning is a process that will diminish releases of all kinds with time. One should expect a progressive reduction of effects linked to the INPP activities.

3.9 Cultural Heritage

This chapter covers the landscape of which the INPP is part, as well as objects of cultural interest among which protected areas and monuments that can be impacted by the project.

3.9.1 Landscape

The INPP region covers two districts – Zarasai and Ignalina districts.
The landscape in the basin of Lake Drukshiai has degraded because of the building and exploitation of INPP, Visaginas town and related infrastructure. According to the State Research [6], it was determined that 1.43% of the lake basin (not taking the lake into account) was damaged irreversibly. There are abandoned farming lands (1.56%) and a reduction of the forest area (3.83%).

Today, the landscape can be characterized as industrial in the vicinity of the INPP: power production units, ancillary facilities, partly build third unit (industrial ruin), spent fuel storage facility, domestic wastewater treatment plant, ducts for the urban warming system of Visaginas.

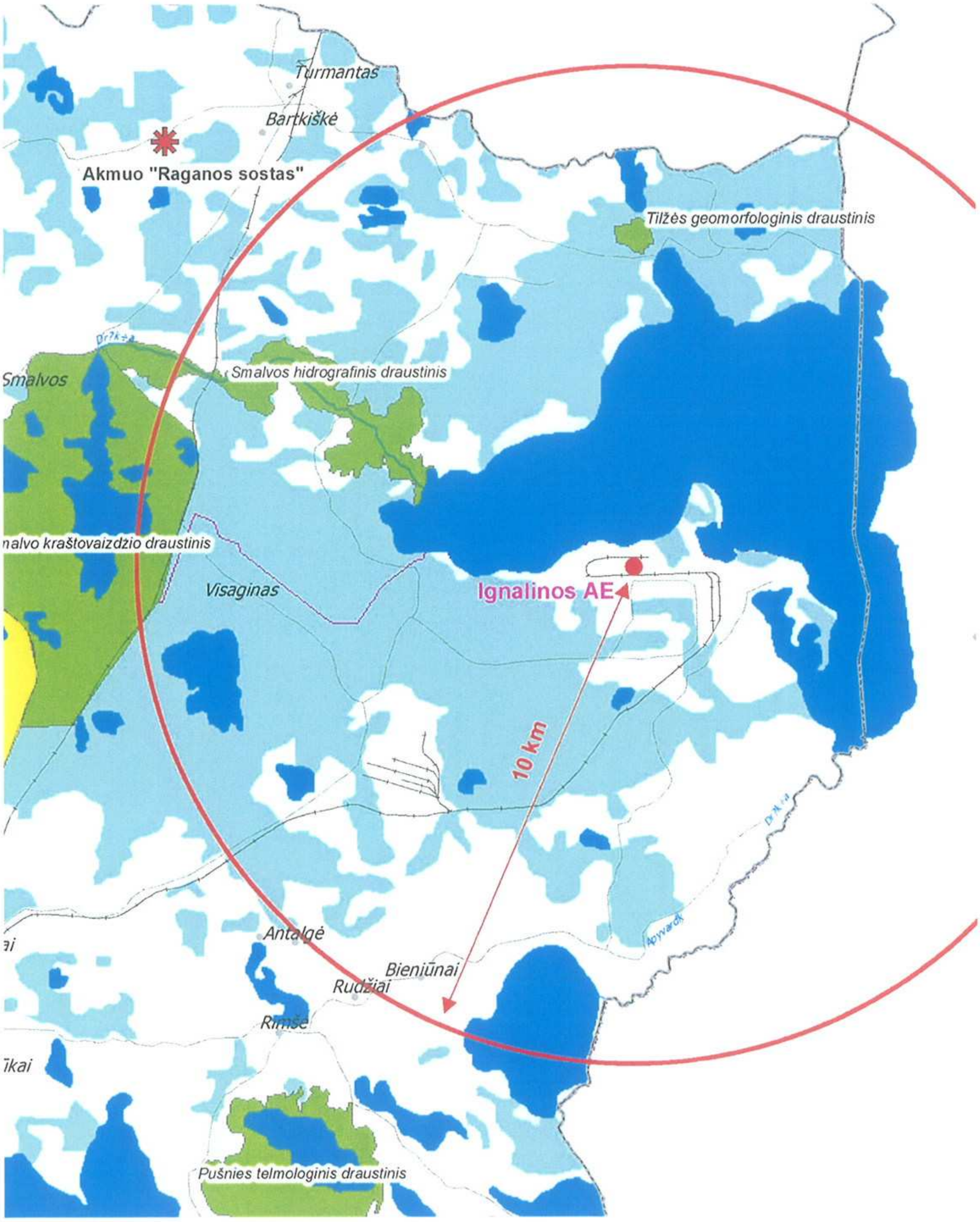
At greater distance, it is mainly composed of forests and wetlands. Residential areas are made of small villages with traditional houses. The lake Drukshiai is a major natural landscape element, with associated activities (fishing, recreational).

A photographic report is presented in Annex 2. The locations of picture shots are shown on the map in Annex 1. It shows views of significant objects pertaining to the INPP and some typical landscape elements in the region.

3.9.2 Objects of cultural interest

The Department for Protected Areas released a map with protected territories in a radius of 10 km around the INPP (see Figure 3-20).

Figure 3-20. Protected territories around the INPP, indicated in green colour (April 2004)



Additionally to these protected territories, Natura 2000 areas were proposed by the Authorities. Once approved by the European Commission, these areas shall be considered as protected territories as well.

No archaeological remains were detected during the works carried out for construction of the plant and ancillary facilities. During the construction of INPP, the site located within the boundaries of the plant underwent large excavations works and earth movements that revealed no outstanding elements as regards the architectural and archaeological heritage. As a result, there is assurance that no possible elements of the archaeological heritage will be affected by the decommissioning. There are no objects of cultural heritage, ethnic or cultural conditions that could be negatively impacted by the decommissioning of Ignalina NPP.

The EIA Report(s) shall contain a description of the landscape impacted by the INPP and the Decommissioning Project, in particular the protected territories that could be affected by the Project.

3.10 Noise and vibrations

The activities at INPP are not an important source of noise or vibrations. Moreover, there is no inhabitant within a zone of 3 km of radius, so that there is no particular perception of noise or vibrations. This subject is not relevant for INPP Decommissioning, apart for possible nuisances caused by the traffic of trucks transporting heavy loads of civil works wastes.

3.11 Radiological Conditions

Nuclide content in the air and precipitations of INPP site is determined mainly by presence of ^{137}Cs and ^{60}Co (not considering naturally existing nuclides). The annual variations of nuclides concentration in atmospheric air and nuclides amount in precipitation are presented in Figures 3-21 and 3-22 [22].

Better operation and effluent purification procedures are at the basis of a part of the decrease observed in the last years.

The yearly external exposure dose (including natural background) based on measurements using TL-dosimeters located inside the 30 km monitoring zone for the year 2002 was 0.41 mSv on average. The yearly average dose rate within the above-mentioned zone for the same period was 0.087 μSv/h. The external yearly doses during last few years have slightly decreased (from 0.61 mSv in 1997) [16-22].

The general conclusion based on the radiological investigations in the INPP region [21] is that radiological conditions in the region are determined by natural background, the operation of INPP having insignificant effect.

This conclusion is supported by independent measurements performed by Radiation Protection Center in the period November 1999 – May 2000 [32]. The measurements were performed in INPP region and Kupiskis municipality, located in about 100 km to the northwest from INPP. The Kupiskis municipality was chosen due to absence of big industrial facilities and other objects using ionizing irradiation sources. The measured exposure doses (including natural background) during the investigation period in both regions were about 0.4 mSv. The conclusion is made that external exposure doses in both regions are the same.

Figure 3-21. Annual variation of yearly averaged nuclide concentration in the air of 3 km and 30 km radius zones of INPP

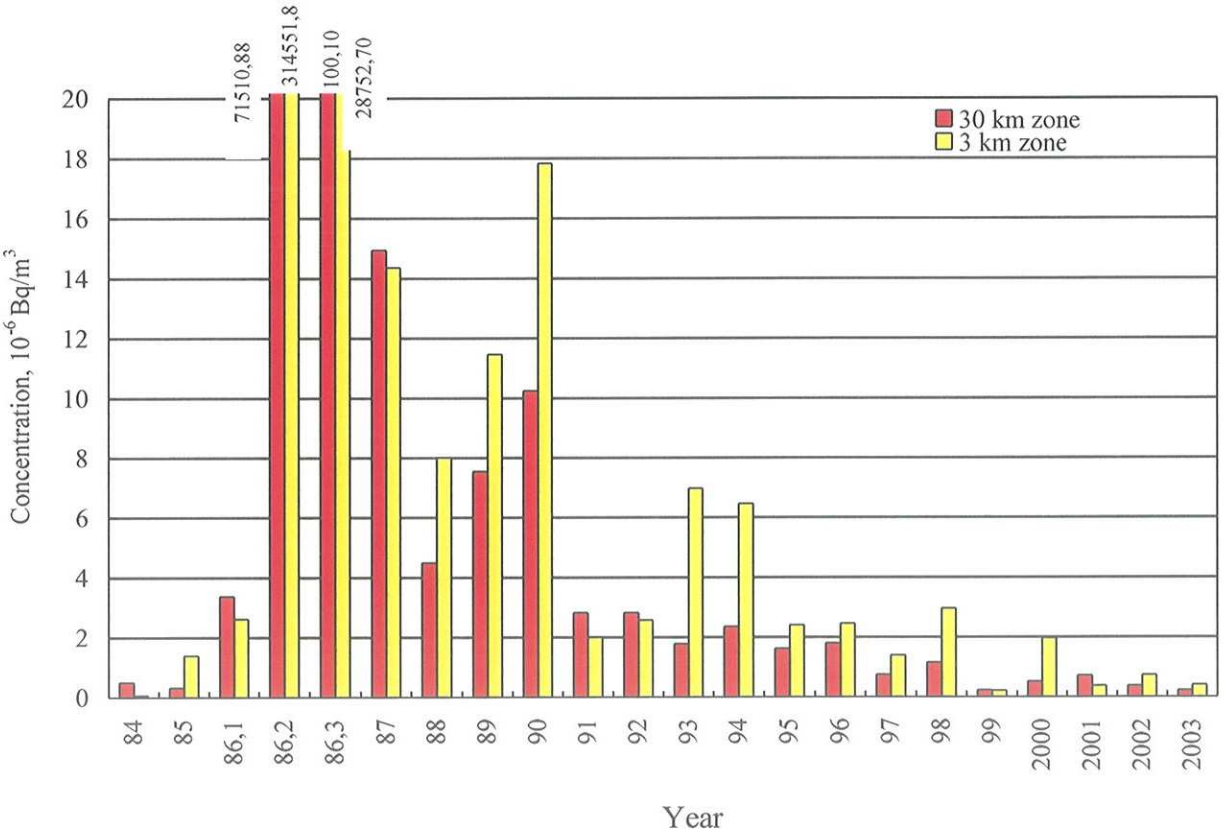
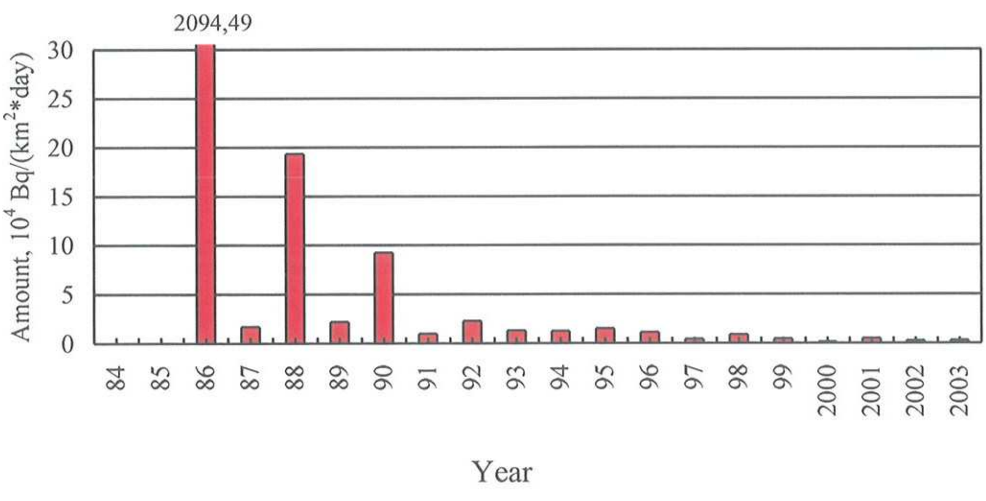


Figure 3-22. Annual variation of yearly averaged nuclide amount in the precipitation of 30 km radius monitoring zone of INPP



Dose rate in the INPP industrial site as well as inside controlled zone is monitored and controlled. The 25 m radius distance from buildings 157/1, 157, 155/1, 155, 151/154, 150, 158 156 (radioactive waste treatment and storage buildings area) is specified as zone for contamination and radiation exposure control. The dose rate in these areas is controlled to be below 12 μSv/h [33]. The real dose rate in 1 m from building 158 northern side is in the range of 0.2 – 0.3 μSv/h.

The diseases and health injuries mentioned in the surroundings of the INPP could not be associated with the exposure to radiation [6].

The accumulation of radionuclides in water, soils and natural components is described in related sections.

The EIA Report(s) shall synthesize data available on radionuclides in the components of the environment (air, water, soil, natural components) and on exposure to population in the area of influence of the INPP.

3.12 Emergency Response Plan and Preparedness

Those topics are addressed in Chapter 11 (Decommissioning Safety Assessment) of the INPP-FDP (Section 11.6).

The EIA Report(s) shall contain a summary of specific provisions established for each Decommission ng Project on which the EIA Report applies.

3.13 The Transboundary Issues to be considered

Lithuania has signed the Convention on Environmental Impact Assessment in a Transboundary Context, done at Espoo on 25 February 1991. Latvia and European Union have signed this Convention, but Byelorussia has not signed it.

A notification must be made to potentially affected Parties in the case of activities that are likely to cause an adverse transboundary impact. The notification must include information on the proposed activity and its expected impacts during normal operation and anticipated fault conditions, as well as an invitation to express their interest to participate in the decision making process. If an interest is expressed, relevant information regarding the EIA must be provided. The affected Party must ensure that its own general public are informed of the process and given an opportunity to express their comments or objections. Consultations must take place between the Parties, after completion of the EIA and submission of the EIA Report, concerning the potential transboundary impacts and the measures to reduce or eliminate such impacts.

The above notifications are in line with the requirements of Appendix 2 of Article 37 of EURATOM Treaty, dealing with the INPP decommissioning activities [34]. The implementation of the Article 37 of the treaty is made through the resolution of the Government dated 3rd December 2002, n° 1872, concerning data regarding plans relative to radioactive waste disposal.

The EIA Report(s) shall highlight issues in the environmental baseline that are of transboundary importance, for which impact assessment should be made.

3.14 List of References

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4 The Ignalina NPP Decommissioning

One of the main issues in decommissioning is the Wastes Issue, for which we develop objectives and needs hereafter. Then follows a description of the INPP and works to be done under the decommissioning, so that environmental issues can be presented.

4.1 INPP Decommissioning Scope and main Environmental Issues

The INPP Decommissioning project covers the decommissioning of both Units 1 and 2 and of the auxiliary facilities kept in operation after the Reactor Final Shutdown (RFS) of Units 1 and 2 (waste conditioning and interim storage facilities, interim spent fuel storage facility).

During its industrial service life, INPP has generated different types of liquid and solid radioactive waste, with various activity inventories. Most of this waste is stored, sometimes with small levels of segregation, in tanks and pits awaiting for retrieval, treatment, conditioning and further storage.

During the power operation, many equipment and structures of the plant became contaminated or activated. Some of these exhibit only very low surface contamination (such as the turbine hall equipment), while others (such as the reactor internal structures) exhibit very high surface contamination and internal massic activation. Decommissioning of INPP will involve a huge number of decontamination and dismantling activities, which in turn will also generate radioactive and non radioactive wastes.

The accumulated non conditioned operational radioactive waste and the waste that will be generated by the decommissioning activities represent a potential long term threat for the surrounding populations. From the nuclear safety and environmental impact standpoints, the objectives of the decommissioning are therefore the retrieval, conditioning and disposal of the operational and decommissioning waste, in such a way that they do not lead to long term threat for the public via direct (external irradiation) and indirect (inhalation, ingestion) exposure pathways.

The volumes of conditioned operational and decommissioning waste to be disposed off into near-surface disposal sites must be minimized. The conditioned waste must comply with the Waste Acceptance Criteria[4] (WAC) applicable to the intended repositories, namely with respect to the incorporation limits of the critical nuclides inventories as these latter form the radiological source term for the long term safety of the repository sites (see Chapter 6).

For what concerns non toxic and non radioactive waste, INPP transports waste, after control, to the industrial waste dump. All other types of non radioactive wastes are handed over by INPP to waste managing enterprises (granted with permission for this activity and registered in the State Register of enterprises dealing with waste). Waste treatment activity is performed at INPP in accordance with Programme of Non Radioactive Waste Handling at INPP (ПТОэд-0410-1). Work performance under this programme is purposed to environment protection, reduction of waste amount subject to disposal, provision of safe waste storage. The same philosophy will be applied for wastes resulting from Decommissioning activities.

[4] WAC are used to determine the category of wastes' management, taking into account their level of radioactivity. In some cases, the level can be as low as to allow their free release of constraints applied to radioactive waste; this allows not to treat all wastes coming from nuclear facilities as radioactive wastes, that mobilize important resources for their proper elimination.

By the completion of the decommissioning, the site restoration will enable the development of new industrial activities or the growing up of a forestry zone.

Further details are to be found in the INPP-FDP.

4.2 INPP Decommissioning needs

The INPP decommissioning implies the availability of:

a) waste retrieval and conditioning techniques, conditioned waste interim storage facilities awaiting for their evacuation to final near-surface/geological disposal sites;

b) advanced cleaning and decontamination techniques enabling not only to reduce the ambient dose rate of the to be accessed areas, but also to reach the free release levels (conditional and unconditional) for the largest possible amount of dismantling waste and to minimize the overall volume of waste to be disposed off after conditioning;

c) dismantling techniques;

d) landfill sites, near-surface repositories and deep geological disposal facilities.

The decommissioning needs are summarized hereafter and will be addressed in detail in the corresponding EIA Report.

4.2.1 Radioactive Waste Retrieval and Conditioning Techniques

A) Liquid waste:

The liquid waste generated during the decommissioning will be processed by the existing evaporators (building 150). The concentrates will be immobilized by the existing bituminisation installation and disposed in the vaults dedicated to the storage of the bituminised waste (building 158). It is worth to recall here that those vaults are now being upgraded in order to be used as long term final disposal.

B) Spent Ion Exchange Resins (IER) and Perlite mixtures:

INPP has ordered new installations for the retrieval, the conditioning and the interim storage of the IER and Perlite. These latter will be immobilized in a concrete matrix, in 200 liters drums. These drums will then be put into large concrete containers for interim storage on site.

C) Solid waste:

New installations and interim storage facilities will be erected on the INPP site, including a super-compaction, a grouting and an incineration unit. In that latter case, the ashes generated by the incineration will be super-compacted to maximize the volume reduction factor.

The Decommissioning Investment Packages also include the erection of a new Interim Spent Fuel Storage Facility with associated Spent Fuel casks for dry storage of the Spent Fuel Assemblies removed from the pools of Units 1 and 2.

4.2.2 Advanced Cleaning and Decontamination Techniques

Advanced and industrially proven decontamination techniques will be considered for INPP Decommissioning with, as objectives:

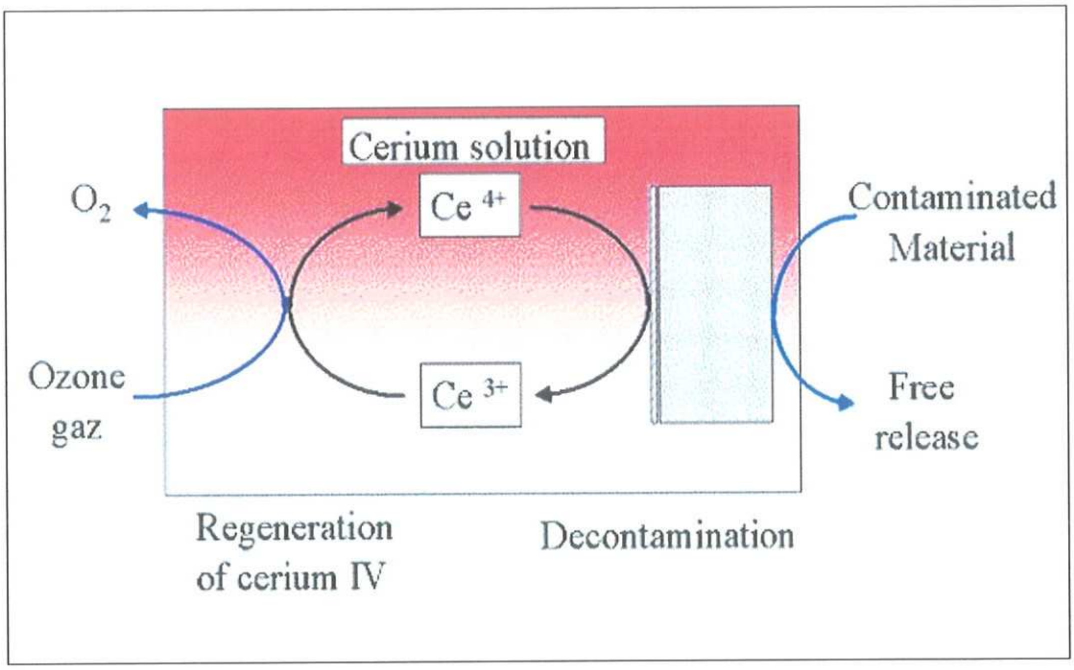
a) To minimize the plant personnel radiological exposure prior to carrying out dismantling activities (ALARA policy);

b) The minimization of the final volumes of conditioned waste to be disposed off;

c) The maximization of the decommissioning waste volumes that can be cleared on the radiological point of view, so that it can be free released and if not, routed towards an appropriate repository site.

One of the main characteristics of these decontamination processes is that they must be of a regenerative type, i.e. implying the continuous regeneration of the chemical reagents used for the decontamination, so as to minimize the consumption of those reagents and to avoid the excessive production of chemically loaded waste requiring conditioning. The industrially proven $Ce(SO_4)_2$ regenerative process used to decontaminate equipment up to the free release levels, will be taken into account at INPP. In this process, the reagent (Ce^{4+}) is regenerated by a continuous Ozone (O^3) injection. Possible releases are Ce^{3+} (non oxidant) and ozone (that recombines into oxygen), as shown on Figure 4-1:

Figure 4-1. Principles of the decontamination and the regeneration steps of the process



The waste generated by the chemical decontamination are to be processed either by the existing installations at INPP or by specific installations coupled to the decontamination unit.

4.2.3 Landfill, Near-Surface and Geological Disposal Sites

Landfill, Near-Surface and geological disposal sites are currently not available in Lithuania for radioactive wastes. Studies about the design characteristics of these sites are now being prepared (ex [1]). Awaiting upon the availability of these sites, the conditioned operational and decommissioning waste will be stored in interim storage facilities to be built on INPP site.

Near-Surface Disposal

In the preparation of the EIA Report and of the INPP-DP, the DPMU will use the sets of WAC developed by RATA and approved by VATESI [2].

Landfill Disposal

WAC are still to be proposed by RATA and approved by VATESI.

4.2.4 Dismantling Techniques

The DPMU has investigated different dismantling techniques that have been proven to be efficient in previous industrial dismantling projects.

Adapted cutting/segmenting tools have been listed in Chapter 9 of FDP in function of the to be dismantled equipment characteristics (sizes, material, thickness, dose rate…). These will be updated along with the development of the INPP DP. As already mentioned, the minimization of the secondary waste production (swarfs, dusts, aerosols, abrasive materials…) is a key criterion in the selection of the cutting/segmentation techniques.

4.3 INPP Design Characteristics that Impact the Environment during the Decommissioning

4.3.1 Introduction and Historical Context

The Ignalina NPP contains two RBMK-1500 reactors. This is the most advanced design of the RBMK type reactor (actually the only two of this type that were built). "RBMK" is a Russian acronym for "Channelized Large Power Reactor". Compared to the Chernobyl NPP, the Ignalina NPP is more powerful (1500 MW versus 1000 MW), and is provided with an improved ALS (Accident Localisation System). In most other respects, the plants are quite similar to their predecessors. They have two cooling loops, a direct cycle, fuel clusters are loaded into individual channels rather than in a single pressure vessel, the neutron spectrum is thermalized by a massive graphite moderator block. The plant can be refuelled on line and uses slightly enriched nuclear fuel.

The power plants were built not to m eet Lithuania's needs, but as part of the Soviet Union's North - West Unified Power System. The first unit of Ignalina NPP went into service at the end of 1983, the second unit in August 1987. Their design lifetime was projected out to 2013 – 2017 respectively. A total of four units were originally planned on this site. The construction of the third unit was abandoned in 1989 due to political pressure.

RBMK - type reactors were not exported, and were built exclusively in the territory of the former Soviet Union. There are presently plants at Saint Petersburg (Sosnovy Bor), Kursk, Smolensk and Chernobyl. A total of 17 such reactors have been built and 13 are currently still in operation.

Lithuania declared its independence in March of 1990, but the Ignalina NPP remained factually in the jurisdiction of the Soviet Union until August 1991. Supervision was carried out by that country's regulatory authority, the State Atomic Supervision. After the political events of August

1991 (the collapse of the former Soviet Union), Ignalina NPP finally came under the authority of the Lithuanian Republic. The Lithuanian Ministry of Economy now controls it administratively. The Lithuanian State Atomic Energy Safety Inspectorate (VATESI) exercises regulatory control.

4.3.2 General Plan Description

The Ignalina NPP is located in the north-eastern part of Lithuania, near the borders of Latvia and Belarus.

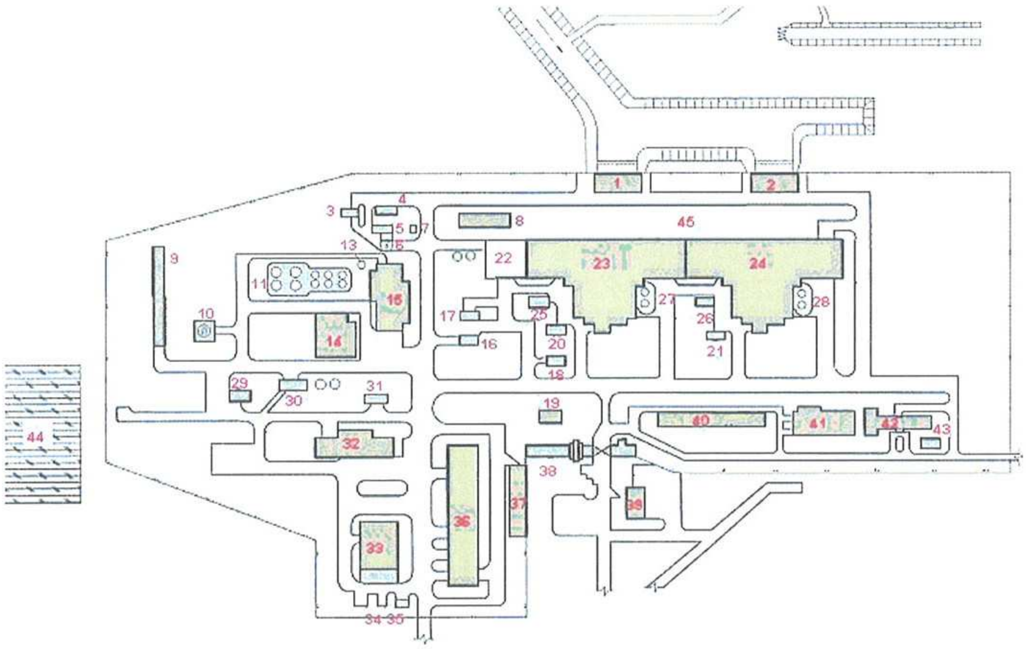
The general Ignalina NPP panorama is shown in Figure 4-2. State Enterprise INPP owned territory covers a total of 2644 ha. (In comparison: the Swedish Barsebeck nuclear power plant with two BWR reactors covers an area of about 24 ha). The buildings take about 22 ha.

The Ignalina NPP possesses two similar units of RBMK-1500 reactors, as shown in Figure 4-3. Each unit consists of five construction buildings; namely, buildings designated as A, B, V, G and D. Reactor buildings A 1 and A 2 are adjacent to a common building D 1 and D 2 housing the control rooms, the electric instrumentation rooms and the deaerator rooms. D buildings are adjacent to a common turbine hall G. The main buildings of the plant are situated about 400-500 m from the banks of lake Drukshiai.

Both units have the following common facilities: low-activity waste storage (buildings 155, 155/1, 157, 157/1), medium - and high-activity waste storage (buildings 157, 157/1), liquid - waste storage (buildings 151 and 158), an 110/330 kV distribution system, nitrogen and oxygen manufacturing facility (building 137) and other auxiliary systems. The building 111 which houses the 12 diesel-generators (six diesel-generators per each unit) for emergency power supply is physically separated from other buildings. A separate water-pump service station is also built for each unit, serving the needs of uninterrupted supply of water.

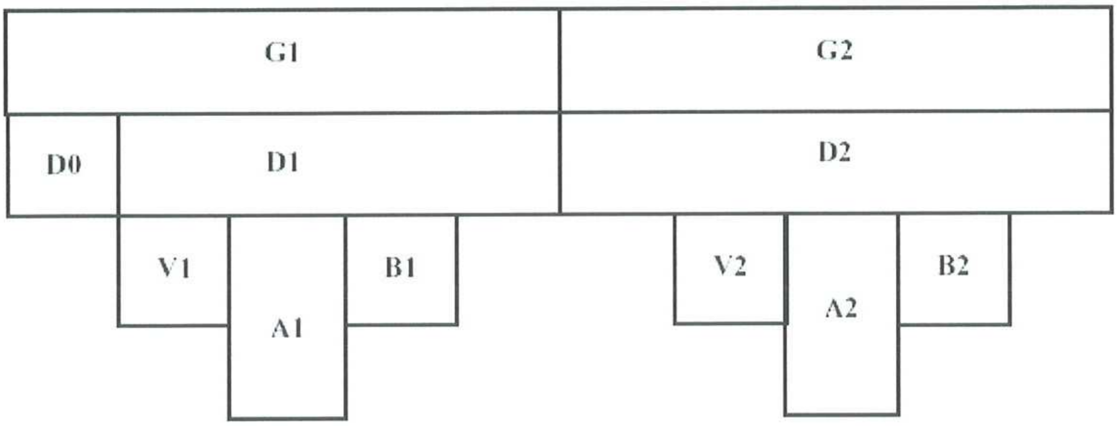
A panorama of the auxiliary services for the Ignalina NPP is shown in Figure 4-4.

Figure 4-2. General panorama of the Ignalina NPP



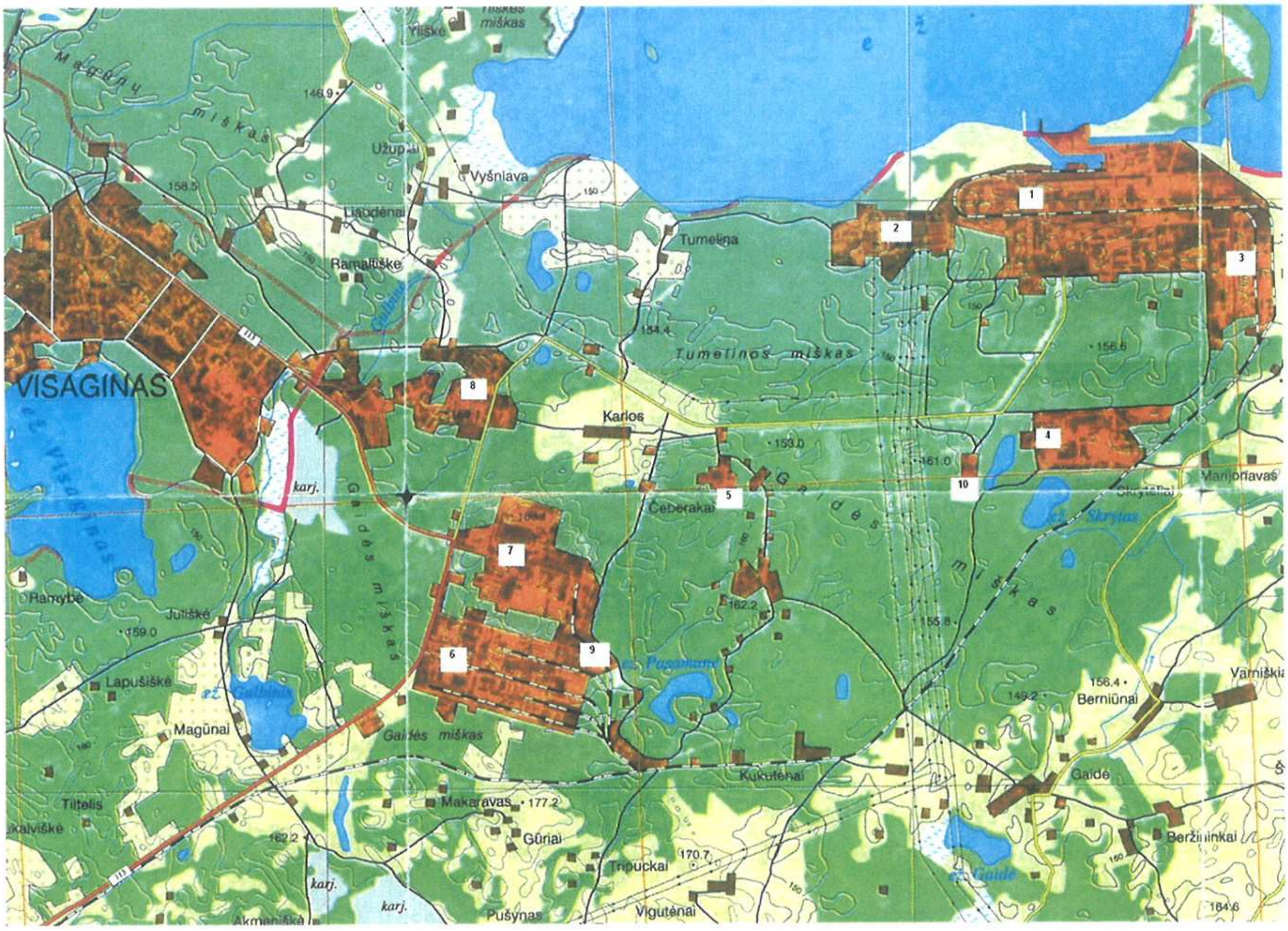
1,2 - service water pump station
3 - acetylene bottle depot
4 - oil depot
5 - oil system equipment room
6 - transformers inspection tower
7 - pump station for household sewage discharge
8 - hydrogen - and oxygen-receiving facility
9 - low-level radwaste repository
10 - medium - and high-level radwaste storage
11 - operational flushing water reservoir
12 - drain water tanks
13 - venting stack of the radwaste reprocessing building
14 - bitumen storage
15 - liquid radwaste reprocessing and bituminisation facility
16 - water conditioning facility
17 - water conditioning tanks
18,19 - amenity rooms building
20,21 - gas decay chambers
22 - heat supply station
23,24 - main plant units 1 and 2
25,26 - ECCS pressurised tanks
27,28 - low-salt water accumulation tanks
29 - car-washing facility
30 - bitumen depot
31 - active laundry
32 - chemical reagent depot
33 - equipment storehouse
34 - noble-gas bottle depot
35 - reservoir facility with artificial evaporation
36 - repair workshops
37,38 - administrative buildings
39 - cafeteria
40 - diesel - generator station
41 - compressor and refrigeration station
42 - nitrogen and oxygen manufacture building
43 - liquid nitrogen reservoir
44 - 110/330 kV outdoor switchgear

Figure 4-3. General units arrangements



A1, A2 - reactor buildings, B1, B2 - demineralised water treatment facilities of the MCC, V1, V2 - reactor gas circuit and special venting system, G1, G2 - turbine generators with auxiliary systems, feed facilities and heat supply facilities, D1, D2 - control, electrical and deaerator rooms, D0 - heat pipe service and fire fighting facilities.

Figure 4-4. Panorama of auxiliary services



1 - NPP site, 2 - open distributive system, 3 - supply base, 4 – sewage purification constructions, motor transport department, 5 - artisan well site, 6 - construction base, 7 - industrial construction base, 8 - military base, health clinic, 9 - heat boiler station, 10 – Visaginas dumpsite.

4.3.3 Plant Layout

The structure and layout of the main buildings of Ignalina NPP are subordinate to the peculiarity of the requirements of the RBMK-1500 reactor operation. Figure 4-5 shows the top view of the buildings of Unit 2. Cross-sections A-A and B-B through the building are displayed in Figure 4-6 and Figure 4-7, respectively.

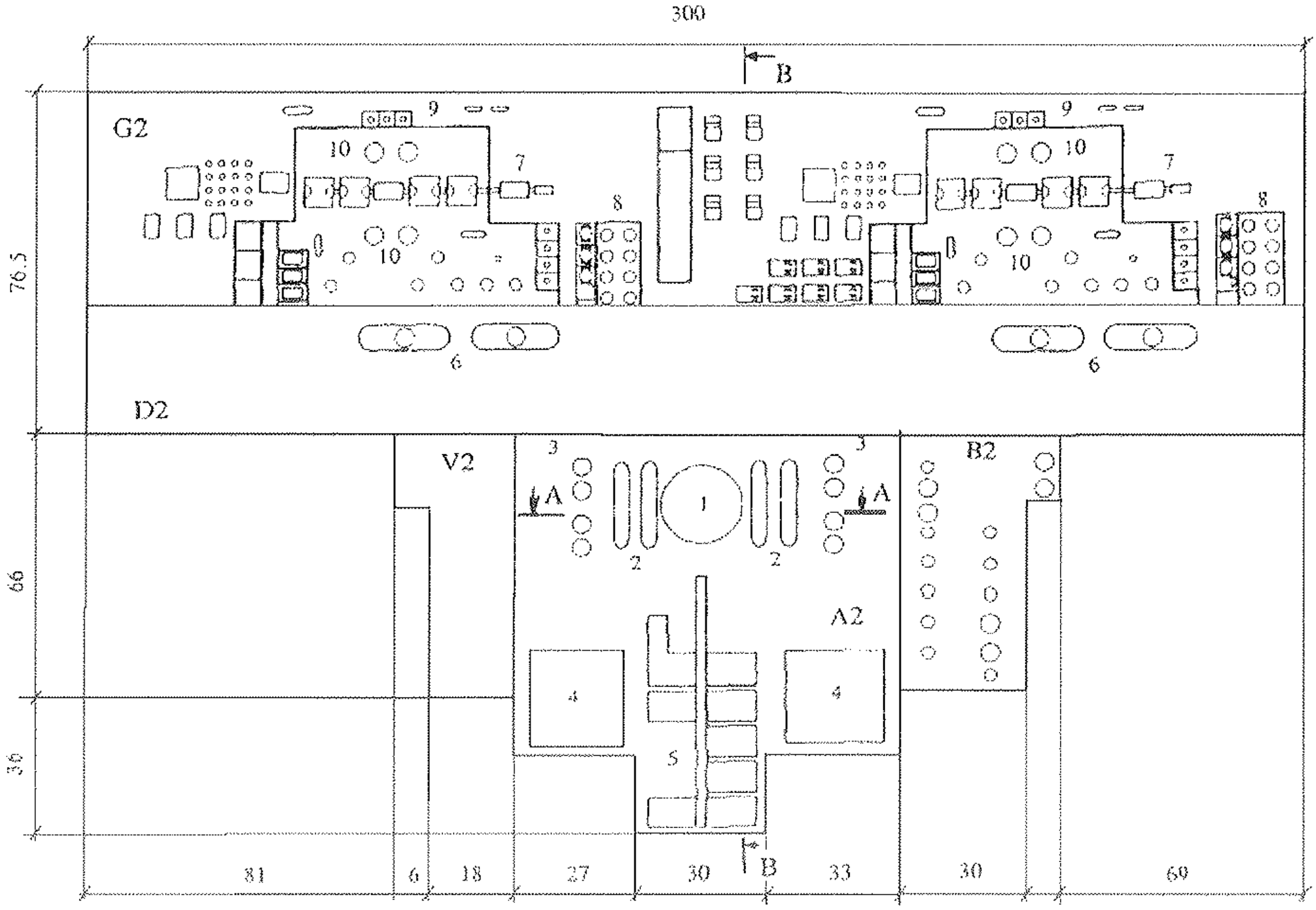
Building A contains an RBMK-1500 reactor with a Main Forced Circulation Circuit (MCC), and the following main auxiliary systems of the reactor: Emergency Core Cooling System (ECCS), Accident Localization System (ALS) and Control and Protection System (CPS). The hall above the reactor is a large open workspace housing the refuelling machine. The spent-fuel storage pond is situated in an adjacent hall, but separated from the reactor hall. The reactor compartment consists of a rectilinear structure, the horizontal cross-section of which is 90 m x 90 m and a height of about 53 m.

Building B houses the primary coolant purification system and the demineralised water treatment facilities. The reactor gas circuit and the special venting system are located in building V. The building area for the special water treatment has dimensions of 66 m x 36 m, and the building for the reactor gas circuit measures 66 m x 25 m. Both of these buildings have a height of about 31 m.

Building D houses the main control room, the electrical instrumentation and deaerator rooms. This common building for both units has an area of 600 m x 25.5 m and a height of about 44 m.

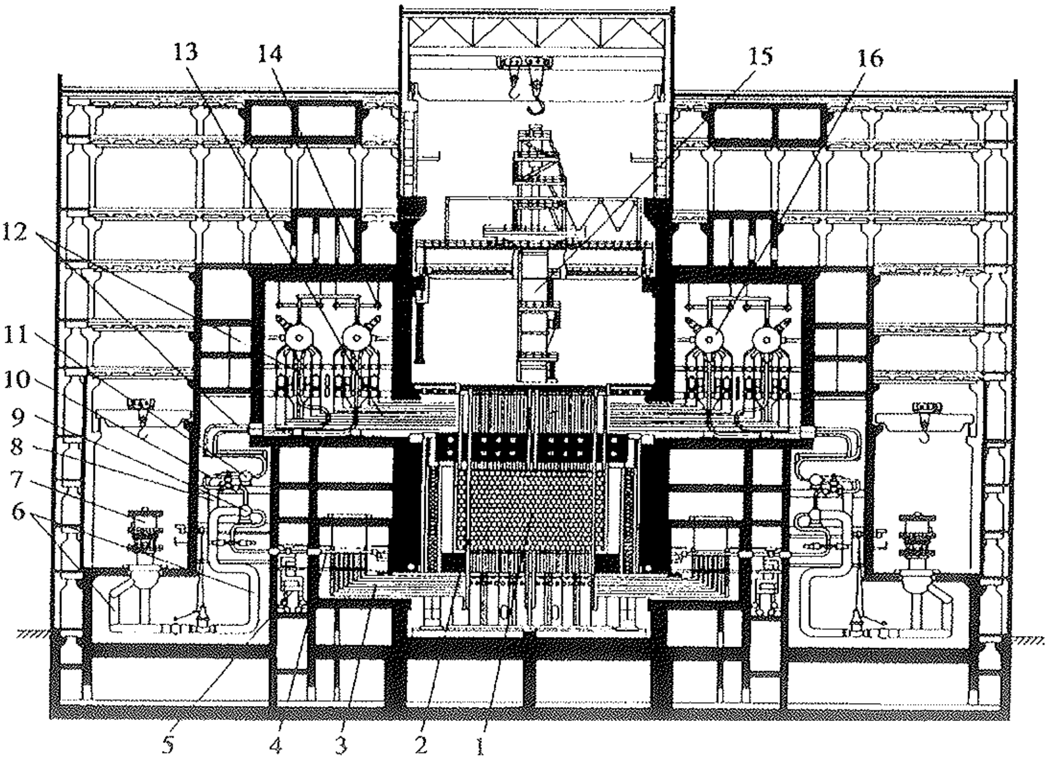
Building G houses the turbine generators with auxiliary systems, the feed and heat supply facilities. The turbine hall is common to both units and houses the four 750 MW turbine and their respective AC generators. Each turbine is assembled on a single shaft with 5 (1HP + 4 LP) cylinders. The first floor of the turbine hall contains condensers, separator-reheaters, evaporators, condensate pumps and components for heat extraction to the district-heating system. The entire building measures 600 m x 51 m and is about 28 m high.

Figure 4-5. Plan of the Ignalina NPP main buildings



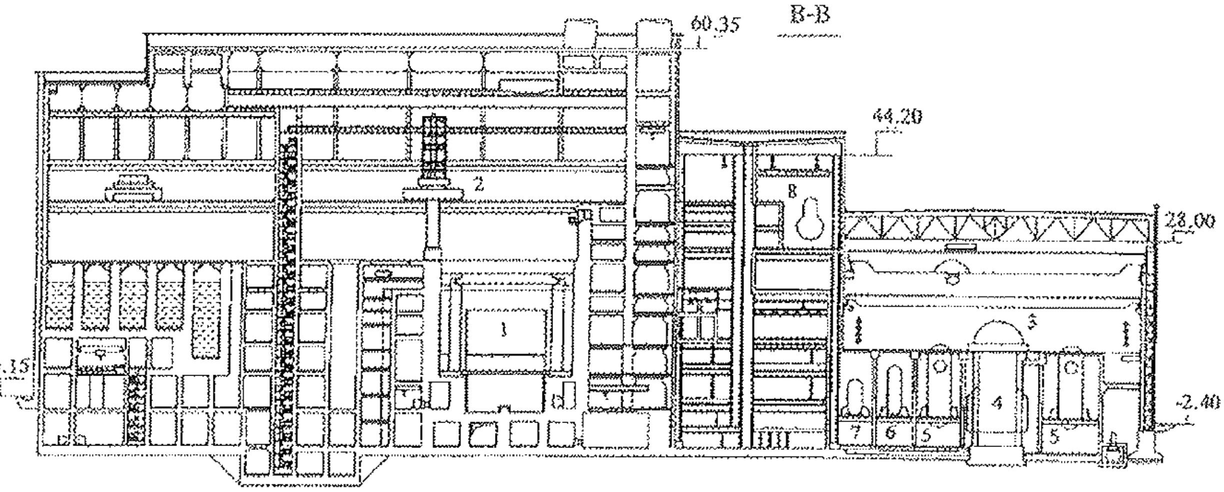
1 – reactor;
2 - pressure and suction headers;
3 - main circulation pumps;
4 - accident confinement system;
5 - spent fuel compartment;
6 – deaerators;
7 - turbine generators;
8 - condensate cleaning filters;
9 - first stage condensate pumps;
10 - separator - reheater.

Figure 4-6. Cross-section A-A of one unit of the Ignalina NPP



1 - graphite stack	6 - pressure pipes	12 - downcomers
2 - fuel channel feeder pipes	7 - main circulation pump	13 - steam and water pipes
3 - water pipes	8 - suction pipes	14 - steam pipes
4 - distribution header	9 - pressure header	15 - refuelling machine
5 - emergency core cooling pipes	10 - bypass pipes	16 - separator drum
	11 - suction header	

Figure 4-7. Cross-section B-B of one unit of the Ignalina NPP



1 - reactor, 2 - refuelling machine, 3 - turbine, 4 - condenser, 5 - separator - reheater, 6 - evaporator, 7 - first stage of the condensate pump, 8 – deaerator.

4.3.4 Power Plant Parameters

The Ignalina NPP belongs to the category of "boiling water" reactors, a simplified thermal diagram of which is provided in Figure 4-8. As it passes through the reactor core the cooling water is brought to boiling and is partially evaporated. The steam - water mixture is then routed to the large separator drums (3), the elevation of which is above the reactor. Here, the water settles down, while the steam proceeds to the turbines (4). The condensate is returned via the deaerator (8), by the feed pump (9) to the water of the same separator drum (3). The coolant mixture is returned by the main circulation pumps (10) to the core, where part of it is again converted to steam.

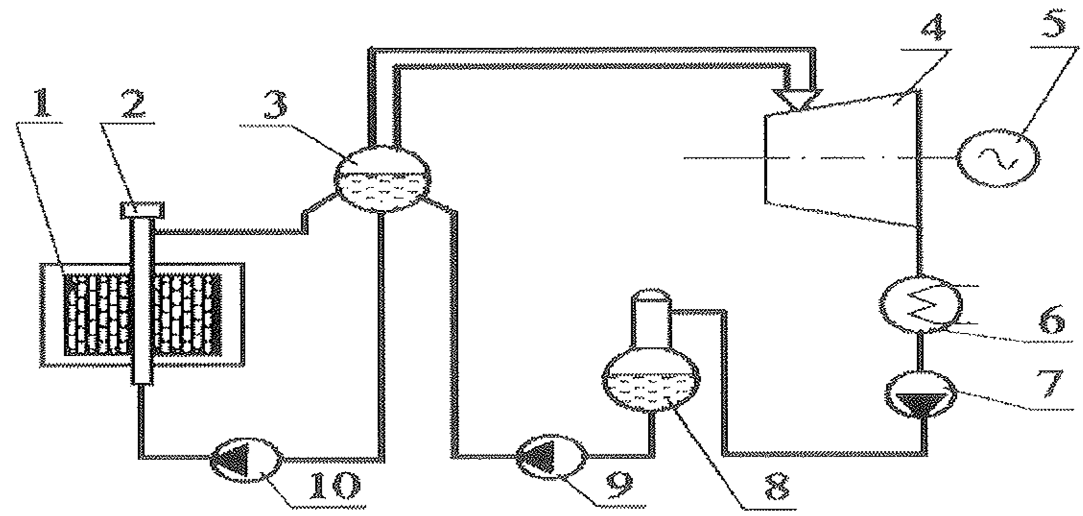
This fundamental heat cycle is identical to the Boiling Water Reactor (BWR) cycle extensively used throughout the world, and is analogous to the cycle of thermal generating stations. However, compared to BWRs used in Western power plants, the Ignalina NPP and other plants with the RBMK-type reactors have a number of unique features. The most important features are discussed in the subsequent sections.

The Ignalina NPP uses an RBMK – channel-type reactor. This means that each nuclear fuel assembly bank is located in a separately cooled fuel channel (pressure tube). There are a total of 1661 of such 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 above - mentioned separator drums.

The RBMK reactors belong to the thermal neutron reactor category, where graphite is used to moderate the fast fission neutrons. Due to the large volume of the core of this type of reactor, this requires a large amount of graphite, 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 reloaded on line during normal operation of the reactor The refuelling machine allows a fuel assembly to be changed without interrupting the coolant flow in the associated channel.

Figure 4-8. Heat cycle diagram



1 - reactor, 2 - fuel assembly, 3 - separator drum, 4 - turbine, 5 - generator, 6 - condenser, 7 - condensate pump, 8 - deaerator, 9 - feedwater pump, 10 - main circulating pump.

Figure 4-9. Following table lists the most important plant parameters.

Coolant	water (steam-water mixture)
Heat cycle configuration	single circuit
Power, MW:	
• thermal (design)	4800
• thermal (actual)	4200
• electrical (design)	1500
Core dimensions, m:	
• height	7
• diameter	11.8
Thickness of reactor's graphite reflector, m:	
• end	0.5
• side	0.88
Lattice pitch, m	0.25 x 0.25
Number of channels:	
• fuel	1661
• control and shutdown system	235
• reflector-cooling	156
Fuel	uranium dioxide
Initial fuel enrichment for ^{235}U, %	2.0 *
Nuclear fuel burnup, MW·days/kg	21.6**
Number of main circulation pumps	8
Capacity of main circulation pumps, m^3/s (m^3/h)	1.805 - 2.22 (6500 - 8000)
Temperatures, °C:	
• maximum acceptable temperature at centre of fuel pellet	2600
• maximum acceptable graphite stack temperature	760
• maximum acceptable fuel cladding temperature	700
• maximum acceptable fuel channel temperature	650
Coolant temperature at fuel channel inlet ***	260 - 266
Feedwater temperature ***	177 - 190
Pressures, kgf/cm^2:	
• at separator drum	67
• at pressure header	86.6
Coolant flow rate through reactor, m^3/s (m^3/h)***	10.83 - 13.33 (39000 - 48000)
Steam produced in reactor, kg/s (t/h)***	2056 - 2125 (7400 - 7650)
Steam fraction at reactor outlet, weight %	23 - 29
Maximum fuel channel parameters:	
• fuel channel power, kW	4250
• coolant flow rate through fuel channel, m^3/s (m^3/h)	0.0111 (40)
• steam fraction at fuel channel outlet, weight %	36.1

* Now the fuel is being changed to 2.4 % and 2.6 % enrichment fuel with erbium as burnable neutron absorber.
** At 2% ^{235}U fuel enrichment.
*** At 4200 MW(th).

When analysing emergency conditions and establishing safety measures, the RBMK-1500 design is based on the following safety criteria:

a) with the reactor at nominal power, breaking of the maximum diameter pipe with discharge of coolant from both ends is considered to be the Design Basis Accident (DBA);

b) first design limit of fuel-element failure under normal operating condition:

I. 1% of fuel elements with gas leakage-type defects,

II. 0.1% of fuel elements having defects resulting in direct contact between coolant and fuel,

c) second design limit on fuel failure:

I. fuel cladding temperature less than 1200°C,

II. local depth of fuel cladding oxidation less than 18% of initial clad thickness,

III. fraction of zirconium oxidation less than 1% of fuel cladding weight in one group distribution header channels (about 40 of such channels).

4.3.5 Primary Masses

Figure 4-10 contains the results of the collection of the primary mass, grouped by buildings [3]. The result, in total about 129,100 tons, covers only masses of the equipment and material to be decommissioned and of already stored waste. It does not take the building structures into account.

Figure 4-10. The results of the collection of the primary mass, grouped by buildings

Building	Name	Unit 1 [ton]	Unit 2 [ton]
		Common [ton]	
A	Main building, block A. Reactor building	29,652	29,652
B	Main building, block B. Low-salt water facility and bypass water treatment facility of the MCC	1,625	1,625
D0	Main building, block D0.Heat pipe service and fire fighting facility	974	
D	Main building, block D. Control, electrical and deaerator rooms	7,132	7,132
G	Main building, block G. turbine generators with auxiliary systems	19,575	19,575
V	Main building, block V. Reactor gas circuit and special venting	728	728
117	Pressurised tank of the ECCS	1,031	1,031
119	Heat supply station	1,917	
130	Repair building	1,020	
135	Gas holding chamber	2	2
140	Recreational facility	57	57
150	Liquid waste treatment building	2,166	
151/154	Waste water tanks / Operational water reservoirs	874	
152	Low-salt water tanks	118	118
153	Venting stack	346	346
154	Operational waste reservoirs	387	
155	Solid low-level waste storage facility	121	
157	Solid radioactive waste storage facility	149	
158	Bituminised radioactive waste storage facility	266	

Building	Name	Unit 1 [ton]	Unit 2 [ton]
		Common [ton]	
	Other Buildings (Fresh fuel storage, galleries, cable tunnels, sanitary passageway, gas holding chambers)	696	
	Total Unit 1 / Unit 2	60,265	60,265
	Total Common Buildings	8,570	
	Grand Total	129,100	

4.3.6 Identification of the Technical and Operational INPP Features that will Impact the Environment During the Decommissioning

4.3.6.1 Masses of Equipment and Structures that are contaminated or Potentially contaminated

For both units, the overall mass inventories of the main equipment and structure located in the controlled zone of the plant are as following:

a) Carbon steel, stainless steel equipment (tanks, pipeworks, valves, heat exchangers) 63000 tons;

b) zirconium channels 214 tons;

c) graphite (moderator) 3600 tons;

d) structural materials, steel girders, stair doors 33422 tons;

e) electrical equipment 12731 tons;

f) cables 3378 tons;

g) thermal insulation + sheathing materials 2018 tons.

The levels of contamination of the above equipment and materials widely vary in function of their location and operational conditions. These are addressed in chapter 6 of FDP (data base and radiological characterization).

4.3.6.2 Routine Contamination of the Main Circulating Fluids and of the Corresponding Circuit, of the Operational and Decommissioning Waste

INPP Units 1 and 2 belong to the water cooled reactor type. The contamination of the Main Cooling Circuit (MCC) as well as of the nuclear auxiliary circuits functionally linked to the MCC result from the following phenomena:

a) the in-core activation of the erosion-corrosion products of the MCC pipework, equipment (drums-separators, main coolant pumps, headers) and of the in-core channels;

b) the presence of fission products (FP), including the U and TRU nuclides, as a result of the tramp U^{235} fission and of release of those nuclides via the fuel cladding defects.

The MCC contamination levels of the activated corrosion products, of the FP, U and TRU nuclides determine:

a) the contamination of the operational process and technological waste;

b) the contamination of the decommissioning waste, i.e. the contamination of the to be dismantled equipment and, when relevant, of their spent decontamination solutions, of the contaminated process[5] and technological[6] waste generated during the different phases of the decommissioning.

A. Activated corrosion products

The surfaces of the MCC and of the nuclear auxiliary circuit equipment in contact with the circulating fluids are mainly made of:

a) titanium stabilized austenitic stainless steel (basically: alloy OX18HIOT) for all equipment and circuit, with the exception of the in-core fuel channels;

b) Zr (allied with 2.5% Nb) for the in-core fuel channels.

This means that the short term contamination of the operational and decontamination waste will be governed by short lived γ emitters.

(Such as: Mn^{54}, Co^{58}, Co^{60}, Fe^{59}, Zr^{95} and Nb^{95}), while the long term activity of this waste will be governed by weak β-γ emitters (such as: C^{14}, Ni^{59}, Ni^{63} and Nb^{94}). These latter nuclides belong to the so-called category of "difficult – to – measure" critical nuclides (DTM critical nuclides).

The methodology developed to assess the inventories of these DTM critical nuclides in the operational and decommissioning waste is detailed in Chapter 6 of the FDP.

B. Fission products, U and TRU nuclides

The contamination of the MCC and of the nuclear auxiliary circuits by FP, U and TRU nuclides result from the occurrence of the following phenomena:

a) the fission of tramp U^{235}, taking place outside of the fuel elements, i.e. the fission of uranium particulates deposited on the external walls of the fuel cladding and of uranium particulates present in the MCC and circulated through the core. The presence of short lived I^{134} in the MCC is an indicator of tramp uranium fission;

b) the release of FP from the fuel pellets by diffusion via the cladding defects.

The above mechanisms lead to quite different spectra of FP in the MCC and in the nuclear auxiliary circuits. Their contribution to the overall contamination of this circuit is detailed in Chapter 6 of FDP. A particular attention has been paid to the assessment of the long lived and DTM critical nuclides (such as: Sr^{90}, Te^{99}, I^{129}, Cs^{135}, Cs^{137}, U^{235}, U^{238}, Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Am^{241}, Pu^{242} and Cm^{244}) inventories in the MCC and in the auxiliary circuits, in the operational and decommissioning waste.

[5] Process waste = spent filters, ion-exchange resins and perlite, evaporator concentrates.

[6] Technological waste =all the miscellaneous solid waste.

The methodology developed to assess the inventories of the FP, U and TRU nuclides in the operational and decommissioning waste is given in Chapter 6 of the FDP.

4.3.6.3 The Graphite Moderator

The graphite stacks of the reactors of Units 1 and 2 contains 3549 tons of graphite used as neutron flux moderator. The stack can be visualized as a vertical cylinder, made up of 2488 graphite columns, constructed from various types of parallelepiped blocks of 0.25×0.25 m, and heights of 0.2, 0.3, 0.5 and 0.6 m of which that are stacked up along the fuel channels, the 0.6 m blocks are most common. The short blocks are used only in the top, bottom and reflector of core. It is activated to various levels, i.e., has various levels of C^{14} specific activities (Chapter 6 of FDP).

The current management (not at INPP) of this type of waste consists of putting the spent graphite blocks into sealed metallic containers for long term disposal. INPP selected decommissioning option consists of an Immediate Dismantling. It is expected that, by the year 2015, where the dismantling of the graphite will actually be carried out, INPP will take benefit of the results of the research and development works currently underway in several countries (Russian Federation, UK, France), in order to improve the management of the spent activated graphite (waste reduction volume, etc.).

4.3.6.4 Reactor Metal Structures

The reactor core is surrounded and supported by metal structures. They consist of welded metal structures which transmit the weight of the reactor core and its components to the concrete foundation, and ensure the leak-proofness of the inner reactor cavity. These structures also contribute to biological shielding.

The most complicated heavy components are the top and bottom metal structures. The top cover dimension is 17650×3000 mm and weights 600 tons. The inside cavities of this metal structure are filled with serpentine (a mineral containing bound crystalline water). Weight of serpentine is about 1000 tons. The top and bottom of this cylindrical structure is made from a 40 mm thick steel plate. This structural component supports the weight of the loaded fuel, technological and control channels.

The construction of bottom metal structure is very similar to top metal structure. Dimension of this structure is 14500×2000 mm. This metal structure is filled with serpentine. Weight of serpentine is about 425 tons. Structure supports the weight of the entire graphite stack, the bottom biological shield and feeder pipes supplying coolant water to the fuel channels.

The cylindrical shell of the reactor core is constructed from a 16 mm thick plate. Dimension of this scheme is 14520×9750 mm and weight is about 77 tons. To compensate for axial thermal expansion, the shell is provided with bellows compensators. The shell is welded together with the top and the bottom metal structure i.e. forms the sealed reactor core compartment.

4.3.6.5 Operational Events with Potential Impact on INPP Decommissioning Programme

The concern is to identify the operational events that may have a significant impact on the contamination levels of the operational and of the future decommissioning waste and/or that may lead to the implementation of special cleaning decontamination and dismantling techniques, such as:

a) excessive contamination levels of the circuit by fission and activated corrosion products;

b) spillage of contaminated fluids on the floors;

c) leakages from the spent fuel pools cladding and contamination of the concrete structures;

d) contamination of the soils outside of the INPP main and auxiliary (waste treatment facilities) buildings as a result of leaks;

e) incidents/accidents during the fuel handling operations;

f) long term accumulation of contaminated sludge onto the bottom of tanks of large reservoirs (spent fuel pools) with poor circulation ("dead zone").

It is worth to point out that, in order to maintain good working conditions and to comply with the ALARA objectives, INPP has implemented several "good practice" rules in the operational procedures:

A) Excessive Contamination of the MCC by FP, U, TRU and activated corrosion products (see also Chapter 6 of FDP):

I. The specific activity of Cs^{137} in the MCC remains often below the detection limits. Upon occurrence of noticeable fuel cladding defects, the Cs^{137} specific activity is usually kept in the range $1\cdot10^{-7}$ - $1\cdot10^{-6}$ Ci/l ($3.7\cdot10^{6}$ – $3.7\cdot10^{7}$ Bq/t), i.e. never exceeds $1\cdot10^{-6}$ Ci/l ($3.7\cdot10^{7}$ Bq/t). Fuel assemblies developing excessive cladding defects are systematically removed from the core and stored in dedicated casks. It is also worth to mention that the specific activities of short lived iodine nuclides (I^{131}, I^{133} and I^{134}) remain usually very low (i.e. lower by 2-3 orders of magnitude than the design values), confirming thereby the low rate of fuel cladding defects and the low inventory of tramp uranium in the MCC.

II. Similarly, the MCC specific activities of the activated corrosion products remain generally very low. So, the specific activity of Co^{60}, i.e. the γ emitter governing the equipment dose rates at steady state is, usually, $< 1\cdot10^{-7}$ Ci/l ($3.7\cdot10^{6}$ Bq/t).

III. Further the MCC purification rate is kept at a high flow rate, i.e. 400 t/h. This leads to about 400t/h/1000t = 0.4 change per hour of the MCC water mass inventory (1000t). For indicative purpose, in VVER 440 and 1000, the purification rate of the primary circuit is such that water inventory change rate is lower than or equal to $0.1h^{-1}$

As a conclusion, it can be stated that, up to now, the radioactive contamination of the MCC has always been kept at a low level.

B) Spillage of contaminated fluids on the floors

In accordance with operational procedures the radiological conditions in the INPP compartments are measured on a regular basis. Should the contamination level exceed the relative operational limit, the necessary corrective measures are taken as soon as possible. These measures can include: decontamination of equipment, rooms' floors and walls, removal of contaminated concrete, installation of additional shielding etc. The results are controlled by health physicists. The limits of INPP compartments contamination for different zones are given in the Figure 4-11 [4], [5].

Figure 4-11. The limits of INPP compartments contamination for different zones

Controlled parameters	III	II
Dose rate	<12 µSv/h	12 ÷ 56 µSv/h
Surface contamination	< 4 Bq/cm^2	4 ÷ 40 Bq/cm^2
Aerosols	185 Bq/cm^3	185 ÷ 1110 Bq/cm^3

In category II areas, the working time is regulated by the Radiation Protection Department of INPP. For example, for a γ dose rate of 24 µSv/h, the working time is limited to 50% (3 hours) of the total effective working time. In the category III area, the working time is normal working time.

In case of leakages, the measures on localisation or elimination (if possible), prevention of contamination spreading, preliminary decontamination are carried out by operational personnel. The further thorough decontamination and contaminated structures removal, down to the radiological operational limits, can take place if necessary [6]. The most significant events concerning concrete construction contamination and which took place at INPP are:

- Contamination of boxes 051A1, 2 and adjacent corridors resulting from leakage through the refuelling machine drainage filter. Contaminated layer of concrete floor under the PVC sheets was removed over a surface area of ~60 m^2. Contaminated concrete was transferred to the radioactive waste storage facility. Such event occurred several times.

- Contamination of floor in the box 012B1 resulting from leakages from low salt water purification system pumps and damaged PVC sheets. Concrete floor under PVC sheets was contaminated over a surface area more than 100 m^2. Contaminated layer of concrete was removed; the plastic sheets were replaced by a stainless steel lining.

- Contamination of concrete structures of leak-tight compartments. All leak-tight compartments of INPP have metal floor lining for collecting of equipment leakages. Defects in the floor lining results into contamination of concrete structures in case of leakages. It is impossible to carry out measurements in these structures during exploitation, but taking into account that dose rate from the concrete structures cooling ventilation system ducts reached 0.3mSv/h, a significant contamination of the concrete under floor lining has to be expected. Aforesaid is also true for Accident Localisation System constructions and compartments of Primary Circuit Purification System.

The other possible source of building constructions contamination consists of drainage pipelines, which are installed inside the walls of buildings. In case of leakage, the contamination of surrounding concrete will occur.

It's important to note, that there isn't database of events, connected with spilling of contaminated liquids, at INPP. So, at present it's practically impossible to state what was the residual activity after completion of the decontamination works.

The above concerned contaminated areas will require a careful radiological monitoring. Indeed, the experience has shown, for example at Greifswald NPP (Germany) that is now under decommissioning, that significant concrete contamination could occur over depths such as 15-20 cm under surface layer, and this despite of an apparent good condition of the soil protective epoxy.

C) Leakages from the spent fuel pools walls

There is a special system for collecting leakages from spent fuel pools liner. It consists of layer of porous concrete, metal tray and equipment for leakage flow measuring.

During operation period there were 14 cases of spent fuel assemblies' (SFA) drop. All these assemblies were lifted later, and significant damages of some fuel elements were observed. Because of lack of historical records, it is impossible to ascertain quantity of other items (additional absorbers, suspensions, power density sensors etc.) dropped into the spent fuel pools, but such events took place repeatedly. However, only one FA drop led to damages of the pool liner:

In May 1989, penetration of bottom of pool 236/1 occurred as a result of a fuel assembly drop. Leakage flow was $3m^3/h$. The hole was pressurized by special rubber plaster in short time, and the leakage was eliminated.

Currently, it's reasonable to assume, that whole porous concrete construction is contaminated.

D) Contamination of the soils outside of the INPP main and auxiliary buildings

The dose rate of INPP site is regularly monitored. Some local contaminations were revealed nearby transport gates and along waste transportation ways. In most cases, contamination was caused by very small particles blown down during waste containers transportation and/or unloading. In all cases contaminated soil was removed to the waste storage immediately after the contamination was observed.

The most significant event occurred on 15/05/2001 as a result of waste container drop during transportation. Approximately 0.3 m^3 of solid waste spilled on a surface area of 30 m^2. The decontamination by vacuum cleaners was carried out during the evening of same day. Finally, the road asphalt was removed over the depth of 10 cm at places, where decontamination was not successful. The residual dose rate has not exceeded 0.4 μSv/h [6]. This incident was classified as level 1 on the INES scale.

So, it is possible to state, that there is no contamination at INPP site outside of the controlled area.

E) Incident/accident during the fuel handling operations.

There were no accidents except those mentioned above in paragraph C). All dropped spent fuel assemblies were lifted, but significant damages of some fuel elements were observed and therefore some quantity of fuel pellets fragments can be presented in the sludge on the spent fuel pools bottom.

F) Long term accumulation of contaminated sludge onto the bottom and of tanks and of large reservoirs with poor circulation

Although no specific data are available at INPP, it has to be expected, on the basis of the experience gained in other NPPs, that sludge deposits have accumulated, during the plant operation, in these low circulation zone (bottom of the spent fuel pools, of large tanks,...). This sludge:

I. usually consists of corrosion products oxides;

II. may exhibit significantly high specific activities;

III. are present in quantities that may significantly vary from plant to plant and in function of the concerned areas (i.e. from < 100 kg up to several 100 kg);

IV. will require specific tools and equipment for their removal. Immersed pumps coupled to filtering units operating under the water level of the pools (or large tanks) have been frequently used in western NPPs for this type of application (see Chapter 9 of FDP).

4.3.6.6 Spent Fuel Management after RFS of Unit 1 Including the Possible Recycling of Some FA in Unit 2

INPP Unit 1 is to be shutdown by 31 December 2004. At this time Unit 2 will still be in normal operation. Prior to starting the decommissioning operations of the reactor, it is necessary to have it unloaded. Any delay for the unloading operations would lead to the same delay for the reactor availability for decommissioning. First task is to unload the reactor and second – to unload decay pools of Unit 1.

So, we can consider two stages after RFS of Unit 1:

- stage 1: unloading all FA from the reactor, placing into the spent fuel pools or reuse part of them in the reactor of Unit 2;
- stage 2: unloading all FA from the SF pools into the interim spent fuel storage facility (ISFSF).

According to real filling of spent nuclear fuel pools, capacity of the existing interim spent nuclear fuel storage facility and operation forecast for a new interim spent nuclear fuel storage facility by the end of 2005, duration of stage 1 can be determined as follows: from 1 January 2005 to 1 April 2008, stage 2 – from 1 April 2008 to 1 January 2010.

After the final shutdown of Unit 1 (31/12/2004), about 1660 partially burnt FA will remain in the core and approximately 1300 of them will show burn-up allowing for possible reuse in Unit 2. By redirecting those FA into the core of Unit 2, a saving of 670 equivalent new FA could be achieved and the required storage capacity of the new Interim Spent Fuel Storage Facility reduced accordingly. In order to minimize the risks linked to fuel assemblies handling, the partially burnt FA will be transferred from reactor to reactor without intermediate storage in decay pools.

For Unit 2 if final shutdown is to occur on 31/12/2009, the reactor will be free of fuel by the end of 2010. The uncut and cut FA decay pools of Unit 2 will be free of fuel respectively by the end of 2011 and by the end of 2015.

The EIA Report(s) shall describe installations and operations concerned about the specific Decommissioning Project considered, and highlight activities that may potentially affect the environment, directly or indirectly, immediately or with time delay. Effluents will be quantified as much as possible, such as radioactive and non radioactive wastes, liquid and gaseous effluents,

4.4 List of References

1. Reference design for a near-surface repository for low-level, intermediate-level short-lived radioactive waste in Lithuania. Draft Project Report. December 2001. SKB-SWECO International Westinghouse Atom Joint Venture.

2. General Waste Acceptability Criteria For Disposal In Pre-surface Repository. 2003-02-20 approved by Head of VATESI.

3. Preliminary Decommissioning Plan for INPP. Phare Project 4/08/94. Final Report, NIS/SGN/SKB. December 1999.

4. Зональность зданий, сооружений и помещений, относящихся к зоне строгого режима. ПТОэд-0516-1.

5. Инструкция по радиационной безопасности на ИАЭС. ПТОэд-0512-2.

6. Ограниченное воздействие на площадке в результате падения контейнера с радиоактивными отходами средней активности во время транспортировки в хранилище. Отчет о необычном событии на ИАЭС. ПТОот-0345-185.

5 Decommissioning Alternatives and Preferred Option

5.1 Description of the Decommissioning Project

A comprehensive description of the Decommissioning Project is presented in the Final Decommissioning Plan drafted for the Ignalina Nuclear Power Plant (INPP-FDP).

The structure and content of this INPP-FDP is summarised hereafter:

- Chapter 2 gives a general description of the installations to be decommissioned.
- Chapter 3 describes the regulatory framework that applies for INPP decommissioning.
- Chapter 4 identifies the strategy that is taken into account for INPP Dismantling purpose and outlines the main considerations that allowed to make the choice.
- In November 2002, the Government of Lithuanian Republic officially adopted the Immediate Dismantling strategy for decommissioning of INPP Unit 1.
- A short description of the main alternatives considered and of the information gathered or produced in different DPMU documents is presented in the two sections hereafter.
- Chapter 5 outlines the preliminary planning of the decommissioning activities.
- Radiological characterisation methodology and examples of associated equipment data sheets (considering surfaces, masses, materials, contamination, activation…) are presented in Chapter 6.
- Chapter 7 outlines the methodology proposed to identify, along the various decommissioning stages, the needed systems modifications, isolations and possible dismantling works.
- Chapter 8 describes the miscellaneous cleaning and decontamination operations including associated waste conditioning.
- Methods and tools to be applied when performing the decommissioning activities are presented in Chapter 9.
- Chapter 10 highlights the INPP waste (radioactive and non radioactive) management strategy, including interim and final disposals, the use of existing plant waste treatment facilities, etc.
- Chapter 11 identifies the potential incidents and accidents that may occur during the decommissioning of the Units together with the precautions that are taken to avoid their occurrence and the actions that can be implemented to mitigate their consequences. It analyses also the measures that will be implemented to warrant the continued safe operation of Unit 2, after RFS of Unit 1.
- Present EIA Programme constitutes Chapter 12 of the INPP-FDP.

- Radiation Protection Programme is presented in Chapter 13.
- Chapter 14 identifies the organizations performing the decommissioning.
- Costs and funding are estimated in Chapter 15.
- The QA Programme and organization which will cover the whole decommissioning are outlined in Chapter 16.
- Final radiation survey and license termination are presented in Chapter 17.
- Finally, the facility and site restoration is described in Chapter 18.
- Chapter 19 describes the Final Decommissioning Report.

5.2 The Main Dismantling Alternatives and their Characteristics

5.2.1 Possible Dismantling Alternatives

In accordance with worldwide practices, the following Dismantling strategies were envisaged for INPP:

- Immediate Dismantling;
- Deferred Dismantling (with four variants for the Safe Enclosure - SE: successively Restricted; Small; Extended and Maximum SE corresponding in turn to reactor core; hermetic zone of the Accident Localization System; reactor building A and all A, B, V, G and D buildings);
- Entombment.

All above options were first assessed in the INPP Preliminary Decommissioning Plan (INPP-PDP) [1].

In the next step of the Decommissioning preparation, INPP and its Decommissioning Project Management Unit (DPMU) did not consider the Entombment as a strategy valuable for further investigation in the case of INPP decommissioning.
Main reasons were that:

a) entombment option for decommissioning of nuclear fuel cycle facilities that are contaminated with long lived nuclides, implies that radioactive materials will be kept inside engineered structures for a very long period (~ 200 years), whereas IAEA recommends not to dispose of such waste in near surface facilities.

b) a 200 years storage period before final dismantling, conditioning and packaging of waste is unlikely to be accepted in Lithuania either by the public, the green organizations and the Authorities; and makes it almost impossible to predict evolution of costs, technology and Waste Acceptance Criteria (WAC).

5.2.2 Main Characteristics of Immediate Dismantling

Immediate Dismantling implies the removal of all radioactivity inventories from the site as soon as possible. All equipment inside the controlled area and also inside the non-nuclear installations has to be dismantled. The radioactive material should be conditioned and packaged in a form which ensures safe conditions for the storage or the disposal of this material. Non-radioactive material should be recycled, reused or treated as conventional waste in the usual industrial way.
The dismantling should occur in principle room by room if not system by system using the following sequence:

a) non-contaminated or presumed non-contaminated, if they are not needed during the dismantling of contaminated parts;

b) low-contaminated, if they are not needed during the dismantling of medium and high contaminated parts;

c) medium- and high-contaminated.

Proceeding according this sequence allows the subsequent contamination during the decommissioning work to be avoided (in specific rooms "hot" spots can be dismantled first). After the removal of the components and systems, the building structures and the site are to be decontaminated to reduce the existing radioactivity under the clearance levels. Apart from an interim storage of different radioactive materials, after decontamination and clearance, the remaining building structures are no longer considered as nuclear facility. The removal of these building structures could then be performed as a conventional work.

5.2.3 Main Characteristics of Deferred Dismantling

Deferred Dismantling involves an early dismantling of low to medium contaminated and/or activated parts of the facilities and the conversion of the plant to a Safe Enclosure (SE) that houses the most contaminated and/or activated parts of the facilities awaiting for their eventual dismantling. The aim of the SE operation period is to benefit from the natural decay of the radioactive nuclides, so that the deferred dismantling would be performed in an area with reduced dose rates and with a reduced radioactive inventory. The radioactive material would be conditioned and packaged in a form which assures safe conditions of storage or disposal of this material. Non-radioactive material would be recycled, reused or treated as conventional waste in an usual industrial way.

In order to avoid subsequent contamination, the dismantling works should occur as described here above for Immediate Dismantling.

The main question in Deferred Dismantling strategy is to identify which parts of the facilities should be included in the SE.

Anyway, all options consider removal of the fuel, removal of the operational waste and emptying of the circuits early in the decommissioning phase in order to obtain a significant reduction in the hazards associated with the installation:

a) Restricted SE: the SE is reduced to the smallest reasonable area, in particular to the reactor core. This variant takes into account the radioactive decay of the steel structures of the reactor core and allows waiting for an improved technology for the management of the reactor graphite. The remaining SE area is contained within the reactor building (Building A) which must be kept as a tight structure during the SE period. The not needed inventories of building A and of the other buildings of the INPP are to be removed during the SE preparation phase.

b) Small SE: the SE is limited to hermetic zone of the Accident Localization System (housing the reactor area and parts of the main coolant circuit). This variant takes into account the radioactive decay of the contamination and/or activation of the main circuit components and of the steel structures of the reactor and allows waiting for an improved technology for the management of the reactor graphite. The remaining SE area is contained within the reactor building (Building A) which must be kept as a tight structure during the SE period. The not needed inventory of building A and the other buildings of the INPP would be removed during the SE preparation phase.

c) Extended SE: the SE area is defined by the reactor building (Building A). In this variant the components would not be removed from Building A, they would remain there for 35 years.

d) Maximum SE: the SE encompasses all A, B, V, G and D buildings. The costs estimate of this variant clearly shows the relative benefits and drawbacks of early dismantling on one side and operation effort during the SE period on the other side. It appears not very economical to contain all (low, medium and high) activated parts of the plant in a SE if the associated operational effort is high.

5.3 The Dismantling Strategy Selection

5.3.1 The INPP-PDP

The INPP-PDP (issued end of 1999 under the PHARE Programme) did not make any firm recommendation on the best option to be followed for the decommissioning of INPP. In INPP-PDP Final Report (Section 12.2 – Recommendations), it was concluded that "Final recommendation for an immediate or a later decommissioning strategy as an optimum is not yet possible. As demonstrated in the planning work, there is no clear advantage or disadvantage given for one strategy from the technical or radiological point of view".

It should be noted that the activity inventories and equipment radiological characterization data taken into account as input for INPP-PDP calculations were mostly not INPP specific. This is of concern for assessment of:

- the decommissioning costs;
- the doses to the personnel;
- the decommissioning waste production, their conditioning and storage;
- the possibility to free release dismantled equipment.

5.3.2 IAEA Report "Selection of Decommissioning Strategy for INPP"

IAEA report TCR-00368 [2] "Selection of decommissioning strategy for INPP" was issued early 2001 in the frame of the IAEA LIT/4/002 project "Support for the Decommissioning of INPP Unit 1".

This report relied on the INPP-PDP documents and considered strictly the figures given in those documents. In its conclusions, the report promotes the Immediate Dismantling as being the best alternative for INPP decommissioning strategy. This report, however, clearly highlights that:

- "The social factors and the possible restrictions on the funding supply were not considered in any depth;
- The adequacy of the proposed reference strategy should be re-evaluated against new information becoming available or being developed under the Decommissioning Programme."

5.3.3 The INPP-FDP Preparation

Early 2002, in its INPP-FDP preparation phase, the DPMU reviewed the present situation prevailing at INPP and more globally in Lithuania as far as are concerned:

- the overall fuel management strategy at INPP site (which was examined in [3]);
- the operational waste management strategy (which was discussed in [4] and [5]);
- both inputs to and outcomes of INPP-PDP for Immediate Dismantling and for the four Deferred Dismantling scenarios (which were reviewed in [6]) in order to identify:
    - input and output data that could be re-used during preparation of INPP-FDP and EIA Programme;
    - missing data and possible inaccuracies required to be addressed during INPP-FDP and EIA Programme preparation and later on during Decommissioning Project (DP) and EIA Report preparation.

The figures of INPP-PDP were first updated technically. Further, the impact of different scenarios of future wages escalation in Lithuania was considered. The technical comparison and the global costing evaluation did not come up with definitive arguments in favour of one specific strategy. However, considering slight technical advantages, reduced yearly Cash Flow needs easing the decommissioning funding and a lower Net Present Value of decommissioning costs, the Deferred Dismantling (considering Small Safe Enclosure boundary) appeared to be an advisable strategy for INPP decommissioning.

In order to allow adequate governmental final decision making, the Ministry of Economy asked INPP/DPMU to produce a separate document outlining, for both Immediate and Deferred Dismantling strategies, the technical and financial elements impacting the selection.

The various involved Lithuanian Bodies identified the elements they considered as being important and that should be tackled in the decommissioning strategy selection document.

The INPP dismantling strategy selection support document was officially issued in October 2002 [7].

5.3.4 The Final Lithuanian Governmental Decision

To reach a final decision on the INPP dismantling strategy that encompasses the global Lithuanian socio-economic situation, the Lithuanian Government complemented the technical and financial elements presented in above strategy selection support document with due consideration on more general social, political and economic grounds.

On the 26th of November, in its decree No 1848, the Government of the Lithuanian Republic stated that: "... in order to prevent the heavy long-term social, economical, financial and environmental consequences... Decommissioning of Unit 1 of the State Enterprise Ignalina NPP shall be planned and implemented in accordance with the Immediate Dismantling Strategy".

5.4 Evaluation of Environmental Impacts of the Dismantling Alternatives

5.4.1 Introduction

An "Environmental Impact" means anticipated changes in the environment caused by a proposed economic activity [8]. These changes can be direct, indirect or cumulative and can be found at different ecological (species to ecosystem) and social (individual to community) levels, can vary over space and time, and can be either positive or negative [9].

Lithuanian law on Environmental Impact Assessment is very similar to related EU legislation. The purpose of the present EIA Programme is to identify the scope of the assessment (i.e. the various relevant impacts to be investigated), those impacts will be predicted during EIA Report preparation, in terms of their possible change from baseline conditions, and then assessed, in terms of their importance. Comparison with environmental standards will be made as far as possible (example: releases of radioactive liquid and radioactive effluents, doses to the members of the public, temperature of Lake Drukshiai). For more subjective impacts (e.g. landscape impacts) qualitative assessments will be undertaken.

The EIA process will be coherent with Lithuanian EIA legislation and regulations analysed in Chapter 2. The EIA study will also be carried out in accordance with the guidance given in the "Manual for Environmental Impact Assessment in Lithuania" [9] and "Guidance for Undertaking an EIA of Proposals to Decommissioning a Nuclear Power Plant" which was produced in February 2002 under European Commission Contract [10].

Based on the Environmental Baseline (Chapter 3) and Characteristics of the INPP Decommissioning (Chapter 4), the present section identifies the potential Environmental Impacts of the Decommissioning of INPP. The elements of the decommissioning activities which will generate impacts, the components of the environment, the territories concerned and the socio-economic factors which may be affected and the nature and importance of these impacts are shortly described.

At the EIA Report stage, the detailed discussions of relevant potential Environmental Impacts will describe the methodologies employed and the assumptions and uncertainties included within the assessments. The EIA Report will consist of the systematic and interdisciplinary prediction, identification, and evaluation of impacts of the proposed decommissioning project.

5.4.2 Foreseeable Effects of the Decommissioning on the Environment

The Environmental Impact Assessment takes into account the decommissioning activities with consideration given to the current status/use of the land on which the decommissioning project is to be implemented.

It identifies also the environmental components that are potentially impacted.

5.4.2.1 Decommissioning Activities with Potential Environmental Impacts

The EIA programme includes "characterization of the main alternatives studied by the developer of the proposed economic activity or the preparer of the EIA documents, and an indication of the main reasons for this choice, taking into account the best available techniques and potential environmental effects" [11].

Immediate Dismantling and Deferred Dismantling are discussed under sections 5.2.2 and.5.2.3. The choice of one of theses strategies must take environmental considerations into account, but also technical, financial and social considerations as well. Let us remind that the INPP Decommissioning is a succession of Decommissioning Project on a long period of time (see for example Figure 1-1).

Taking all these elements into consideration, among which environmental ones, the Government decided on 26^{th} November 2002 to implement the Immediate Dismantling Strategy.

For both Immediate and Deferred Dismantling alternatives considered:

- the main direct environmental impacts will be related to the shutdown of the plant with its associated interruption of massive release of thermal power to the lake; there are also important economical consequences;

- other environmental impacts will be generated by following activities related to the decommissioning of INPP:

As resulting from normal conditions:

- Modification of industrial site and fencing;
- Modification of industrial buildings, demolition of buildings;
- Construction of new buildings;
- Performance of refill and earth movement operations;
- Drainage works;
- Recycling, reusing of waste materials;
- Transport of materials;
- Handling of hazardous materials (radioactive and toxic);
- Controlled releases of liquid and gaseous effluents, cease of these releases;
- Storage of radioactive waste;
- Surveillance and Control Activities.

As resulting from accidental conditions:

- Occurrence of fires;
- Structural failures due to the action of external agents (earthquake, flooding, sabotage);
- Personnel accidents;
- Uncontrolled releases of contaminated liquids and gases.

The foreseeable impacts are developed in the next section.

5.4.2.2 Identification Matrix for Potential Environmental Impacts

The identification of potential impacts from the INPP Decommissioning is based on the knowledge of the environmental baseline, of the Project and from the results of an EU funded study, the Final Report "Environmental Impact Assessment for the Decommissioning of Nuclear Installations" [10]. In this report, an impact identification matrix was developed. Its adaptation to the present project is shown on Figure 5-1.

Important remark:
The matrix and following tables are established on the basis of the information available for what concerns environmental baseline and characteristics of the Decommissioning Plan. They are to be considered as guidelines for the preparation of the EIA Reports. They do not pretend to be exhaustive as the present EIA Programme is a scoping phase in the EIA Process.

Figure 5-1. Impact Identification Matrix for decommissioning

		DECOMMISSIONING PROJECT ACTIVITIES WITH POTENTIAL ENVIRONMENTAL IMPACTS															
		Shutdown of the plant	Modification of industrial site and fencing	Modification of industrial buildings, demolition of buildings	Construction of new buildings (mainly out of scope of the present EIA process)	Refill and earth movements	Drainage works	Recycling, reusing of wastes	Transport of materials	Handling of hazardous materials (radioactive and toxic)	Controlled releases of liquid and gaseous effluents	Interim storage of radioactive waste (new ISFSF out of scope)	Occurrence of fires	Incidental/accidental releases of contaminated liquids and gases	Personnel accidents	Structural failures due to the action of external agents (earthquake, flooding, sabotage)	Surveillance and Control operations
ENVIRONMENTAL COMPONENTS		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
PHYSICAL ENVIRONMENT	E1 AIR	x		x	x	x		x	x	x	x	x	x	x		x	
	E2 LAND AND SOIL			x	x	x	x			x	x			x		x	
	E3 WATER	x	x	x	x		x	x	x	x	x	x	x	x		x	
	E4 FLORA	x			x		x			x	x		x	x		x	
	E5 FAUNA	x		x	x	x				x	x			x		x	
	E6 LANDSCAPE			x	x	x						x	x	x			
SOCIO-ECON. ENVIRONMENT	E7 LAND USE		x									x		x			
	E8 CULTURAL																
	E9 INFRASTRUCTURE								x								
	E10 HEALTH	x		x		x			x	x	x	x	x	x	x	x	
	E11 POPULATION & ECONOMY	x	x					x									

5.4.2.3 Detailed identification of potential environmental impacts

Each potential environmental impact identified within the scope of the present EIA Process[7], can be detailed according to:

- The identification of possible effects,
- Proposals for methodological approach for assessment,
- Territories that should be considered during the assessment.

5.4.2.3.1 *For the Physical Environment*

Air:

Activities	Potential impacts	Methodology	Territories
Shutdown of the plant	Better air quality regarding radioactive pollutants	Determine the decrease of pollutant emissions and compare with natural levels of pollutants	Regional scale (30 km radius for radioactive pollutants, including international aspects) Local scale (few km) for combustion pollutants
Demolition of buildings	Dust fallout in the vicinity of works	Compare with nuisances created by large civil works	Local scale (few hundred meters) around work places
Refill and earth movements	Dust fallout in the vicinity of works	Compare with nuisances created by large civil works	Local scale (few tens of meters) around work places
Recycling, reuse of wastes	Non-radioactive dust fallout in the vicinity of recycling places	Compare with nuisances created by such processes	Local scale (few tens of meters) around recycling places
Transport of materials	Non-radioactive dust fallout along transport routes	Compare with nuisances usually created by the transport of civil works wastes	Local scale (few tens of meters) along the transport routes
Handling of hazardous materials (radioactive and toxic)	Potential increase of radioactivity in the areas of handling	Determine possible emissions and compare with related standards	Local scale (few hundred meters) around handling places
Controlled releases of liquid and gaseous effluents	In the middle and long-term, reduction of releases due to shutdown	Determine the decrease of pollutant emissions, compare with emissions in normal operation and with related standards	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Interim storage of radioactive waste	Potential increase of radioactivity in the surroundings of the storage at full capacity	Determine the radioactivity increase and related dose to critical members of the public	Local scale (few km)
Accidental events	Potential increase of radioactivity in the area of pollutant dispersion	Determine source terms and potential radioactive emissions	Regional scale (30 km radius for radioactive pollutants, including international aspects) – review in function of source terms importance

Couples with:

- A2: is not useful in itself and impacts associated to the evolution of the site are covered by other couples,
- A4: not significant,

[7] Potential impacts related to other projects (such as new HOB, ISFSF, etc.) are mentioned for information in the identification matrix.

- A6, A14 and A16: are not relevant.

Land and soil:

Activities	Potential impacts	Methodology	Territories
Demolition of buildings	Use of land for works and perturbation of soils that are currently not used by INPP. Remove of contaminated soils.	Check localisation of new uses of land and assess consequences on soil structure and quality.	Local scale (few hundred meters) around demolition places
Construction of new buildings	Use of land and impact on soil	Determine areas necessary and soil type at foreseen locations	Local scale (site)
Refill and earth movements	Soils destructuring, use of land for earth deposits. Modification of run-off after works	Compare with soil quality and assess foreseen works in terms of soil quality preservation and restoration. Check current run-off and potential perturbation resulting from works	Local scale (site)
Drainage works	Perturbation of groundwater circulation and quality	Based on the knowledge of groundwater circulation at the INPP site, evaluate potential impacts on water circulation and quality. Verify possible flow from the Lake Drukshiai. Verify possible effects on near marshes (desiccation).	Local scale (few hundred meters)
Recycling, reuse of wastes	Non-radioactive dust fallout in the vicinity of recycling places	Compare with nuisances created by such processes	Local scale (few tens of meters) around recycling places
Transport of materials	Non-radioactive dust fallout along transport routes	Compare with nuisances usually created by the transport of civil works wastes	Local scale (few tens of meters) along the transport routes
Handling of hazardous materials (radioactive and toxic)	Potential contamination of soil in case of no proper handling and storage	Determine what substances are concerned as well as their pollution potential, in parallel with measures foreseen for their appropriate handling and storage	Local scale (site)
Controlled releases of liquid and gaseous effluents	Evolution in soil quality due to the reduction than stop of gaseous effluents and fallout	Determine the decrease of radioactive fallout, compared to previous situation	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Accidental events	Potential increase of radioactivity in the soils resulting from pollutant fallout	Determine source terms and potential radioactive emissions	Regional scale (30 km radius for radioactive pollutants, including international aspects) – review in function of source terms importance

Couples with:

- A1: it will have no effect in itself; associated effects (decrease of radiological releases) are covered in other couples,
- A2: no effect in itself; we can mention a possible change in the far future into the destination of the site, which is related to the decision of the Authorities to change its use (new activities, Greenfield, etc.),
- A7 and A8: no effect,

- A12: is not significant,
- A14 and A16: are not relevant.

Surface waters:

Activities	Potential impacts	Methodology	Territories
Shutdown of the plant	Better lake water and river Prorva quality due to decrease of radioactive, thermal, and sanitary wastewater. Decrease of water consumption	Determine the decrease of emissions and compare with previous levels of pollutants	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Modification of industrial site and fencing	Modification in the local water cycle	Describe the evolution in the local water cycle and evaluate consequences	Local scale (site and close surroundings)
Demolition of buildings	Disturbance of water circulation due to demolition of drainage systems	Evaluate the evolution in the local water cycle	Local scale (site and close surroundings)
Construction of new buildings	Perturbation of run-off at new buildings location	Determine areas concerned and run-off pattern modification	Local scale (site)
Drainage works	Perturbation of surface water circulation and quality (a.o. release of suspended particulates)	Based on the knowledge of surface water circulation on the site, evaluate potential impacts on water circulation and quality.	Local scale (site)
Recycling, reuse of wastes	Run-off water quality changes (a.o. suspended particulates)	Evaluate potential changes and impacts on local surface water	Local scale (site)
Transport of materials	Sludge deposits on roads at the exit of the site (rainy days)	Compare with nuisances usually created by the transport of civil works materials	Local scale (from few tens to some hundreds of meters) along the transport routes
Handling of hazardous materials (radioactive and toxic)	Potential contamination of run-off water or wastewater effluents by hazardous substances in the areas of handling and their transport on site	Determine what substances are concerned as well as their pollution potential, in parallel with measures foreseen for their appropriate handling and storage	Local scale (site and bodies receiving wastewaters)
Controlled releases of liquid and gaseous effluents	In the middle and long-term, reduction of releases due to shutdown	Determine the decrease of pollutant emissions, compare with emissions in normal operation and with related standards	Regional scale (concerned water courses and lakes) including international aspects
Interim storage of radioactive waste	Potential increase of radioactivity in the run-off water	Determine the potential radioactivity increase and compare to applicable standards	Sub-regional scale (concerned water courses and lakes)
Accidental events	Potential pollution of water by extinguishing actions or accidental releases	Determine source terms and potential contaminations	Regional scale (30 km radius for radioactive pollutants), including international aspects – review in function of source terms importance

Couples with:

- A5: is not significant,
- A14 and A16: are not relevant.

Underground waters:

Activities	Potential impacts	Methodology	Territories
Shutdown of the plant	Better water quality due to decrease than stop of radioactive, thermal, and sanitary wastewater. Decrease of water consumption	Determine the decrease of emissions and compare with previous levels of pollutants, taking into account water exchanges between surface and underground	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Modification of industrial site and fencing	Modification in the local water cycle	Describe the evolution in the local water cycle and evaluate consequences	Local scale (site and close surroundings)
Demolition of buildings	Modification of water circulation on the site and transfer to underground water	Describe the evolution in the local water cycle and evaluate consequences	Local scale (site and close surroundings)
Construction of new buildings	Decrease of permeable soil at new buildings location	Determine areas concerned and compare to current impermeable areas and their evolution with the project	Local scale (site)
Drainage works	Perturbation of underground water circulation during works and of quality (a.o. contact with polluting substances)	Based on the knowledge of underground water circulation on the site, evaluate potential impacts on circulation and quality.	Local scale (site and surroundings)
Handling of hazardous materials (radioactive and toxic)	Potential contamination of run-off water or soil by hazardous substances in the areas of handling and their transport on site	Determine what substances are concerned as well as their pollution potential, in parallel with measures foreseen for their appropriate handling and storage	Local scale (site and bodies in contact with underground water)
Controlled releases of liquid and gaseous effluents	In the middle and long-term, reduction of releases due to shutdown	Determine the decrease of pollutant emissions and comment on the possible increasing quality of underground water	Regional scale (concerned water courses and lakes) including international aspects
Interim storage of radioactive waste	Potential increase of radioactivity in the run-off water	Determine the potential radioactivity contamination of underground water	Sub-regional scale (concerned underground water)
Accidental events	Potential pollution of run-off water and soils	Determine source terms and potential contaminations	Regional scale (30 km radius for radioactive pollutants), including international aspects – review in function of source terms importance

Couples with:

- A5, A7, A8: are not significant,
- A14 and A16: are not relevant.

Flora:

Activities	Potential impacts	Methodology	Territories
Shutdown of the plant	Decrease in releases of pollutants, better quality in ecosystems	Determine the possible evolution of ecosystems influenced	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Construction of new buildings	Destruction of flora at new buildings location	Check species importance at areas concerned	Local scale (site)
Drainage works	Perturbation of surface and near surface underground water circulation	Check possible impacts on flora species present at drainage works location.	Local scale (site)
Handling of hazardous materials (radioactive and toxic)	Potential contamination of run-off water or soil by hazardous substances in the areas of handling and their transport on site	Determine what substances are concerned as well as their pollution potential, in parallel with measures foreseen for their appropriate handling and storage	Local scale (site)
Controlled releases of liquid and gaseous effluents	In the middle and long-term, reduction of releases due to shutdown	Determine the impact of the decrease of pollutant emissions, in function of observations made after commissioning	Local scale (few km)
Accidental events	Potential pollution of water, air and soil by releases of polluting substances	Determine source terms, potential contaminations and impacts for flora species concerned	Regional scale (30 km radius for radioactive pollutants), including international aspects – review in function of source terms importance

Couples with:

- A2: though not important, the effect would be a progressive restoration of places for flora growth (it also depends of the decision of the Authorities to change its use (new activities, Greenfield, etc.); linked to A5,
- A3, A8, A11: not significant,
- A7, A14 and A16: not relevant.

Fauna:

Activities	Potential impacts	Methodology	Territories
Shutdown of the plant	Decrease in releases of pollutants, better quality in ecosystems	Determine the possible evolution of ecosystems influenced	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Demolition of buildings	Noisy works could affect the frequentation of surroundings by sensitive species	Describe the potential effects of works on sensitive species	Local scale (site and close surroundings)
Construction of new buildings	Destruction of possible interesting habitats	Check if interesting habitats will be affected by new constructions	Local scale (site)
Handling of hazardous materials (radioactive and toxic)	Potential contamination of run-off water or soil by hazardous substances in the areas of handling and their transport on site	Determine what substances are concerned as well as their pollution potential, in parallel with measures foreseen for their appropriate handling and storage; check transfer pathways that could affect fauna species	Local scale (site and surroundings = few kms)
Controlled releases of liquid and gaseous effluents	In the middle and long-term, reduction of releases due to shutdown	Determine the impact of the decrease of pollutant emissions, in function of observations made after commissioning	Local scale (few km)
Accidental events	Potential pollution of water, air and soil by releases of polluting substances	Determine source terms, potential contaminations and impacts for fauna species concerned, particularly Natura 2000 species	Regional scale (30 km radius for radioactive pollutants), including international aspects – review in function of source terms importance

Couples with:

- A2: though not important, the effect could be an increase in fauna species frequentation of the site (it also depends of the decision of the Authorities to change its use (new activities, Greenfield, etc.); linked to A5,
- A6, A8, A11, A12: not significant; the transport of civil works wastes or other materials will not change significantly the current nuisances caused by the traffic that could influence the fauna,
- A7, A14 and A16: not relevant.

Landscape:

Activities	Potential impacts	Methodology	Territories
Demolition of buildings	Some visual impacts due to works then decrease in built areas with possible landscape enhancement	Evaluate impacts from works characteristics, schedule and remaining buildings on the middle and long term	Sub-regional scale (visual perception area)
Construction of new buildings	Increase of visual impact	Determine on the basis of new buildings locations	Sub-regional scale (visual perception area)
Refill and earth movements	Enhancement of site visual aspect	Evaluate enhancements and propose additional measures if necessary (taking into account synergies with other factors)	Local scale (site and surroundings)
Accidental events	Potential degradation of landscape resulting from destruction of habitats from fires or heavy contamination	Determine source terms and potential impacts	Regional scale (30 km radius for radioactive pollutants, including international aspects) – review in function of source terms importance

Couples with:

- A1: not relevant,
- A2: no effect in itself; we can mention a possible change in the far future into the destination of the site, which is related to the decision of the Authorities to change its use (new activities, Greenfield, etc.),
- A6, A7, A9, A10: no effect,
- A11: only new buildings – out of scope of the present EIA Programme – could have a visual impact; to be assessed in their respective EIA Processes,
- A8, A12: is not significant,
- A14, A15 and A16: not relevant.

5.4.2.3.2 *For the Socio-economic Environment*

Land use:

Activities	Potential impacts	Methodology	Territories
Modification of industrial site and fencing	Modification in the use of land towards uses still subject to decisions by the Authorities	Discuss the evolution of the site according to different projects and final destination. Evaluate relationships with other uses that can be interconnected	Local scale (site and surroundings)
Accidental events	Potential degradation of land resulting from heavy contamination, that can threaten planned or current uses	Determine source terms and potential impacts	Regional scale (30 km radius for radioactive pollutants, including international aspects) – review in function of source terms importance

Couples with:

- A1: no effect,
- A3: same as A2 in this case,

- A4: the new buildings to be constructed that may have a significant impact on land use will be subject to their own EIA process,
- A5, A6, A7, A8: not relevant,
- A9, A10: not significant,
- A11: only new buildings – out of scope of the present EIA Programme – could have a visual impact; to be assessed in their respective EIA Processes,
- A12, A14, A15 and A16: not relevant.

Cultural:

No particular impact of the project on Cultural issues. Protected areas mentioned in Section 3, that could be affected, are to be investigated under other above mentioned environmental components. Attention shall be drawn on possible cultural impacts.

Infrastructures:

Some changes can appear during the INPP Decommissioning, as the increased use of roads for wastes transport (e.g. from civil works on the site), modifications in the electrical power supply network. Impacts of traffic are to be investigated.

People (health):

Activities	Potential impacts	Methodology	Territories
Shutdown of the plant	Better air and water could participate in less exposure to critical members of the public.	Determine the decrease of exposure and compare to previous one	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Demolition of buildings	Workers exposure to dust and other substances, among which possible radioactive ones	Determine potential risks for health and dose to workers and critical members of the public	Local scale (site and surroundings)
Refill and earth movements	Exposure to dust	Compare with nuisances created by large civil works	Local scale (few tens of meters) around work places
Transport of materials	Exposure to radioactivity during transport of radioactive materials	Evaluate by comparison with previous shipments, compare with applicable standards	Local scale along the transport routes
Handling of hazardous materials (radioactive and toxic)	Potential increase of radioactivity and exposure to hazardous substances in the areas of handling	Determine possible impacts for health emissions and compare with related standards	Local scale around handling places
Controlled releases of liquid and gaseous effluents	In the middle and long-term, reduction of releases due to shutdown	Determine the decrease of pollutant emissions, compare with emissions and dose to workers and critical members of the public in normal operation and with related standards	Regional scale (30 km radius for radioactive pollutants, including international aspects)
Interim storage of radioactive waste	Potential increase of radioactivity in the surroundings of the storage at full capacity	Determine the radioactivity increase and related dose to critical members of the public	Local scale (few km)
Accidental events	Potential increase of radioactivity in the area of pollutant dispersion	Determine source terms and potential impacts in terms of dose to workers and critical members of the public	Regional scale (30 km radius for radioactive pollutants, including international aspects) – review in function of source terms importance

Couples with:

- A2: is not useful in itself and impacts associated to the evolution of the site are covered by other couples,
- A4: not significant in itself (as workers safety during construction is covered by other specific legislation for occupational health and safety at work),
- A7: not significant,
- A6, A16: are not relevant.

Population and economy:

Activities	Potential impacts	Methodology	Territories
Shutdown of the plant	Progressive but still important loss of jobs, partly compensated by jobs related to the dismantling. Other energy sources to be found. Town heating system and warm water will be more expensive to inhabitants.	Explain progression of employment, with direct and indirect effects on local economy and social tissue. Use social economic studies made on the subject.	Regional scale, including potential national-wide consequences.
Modification of industrial site and fencing	Modification in the use of the site can, according to decisions made by the Authorities for the future, lead to various social and economic consequences at local and regional level. The changes could be very important in Visaginas.	Describe, on the basis of studies made on this subject, the possible scenarios for social and economic development of the area.	Regional scale

The works for the Decommissioning will need workforce. This should be mentioned in the EIA as social and economical impact (aside the job cut offs that are related to the INPP operation).

5.4.3 Conclusions

The identification matrix applies to both Dismantling alternatives and only differences will be in the quantification and associated minimization and mitigation measures for some of the less significant identified impacts.

In the short term (up to 2012), Immediate and Deferred Dismantling show almost the same Impact on Environment as preparatory activities, first dismantling activities and decommissioning support packages operation are quite similar in both options.

In the mid-term (2012 - 2030):

a) Immediate Dismantling will have a tough Environmental Impact as all remaining dismantling activities are to be performed during this period. The works will tackle high contaminated/activated equipment and material. At around 2030, provided adequate off-site final storages are made available, INPP site could possibly be restored to free field;

b) Deferred Dismantling will have slight Environmental Impact due to Safe Enclosure operation.

In the long term (2043 – 2060), final dismantling to be considered for Deferred Dismantling is to occur and this will have a tough Environmental Impact. Here also the works will have to tackle the safe enclosed high contaminated/activated equipment and material.

The radiological environmental impacts of INPP decommissioning are presented in Chapter 6. The following table compares, from a qualitative standpoint, the differential radiological impacts of the Immediate and Deferred Dismantling options.

Figure 5-2. The radiological impacts of the Immediate and Deferred Dismantling options

Issue	Immediate Dismantling	Differed Dismantling
Release of liquid and gaseous radioactive waste		(-)
Mass of solid waste dedicated to: • Landfill • Near-surface disposal • Geological disposal		 (-) (-) (-)
Non radioactive impact sources (see Section 8)	(0)	(0)
Plant personnel/Public exposure		(-)
Mass of free released materials		(-)

Note: (-) slightly lower impact; (0) no anticipated differential impact; (+) slightly higher impact

The radiological environmental impact of the Differed Dismantling option is somewhat lower than that of the Immediate Dismantling. This results from the fact that the dismantling of the most active components (ex: the reactor components) will start after a Safe Enclosure period of 35 years, i.e. 43 years after the Reactor Final Shutdown. Such a period enables some decay in the inventories of the short to medium lived gamma emitters in the equipment to be dismantled and in the secondary waste generated by the dismantling operations.

The non-radiological environmental impacts of INPP decommissioning are presented in Chapter 7. There also no decisive argument for or against any specific dismantling option is to be found.

Globally, when balancing the technical, financial, economical, environmental, social and political considerations to make a decision on the dismantling strategy to be followed, as a first approach, there is from an environmental impact point of view no definitive argument to go for one dismantling option or another.

Furthermore, considering both dismantling options, adequate minimization and mitigation measures (as outlined in Chapter 8) can be implemented to cope with the identified impacts and ensure that the residual impacts of the decommissioning activities to be performed are environmentally acceptable.

5.5 List of References

1. INPP Preliminary Decommissioning Plan – NIS/SGN/SKB – PHARE Project 4.08/94.

2. IAEA Report No. TCR – 00368 "Selection of the Decommissioning Strategy for the Ignalina NPP".

3. DPMU Document "Comparison of reactor unloading and fuel transfer scenarios" – ref B8/0002.

4. DPMU Document "INPP Operational waste treatment strategy" – ref B2/3/4/TN/0.

5. INPP Solid Waste: preliminary set of WAC for conditioned waste candidate for near-surface disposal – DPMU Report 04.B21.01.20/TN/004 issue 1 – 30/04/02.

6. DPMU report on Preliminary Decommissioning Plan Review – ref A1.1/PDP/0001 issue 2.

7. DPMU document "Technical and Financial Considerations Required to select an INPP Decommissioning Strategy".

8. Law on Environmental Impact Assessment of the Proposed Economic Activity, 18 April 2000, N° VIII-1636.

9. Manual for Environmental Impact Assessment in Lithuania. Ministry of the Environment of the Republic of Lithuania, Finnish Environment Institute. ISBN 9955-425-88-1, Based on Lithuanian EIA legislation in force on 1 January 2001.

10. Environmental Impact Assessment for the Decommissioning of Nuclear Installations. Final Report – Vol.2. Guidance for Undertaking an EIA of Proposals to Decommissioning a Nuclear Power Plant – EC Contract B4 – 3040/99/MAR/C2.

11. Order of the Minister of the Environment of the Republic of Lithuania N° 262, June 2000, on Regulations on Preparation of the Environmental Impact Assessment Programme and Report.

6 Radiological Environmental Impact

6.1 Introduction – Scope

This Chapter addresses the following issues:

a) the key environmental radiation protection criteria applicable during the different phases of the INPP units 1 and 2 decommissioning;

b) the short and long term[8] radiation protection of the public;

c) the INPP personnel individual and collective doses;

d) the measures implemented to minimize the radiological impact for the critical members of the public and for the plant personnel.

This chapter describes the methodology that will be implemented to address the above issues.

The detailed assessment of these issues will be covered by the Decommissioning Projects of the INPP Decommissioning Plan and associated EIA Reports.

6.2 Key Environmental Radiation Protection Criteria

The basic ALARA principles governing the routine operation remain applicable during the different phases of the plant decommissioning. This means, among others, that, on a short term basis:

a) the operational and maximum allowable discharge limits of liquid and gaseous radioactive waste may not be exceeded;

b) the operational and maximum allowable radiological exposure limits for the plant personnel may not be exceeded.

On a medium term basis, the radiation exposure of the public must be ensured as far as the interim storage of spent fuel is concerned. This aspect will be covered in the EIA of associated project for ISFSF.

On a long term basis, the radiation exposure of the critical members of the public shall be warranted by limiting the critical nuclides activity inventory in the conditioned solid waste disposed off into the future near-surface repository site(s).

6.3 Liquid and Gaseous Radioactive Waste Discharges during the Plant Decommissioning

Actually, the reduction of the equipment inspection, maintenance and repair activities will be compensated by an increase of the cleaning, decontamination and dismantling activities.

[8] Short term – during active decommissioning, i.e. – dismantling of equipment, demolition of buildings, treatment of waste.
Long term – when active decommissioning is finished and when all radioactive waste are safely stored or disposed of.

It is worth to note that, 2 months after the RFS:

I. There will no longer be releases of noble gases (Xe and Kr isotopes) and of short lived iodine isotopes (I^{131}, I^{133});

II. There will not longer be emissions of H^3 and C^{14} via the atmospheric releases;

III. The H^3 releases via the liquid waste and atmospheric discharges will be significantly reduced.

Dismantling activities generate the pollutants of liquid and atmospheric radioactive releases. However, taking into account a decay period after the Reactor Final Shutdown, the discharges of short lived fission and activation products (Mn^{54}, Zr^{95}, Nb^{95}, Fe^{59}) in liquid and atmospheric waste will be significantly reduced.

The above mentioned decay period has little effect on the Cs^{137} activity inventory in the decommissioning waste. However, due to a very high solubility, the Cs^{137} activity inventory in the decommissioning waste is predicted to be very low (see Chapter 6 of the INPP-Final Decommissioning Plan). It is therefore proposed to keep, during the dismantling, maximum allowable discharge limits applicable to the routine operation of the plant.

The assessment presented in this item will be addressed in details in the EIA Report.

6.4 Radiological Impact Assessment Methods

The assessment of the effective dose and of the dose equivalents to the organs of the critical members of the public implies:

a) the assessment of the radiological source terms, i.e. the released activities via the liquid and gaseous waste discharges, including the routinely measured nuclides (Co^{58}, Co^{60}, Mn^{54}, $Cs^{134}$and Cs^{137}) and the critical nuclides (long lived β-γ emitters, U and TRU nuclides). The releases of these latter will be assessed on the basis of their appropriate SF and of their physical-chemical behavior in the waste processing installations;

b) the assessment of the resulting effective dose and dose equivalents to the main organs of the critical members of the public, due to the direct and indirect exposure pathways. For this purpose, the methodology recommended by [1] will be implemented.

c) The dose-contamination conversion factors (Sv/Bq) of some critical nuclides (ex. Ni^{59}, Ni^{63}, Nb^{94}, Tc^{99}) are not mentioned in [1]. They will be calculated on the basis of the methodology given in [2] and [3].

These assessments will be prepared for the different phases of the decommissioning in the frame of the INPP-Decommissioning Projects.

6.5 Solid Waste Production, Characterization and Conditioning Techniques with Respect to the Final Disposal

- The production of conditioned decommissioning waste packages is a key issue of the decommissioning activities. Most of the conditioned wastes come into consideration for final disposal into a near-surface repository site (still under study at this stage). The critical nuclides[9] inventories of this waste constitute, therefore, the radiological source term for the long term safety assessment of the final repository site(s).

- Independently from economical considerations, there is thus a strong safety incentive to minimize the volume of conditioned decommissioning waste to be disposed off.

This objective is achieved by:

a) a careful preparation of the dismantling operations (§9.2. of the FDP). The sizes of the segmented/cutted equipment must be optimized so as to make benefit, to the largest possible extent, of the useful capacities (max. load, free volume) of the containers used for immobilization and final disposal;

b) implementing a decontamination, whenever such an operation enables to reduce the overall volume of conditioned waste to be disposed off;

c) implementing waste conditioning techniques that enable to achieve the highest volume reduction factors(VRF), while still complying with the Waste Acceptance Criteria (WAC);

d) for example, incineration of combustible waste followed by super-compaction of the ashes.

e) Waste Acceptance Criteria (WAC): the conditioned decommissioning waste, as well as the conditioned operational waste, must comply with a set of WAC, including among others, strict limitations on the inventories of critical nuclides. The compliance with these WAC implies a detailed radiological characterization of the different waste streams to be conditioned.

   The methodology to be implemented in the Decommissioning Projects is summarized on Figure 6-1.

f) Quality Assurance – Traceability

   The waste management system must enable full traceability and retrievability of each conditioned package dedicated to final disposal.

   A waste package characterisation record must contain the final quantification of the hazardous content of individual packages and determination that the radioactive waste package meets all the regulatory requirements set by public authorities for performance of operations with regards to it (lifting, transfer, etc.), its interim storage, transport and disposal [4]. This means that each package must be provided with waste package characterization records containing, at least, the following information:

[9] C^{14}, Ni^{59}, Ni^{63}, Co^{60}, Nb^{94}, Sr^{90}, Tc^{99}, I^{129}, Cs^{135}, Cs^{137}, U^{235}, U^{238}, Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Am^{241}, Pu^{242}, Cm^{244}

I. origin and type of the conditioned waste;

II. date of conditioning (identification of the conditioning campaign);

III. the total weight of the conditioned waste – type of the immobilization matrix;

IV. critical nuclides inventories in the conditioned waste by the time of conditioning.

V. contact (10cm) dose rate and dose rate at 1m by the time of conditioning;

VI. residual (if any) external α and β-γ surface contamination of the waste package;

VII. presence of toxic/hazardous materials (when relevant);

VIII. location in the interim storage facilities;

IX. date of evacuation to the final disposal site.

A computerized tracking system, enabling the entry and the storage of these data in a database, will be installed at INPP in the frame of the supply of the B Package.

The here above described methodology will be implemented in details, for each decommissioning waste stream in the DP.

6.6 Radiological Consequences of Postulated Incidents and Accidents for the Members of the Public and for the Plant Personnel

6.6.1 Introduction-Scope

After the RFS, the risk of incidents/accidents leading to large releases of fission products from the fuel is considerably reduced. However, the nature of the tasks to be carried out in view of the dismantling is such that incidents/accidents leading to some contamination spreading in the plant and releases into the environment cannot be excluded despite of the precautions taken during the preparation and the execution of the works.

The objectives of this Chapter are:

a) To identify the bounding sequences (scenarios) with respect to the exposition of the critical members of the public and of the plant personnel;

b) To identify the precautions that are taken to avoid the occurrence of such events;

c) To asses the radiological exposures (effective dose, dose equivalents to the main organs) of the critical members of the public;

d) To identify the counter measures that can be implemented to mitigate the radiological consequences of the identified incidents/accidents;

e) To demonstrate that the radiological acceptance criteria (regulatory requirements) are met, even when these analyses are based on conservative approaches (radiological source terms, meteorological conditions, atmospheric dilution factors…).

A preliminary list of possible scenarios to be analyzed during the preparation for dismantling is as following:

a) accidents in spent fuel handling and storage system:

    I. fuel handling accidents;

    II. loss of spent nuclear fuel cooling capability;

b) loss of spent decontamination solution;

c) fire risk, including fire of the flammable ventilation filters;

d) accidents/incidents during the Fuel Assemblies cooling in the reactor core (prior transfer to Unit 2);

e) Spent Fuel storage cask transportation accident;

f) graphite handling and disposal related incidents/accidents.

Item e) (SF storage cask transportation accident) is analyzed by relevant projects and will not be considered in this Chapter.

The above sequences include the highest potential radiological source terms (transferable/volatile contamination) for the members of the public. In addition to these, the EIA Report will also investigate the major potential incidents/accidents related to the implementation of specific dismantling tools and techniques, the radiological exposure of the plant personnel (for example during the recovery phase) becoming then the major concern.

This Chapter also identifies the emergency plans to be implemented for public radiation protection all along the decommissioning process.

6.6.2 Loss of the Core Cooling Capability

Because of transfer of spent fuel to the Unit 2 for reuse, the decommissioning schedule of INPP anticipates that fuel will remain in the reactor of Unit 1 for 3 years. During this period, the necessary cooling of spent fuel in the core will be provided by a set of safety related systems remaining in operation for this period.

These main systems are:

- Primary circuit itself;
- Blowdown and cooldown system;
- Reactor maintenance cooling system;
- Refuelling system;
- Primary circuit purification system;

- Core sub-criticality control system.

The mode of operation at this stage will not differ from the usual one during outages. The safety is provided by the current plant design and operational procedures.

6.6.3 Accidents in Spent Fuel Handling and Storage System

6.6.3.1 Introduction

The purpose of this Chapter is to make an overview of the accidents that may occur in the spent fuel handling and storage system during the post-shutdown phase after the RFS of Ignalina NPP Unit 1.

The spent fuel handling and storage system consists of several independent subsystems each performing the following main functions:

a) transport spent fuel assemblies within the unit;

b) store Spent Fuel Assemblies (SFA) extracted from the reactor (before the cutting);

c) cut SFA into fuel bundles and place them into 102 places baskets;

d) store the 102 places baskets with fuel bundles in SF decay pools;

e) place basket into a storage/transport cask;

f) transport casks outside the unit to a separate on-site storage facility;

g) accountancy of fuel and monitoring of storage arrangements.

The main safety goals of the spent fuel handling and storage system are as follows:

- to maintain sub-criticality;
- to provide appropriate radiation protection;
- to limit the radioactive releases under the authorised thresholds;
- to protect spent fuel bundles from damage.

List of possible accidents that could lead to radiological consequences for plant personnel is as follows:

- drop of SFA on the bottom of the SF decay pool;
- drop of the basket on the bottom of the SF decay pool;
- hovering of SFA;
- the loss of spent fuel cooling capability;

- leakage from SF decay pool that leads to reduction of water level;
- formation of explosive compounds in the case of ventilation system failure;
- infiltration of an air in the spent fuel decay pool through pipelines;
- loss of electricity supply;
- fire in the SF decay pool hall;
- mistakes of the personnel;
- seismic influence.

Above mentioned accidents were analysed in [5, 6] for normal operation of the Ignalina NPP. The same events can also occur during the power unit post-shutdown period. Therefore review of accident analysis performed in [5, 6] was made and its suitability during decommissioning is presented in 6.6.3.2 to 6.6.3.12.

Transportation procedures and measures for not fully depleted fuel assemblies from Unit 1 to Unit 2 are under consideration in a separate project and will not be described in this Chapter.

6.6.3.2 Drop of SFA on the Bottom of the Spent Fuel Decay Pool

The equipments used for transportation of SFA (cranes in the reactor and storage pool halls, grips), exclude a possibility of spontaneous unhook and drop of the SFA or cased SFA on the bottom of the SF decay pool. Thus, the drop of the SFA is possible only at faulty actions of the personnel.

Height of the drop of SFA during rearrangement operation in the SF decay pool does not exceed 1 meter. Breaching of the fuel rod cladding in the case of SFA drop at such height does not occur [7].

Height between lifted SFA and the bottom of SF decay pool is 8 meters when the cutting of a suspension bracket from SFA is performed. In this case breaching of the fuel rod cladding and release of fuel pellets are possible if SFA is dropped. Conservatively it is assumed that all fuel rods of the dropped SFA are breached. In this case ^{134}Cs ($3.3 \cdot 10^{10}$ Bq) and ^{137}Cs ($2.8 \cdot 10^{10}$ Bq) will be released in the pool water of compartment 234 and specific activity of water in this compartment will increase by 85000 Bq/kg. To prevent from activity distribution in all compartments of the SF decay pool when SFA is dropped it is necessary to close bulkhead gate and to switch on a water cleaning system. After such accident radiation conditions in the SF decay pool hall will become worse and the dose rate value at the border of the compartment can increase up to 30 milliSv/h.

Only two isotopes (^{134}Cs, ^{137}Cs) are taken into account in [5, 6]. However, the short lived isotopes of krypton, xenon, iodine and other elements must be under consideration in case of conservative approach especially if the accident occurs soon after the removal of the FA from the core. Further it must be taken into account that Xe, Kr and I are volatile nuclides that will be totally or partially released into the environment. It should be noted that, 2-3 months after removal of the SFA from the core, there will no longer be discharges of noble gases and short-lived iodine isotopes (with the exception of Kr 85).

6.6.3.3 Drop of the Basket in the Bottom of the Spent Fuel Decay Pool

The equipment used for a storage and transportation of baskets with SFA excludes the possibility of spontaneous unhook and drop of the baskets on the bottom of SF decay pool. The drop of the basket is possible only at faulty actions of the personnel.

Height of drop of the basket during transportation operation does not exceed 10 meters. Strength analysis of the basket with SFA, under accident conditions and various drop cases from the height of 0.2 meter to 10 meters, was performed in [7].

In the case of the basket drop from maximal 10 meters height on the rigid foundation, there is deformation of welded seams of the basket, within the limits of elastic area to preserve of geometrical rearrangement of the basket tubes. So the drop of the basket without overturning does not have neither radiological, nor criticality consequences.

6.6.3.4 Hovering of SFA

Hovering of SFA during transportation is possible in the case of the complete interruption of electricity supply or failure of mechanisms of cranes for other reasons.

All transportation operations with the SFA or baskets with SFA are carried out under the water that provides necessary cooling and biological protection of the personnel. Therefore failures of the crane or complete interruption of electricity supply will cause hovering of SFA (or basket), but will not lead to emergency situation.

After recovery of serviceability of the crane or resumption of electricity, the operation can be completed without any consequences for the safety.

6.6.3.5 The Loss of Spent Fuel Cooling Capability

The loss of spent fuel cooling capability leads to the heating of the pool water with the maximum rate of about 3 ^{o}C/h and the time until water temperature in a certain compartment can be close to boiling is approximately 13.4 hours. Within this time frame re-establishment of serviceability of the cooling system or operation of other necessary corrective actions must be secured. Beyond this time frame, failure to initiate the appropriate corrective actions leads to a decrease of the water level in the pool due to evaporation. SFA uncovery is the critical concern as it leads to significant increase of the cladding temperature and of the risk of cladding damages with releases of fission products.

It is possible to make additional cooling due to water exchange supplying it from makeup system and discharging through the pipeline (feed and bleed operation). In such a way, water-boiling time can be increased and the actions of re-establishment of serviceability of the pump and heat exchanger unit can be completed without any consequences for safety.

It is necessary to note that even in case of pool water boiling, SFA uncovery is not a short term concern because the decrease rate of water level due to evaporation will be less than 2 centimeters per hour, i.e. water level will decrease by 1 meter after more than 56 hours from the beginning of boiling. Water level above the SFA is of:

- 4.5 m in the cut FA pool,
- 9.0 m in the uncut FA pool.

6.6.3.6 Loss of Storage Pool Water Inventory

Loss of spent fuel decay pool inventory that leads to reduction of water level is possible for the following reasons:

a) evaporation of the water from pools;

b) leakage through the defects in welded seams of coating;

c) rupture of supply and lateral pipelines of the cooling, cleaning, filling and makeup systems of the storage pools;

d) rupture of the pool bottom coating due to drop of SFA, cased SFA or baskets with SF during transportation.

Evaporation and leakage of the water

Makeup system is designed for compensation of losses of water in the spent fuel decay pools due to evaporation or leakage. Performance of the makeup system is more than 100 m^3/h. During normal operation makeup can be 1.2-1.5 m^3/h.

The makeup system provides an opportunity to supply water in each compartment of spent fuel decay pool. Each compartment has water level sensors and makeup system is automatically switched on or off. Detailed analysis of the failure and reliability of the makeup system is analysed in [8].

Rupture of the pipelines

Pipelines of the filling, cooling and cleaning systems are located in the upper part of the storage pools that prevents pool drainage in case of a pipeline break. Furthermore, these pipelines have special apertures to prevent "siphon effect".

The highest decrease of water level up to the mark +23.00 is possible due to destruction of two redundant isolating valves of the water cooling pipelines and failure of the makeup system. However, even such decrease of the water level does not have radiological consequences for the personnel of the plant.

Rupture of the coating due to drop

Coating of spent fuel decay pool bottom is made from stainless steel plates. The thickness of the coating is sufficient to prevent the rupture due to drop of SFA, cased SFA or baskets with the SNF during transportation or other handling activities.

In case of pool bottom cladding failure, the leaking fluid migrates through a porous concrete layer and is collected into a steel plate collector provided with a leak rate monitor.

In case of the leakage through the coating the makeup system provides possibility for water feeding with the rate of more than 100 m^3/h.

6.6.3.7 Formation of Explosive Compounds

Hydrolysis of water in the pool water leads to the production of hydrogen the mixture of which with oxygen of the air is explosive when the H_2 concentration exceeds 4% in volume. Formation of such explosive compounds in the SP decay pool hall is possible due to failure of ventilation system.

Performed analysis in [5] has shown that the amount of hydrogen necessary for explosive compound creation in the SF decay pool hall will be formed in 765 hours. This time is enough to fix ventilation system problems.

6.6.3.8 Infiltration of Air in the Spent Fuel Decay Pool through Pipelines

Infiltration of air in the SF decay pool is dangerous because locally (in a zone of arranged SFA) water density can decrease and this leads to increase of neutron multiplication factor.

Introduction of air pockets in the lower portion of the pools (i.e. with SFA) during the start-up of the cooling loop pumps is prevented by the actuation of a mechanical vent during the filling of the loop.

6.6.3.9 Loss of Electricity Supply

Loss of electricity supply leads to the interruption in functionality of the following equipments:

- cranes in the reactor and spent fuel decay pools halls;
- water cooling and cleaning systems;
- ventilation system;
- other auxiliary systems which are not influencing safety.

The interruption in functionality of the cranes during operations with SF does not result in an emergency situation, since the operations with SF are carried out under the water. Due to this radiation shielding and removal of residual heat are provided.

Loss of electricity supply in the water cooling and cleaning systems leads to the same situation as the loss of spent fuel cooling capability that was described in the previous paragraph 6.6.3.5.

As mentioned in the item 6.6.3.7, failure of ventilation system may lead to formation of explosive (hydrogen-air) compound in the SF decay pool hall. However, 765 hours are necessary for formation of such an explosive mixture.

6.6.3.10 Fire in the Spent Fuel Decay Pool Hall

SF decay pools hall pump and heat exchanger unit are classified as fire safety category “E”. It means that they are flameproof. There are no combustible materials and materials capable to sustain combustion.

The basic sources of the possible ignition are the cables and electric motors of devices, equipment and cranes. So consequences of the fire accident in the SF decay pools hall and pump/heat exchanger unit can be the failures of the cranes and pumps in the SF decay pools cooling system.

The failure of cranes even when operations with fuel are underway does not result in the further development of the accident, since all operations with SFA are carried out under the water that provides necessary biological shield.

Failure of the pump of cooling system leads to the situation similar to the loss of spent fuel cooling capability or loss of electricity supply.

6.6.3.11 Human Error

All transportation operations of SF in the reactor and SF decay pool halls are carried out by cranes. Drop of the basket with spent fuel, spent fuel assembly during transporting from cranes are prevented by the following measures:

- using the grabber, which eliminates the spontaneous disconnection with transporting loads;
- precautionary lock is placed on the hook, which prevents the dropping of grabber loop from the hook;
- cranes have a normal closed-type brake, which ensures reliable locking of loads during loss of power;
- regular inspection of the load lifting mechanisms.

The following incorrect actions of the personnel are possible:

- unreliably locked grabber loop;
- false switching on of a lifting drive;
- false switching on of a transfer drive;
- simultaneous false switching on of horizontal movement when lifting or sinking operation is in progress;
- erroneous lifting of the SFA.

6.6.3.12 Seismic Influence

For the Ignalina NPP area the design earthquake magnitude is 6 and the maximum possible calculated earthquake magnitude is 7 (according to the MSK-64 scale).

Calculations in [9, 10] have shown that strength and stability of the SF decay pool walls and bottom withstand seismic impact with intensity of 6.5 according to the MSK-64 scale.

6.6.4 Loss of Decontamination Solution

Usually, chemical methods are used for the decontamination of the most contaminated circuits and equipments.

Chemical decontamination process presents following hazards:

a) possible damage to mechanical seals and other system closures from chemical attack;

b) risk to the operating personnel due to the possible toxicity of the solution;

c) risk to the operating personnel due to the physical impact from fluids or gases leaking while under pressure.

The potential component failure (for example, complete break down of pressure header) during decontamination must be evaluated. Due to the fact that the decontamination is carried out at temperature of about 100°C, a fraction of the leaking fluid will flash into steam. Flashing will generate aerosols. The ventilation aerosols filters will fix most of the produced aerosols and limit the discharges of these latter into the environment.

In a conservative approach, it can be assumed that the whole activity deposited onto the inner walls of the equipment is transferred into decontamination solution. The volume of lost decontamination solution must be assessed on a conservative basis for each circuit. The specific activity of the decontamination solution must take into account the time at which the decontamination is carried out. For example, the MCC decontamination of Unit 1 will be carried out only 4 years after the RFS, this enables by the time of the RFS, a significant decay of the short lived nuclides activities deposited onto the inner walls of the equipment (Mn^{58}, Co^{58}, Fe^{59}, Cs^{134}...).

It is recommended that prior to starting the decontamination, leak test be performed to check the tightness of the circuits that will be decontaminated, in order to avoid the risk of loss of active decontamination solution.

6.6.5 Fire Risk

Fire safety is an important component of overall safety of the facility. It encompasses the measures to protect public health and the environment by preventing the fire occurrences and spread. Fire prevention is achieved by decreasing the fire risk. To decrease or even to exclude fire risk the following measures are applied:

a) After INPP Units final shutdown no more needed flammable products (oils, organic liquids and other combustible materials) will be removed. Even in case of ignition of a large volume of oil, the radiological source term would be lower, by several orders of magnitude than that resulting from the loss of spent decontamination solution accident;

b) fire during the removal of spent ion exchange resins is excluded, as these are hydraulically transferred from their storage tank into the cementation facility;

c) some of electrical equipment will no longer be used during dismantling. Cables disconnection will be carried out both at the level of the equipment (electrical motors, valves, instrumentation) and the level of the electrical cabinets;

d) electrical cabinets that will no longer be used will also be disconnected from their supply buses. The fire risk due to electrical power supplies, short – circuits, overheating etc. will be substantially reduced;

e) most of the electrical cables remaining in service are applied with fire protection coatings. Further the cable penetrations are sealed using fire resistant materials. This reduces the risk of fire spread;

f) the electrical equipment remaining in service (mainly motors of the fans, some instrumentation and lighting) are all characterized by a very low contamination. A hypothetical fire of this equipment would generate negligible radioactive aerosols releases and would, further, be quickly detected and extinguished by the fire detection and extinguishing systems that remain in operation for nuclear safety and/or industrial purposes. The rooms and sections whose fire extinguishing systems are under repair, shall be observed by personnel constantly and shall be equipped with additional fire extinguishing means. Where needed necessary compensation measures should be provided;

g) hot exhaust air from the above reactor space before ventilation filters is cooled down in water coolers. Ventilation filters frames are made of steel or wood and filter material is flammable (Petrianov filters). If gases will not be cooled down the filter material will be spoiled by hot gases, but this will not increase overall fire risk during decommissioning;

h) after the reactor final shutdown, the hydrogenated radioactive gaseous waste from the primary circuit are no longer produced;

i) Ignalina NPP fire safety organization and infrastructure include:

   I. the fire protection systems section, the personnel of which originates from the technical maintenance and functional tests and which initiates the emergency actions in case of fire (start localize and extinguishing the fire);

   II. the fire team in Visaginas, which comprises two fire fighting brigades with 172 people and 16 special vehicles in total, as well as needed auxiliary equipment (protection overalls for high temperature condition, communication equipment, breathe masks, etc.). The fire brigade work is organized 24 hours a day.

   III. During the dismantling, the fire detection and extinguishing systems will be, progressively, adapted to cope with the reduced need of the installation (see also ref 7).

6.6.6 Rupture of Extraction Ventilation Filters

6.6.6.1 Background

Ventilation systems solve different tasks at INPP. Part of ventilation systems is assigned for maintenance of safety operation of the plant:

a) to prevent the possibility of air space contamination in the rooms and atmosphere by radioactive and explosive hazardous substances during normal operating mode of NPP and in case of an accident;

b) avoid flow of air from strict regime zone (controlled area) to uncontrolled area, provide direction of air flow only towards the most "contaminated rooms";

c) provide required climatic conditions for functioning of safety system equipment of NPP;

d) prevent fire spread in the rooms, including safety related elements.

During evaluation of ventilation systems from the point of view of fire safety, it is important to identify the possibilities of raised fire spread through ventilation systems and occurrence of fire (explosion) in ventilation systems.

6.6.6.2 Filters Activity Inventory

Data about the activity inventories fixed on the aerosols filters during routine operation are available. Activity values will be less after RFS, but these measured values can be used as a basis for conservative approach for radiological impact evaluation.

6.6.6.3 Filter Rupture

Rupture of extraction ventilation filters can come out from exceeding of pressure drop or excessive temperature of the extracted air stream.

The filter pressure drop (Δp) is monitored during routine operation of the plant and will also be monitored during the post-operation. A prolonged unavailability or erroneous display of the Δp monitoring instrumentation could lead to an unnoticed Δp increase and, in turn, to a rupture of the filtering medium.

During exploitation the hot air from leak-tight compartments and under floor plates of central hall is sucked out by ventilation systems (WZ56 and WZ51 respectively) and cooled down in water coolers. The filtering medium of the aerosol filter (Petrianov filter) is flammable at air stream temperature >100°C. The technical specifications limit air temperature before the filters to 60°C.

After the RFS and during post-operation, the significant heat losses from the not thermally isolated equipment (water-steam pipes from the reactor, separator-drums, down-comer pipes etc.) will no longer occur. But for certain decommissioning activities (for example decontamination) it can be necessary to raise MCC water temperature up to 100°C.

There are five redundant air filters. In case of loss or fouling of one filter, air filtration can be shifted on the redundant filter.

Upstream to the filters, hot air is cooled down in redundant water coolers. In case of one cooler failure air can be directed to the redundant cooler.

Pumps, supplying water to the coolers, are located in room 304/2 (Block B1) i.e. a fire safe compartment [8].

One single pipe supplies water to the both (operative and redundant) coolers. The only considered accident is the loss of cooling water for an unidentified reason. In such case the hot air ($t \approx 180$ °C) from reactor space will be directly supplied to the extraction filters. Such temperature will damage the filter material and radioactive aerosols will be released into the environment.

It must be taken into account that, after RFS, the contribution of the short lived nuclides (^{54}Mn, ^{60}Co, ^{134}Cs) to the global activity inventory will progressively decrease in function of the time elapsed since the reactor final shutdown.

6.7 Emergency Plans for Public Radiation Protection – Transboundary Aspects

The basic objective of the emergency plan is to initiate the appropriate counter-measures, in a timely way, in order to keep the radiation exposure of the public and the plant personnel under the limits fixed by the Authorities.

In emergency situation, the Ignalina NPP personnel is guided by special plant procedures, instructions, guidelines. These procedures describe actions to be taken for elimination and management of the accident and/or mitigation of the accident consequences. Established procedures provide a basis for a suitable operator response to abnormal event.

HN 99:2000 regulation "Protection of the Population in Case of Radiation or Nuclear Accident" that, in general, specifies what radiation protection measures of the public in the short and long terms must be implemented. According to these measures the emergency plans for public protection during decommissioning process should be prepared.

Moreover, an emergency response system exists at Ignalina NPP, which is meant to protect plant personnel and general public in case of an accident at the plant. INPP Emergency Response co-operates closely with the National Civil Defense that performs the following activities:

a) organizes accident termination activities for INPP;

b) coordinates activities of all institutions involved in accident termination at Ignalina;

c) periodically reports to the President, Seimas and Government on the progress in accident termination;

d) executes Governmental decisions and instructions related to the accident;

e) organizes public evacuation from the affected area;

f) informs interested organizations, including the concerned neighbouring countries, mass media, general public on accident termination measures and the risk of ionizing radiations.

The responsibility for the emergency plan for the Republic of Lithuania rests with the Department of Civil Defense.

The current INPP emergency plan, including the frequency of the emergency preparedness exercises, will remain applicable until the final shutdown of Unit 2. It will then be adapted to, take into account the progressive phase out of the nuclear risk (for example the distribution of iodine (KI) tablets is no longer a concern 3 month after RFS).

6.8 INPP Personnel Individual and Collective Doses

The objective of this Chapter is to assess the distribution of the individual doses and collective doses associated to the dismantling. More precisely, the individual and collective doses will be assessed for specific tasks or group of tasks, e.g.: preparation for dismantling.

The following tasks breakdown can be considered:

a) Spent fuel management including as sub-tasks the unloading of the core, the transfer of FA to Unit 2, the transfer of the FA to the uncut FA pools.

b) The cleaning and the decontamination, including the decontamination waste conditioning;

c) The circuit modifications, isolation;

d) The installation dismantling and the dismantling waste conditioning.

Such a breakdown enables to identify the tasks leading to the potentially highest exposures and for which an optimization is needed to comply with the ALARA objectives.

The assessment of the individual and collective exposures implies:

a) To define for each task and sub-task, the manpower needs in the different disciplines (mechanics, electricity, operation, health physics, chemistry, radioactive waste management);

b) To prepare the radiological maps of the to be accessed areas;

c) To assess the scenarios of the tasks to be carried out – sequence of operations, time and manpower needs for each operation, pathways to be followed by the personnel.

d) To define the necessary means to attenuate the exposure – mobile shielding, remote operation, specific ventilation units needs, contamination confinement measures.

Practically, the careful preparation of the tasks to be conducted in the controlled areas is the key element in individual and collective doses optimization to comply with the ALARA objectives.

The preparation includes:

a) The training of the operators and the use of mock-ups especially when new sophisticated techniques are to be implemented;

b) The simulation of the to be performed tasks by use of computer softwares;

c) The adaptation of the procedures.

The above preparatory steps enable to plan the application of radiation protection means and to define quantitative ALARA objectives for each task.

During execution of the task, the actual individual and collective dose rates are monitored and compared to the predicted ones. Exceeding the pre-defined ALARA objectives requires an analysis of the causes of the deviation and the implementation of corrective actions.

The above items can only be addressed in details at EIA Report stage when necessary data will become available as a result of the DP work (decommissioning activities analysis).

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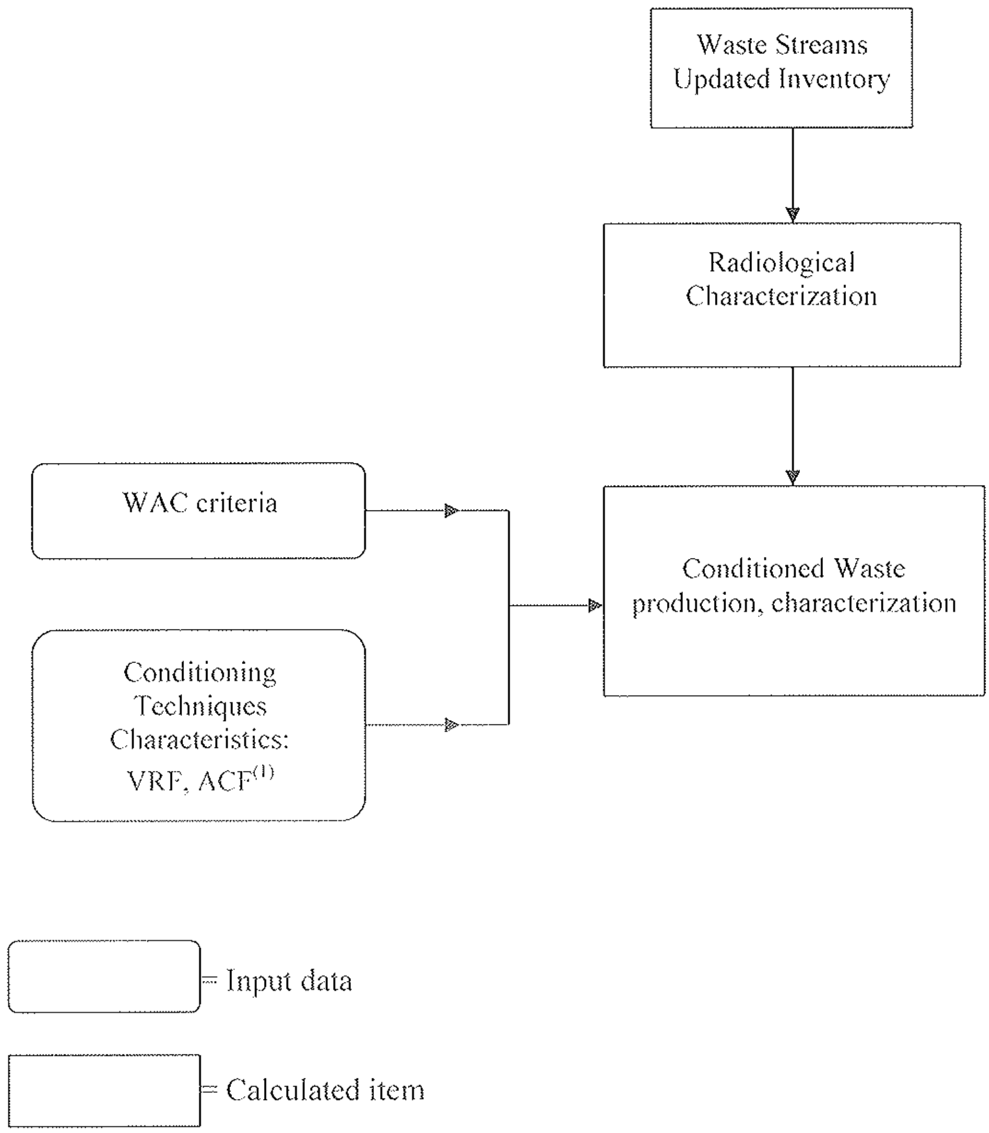
10. Seismic stability analysis of structures of Units A1 and A2 in the building 101 of the Ignalina NPP, VNIPIET Report, Inv. No. 91-13775-P, St. Petersburg, 1991 (in Russian).

Figure 6-1. Decommissioning Waste Management Scheme



(1) VRF = Volume Reduction Factor, ACF = Activity Concentration Factor

7 Non Radioactive Environmental Impacts

Hereafter we base the description of potential environmental impacts on the identification matrix established in section 5.4.2.2. These impacts will be further assessed in the EIA Reports.

7.1 Air

INPP norm values of chemical substances emissions to atmosphere are set forth on the basis of methodology of concentration calculation of INPP harmful substance released to the atmosphere [1].

INPP norm limit values of emission were calculated in 1996. As a result, standards of limit values of INPP harmful substances emissions to atmosphere were issued [2] (see Figure 7-1). Afterwards the Hygiene Norms of Lithuanian Republic had been issued and inventory of emission sources had been performed in 2000 [3]. The limit values developed were approved by the Ministry of Environment and were included to the "Permit for using the natural resources, V-12" [4].

Figure 7-1. INPP chemical substances emission to atmosphere for period 1996-2000, ton/year

Indicator	1996	1997	1998	1999	2000
Unit 2	0.0480	0.0480	0.0480	0.0436	0.0266
Unit 1	0.402	0.402	0.402	0.341	0.304
Heat Only Boiler Plant	274.1	222.5	151.5	195.7	169.1
Other Sources (workshops, transport)	87.9	71.5	72.7	73.7	70.4

It is to be noted that the difference between the emissions from Units 1 and 2 are mainly due to the fact that almost all maintenance shops are located at Unit 1.

The major contribution to atmosphere pollution is provided by the existing Heat Only Boiler Plant (HOB), which is used when additional heat is necessary. New hot water boilers are planned at existing site situated between INPP and Visaginas town and new steam boilers at a site are to be located inside fence of INPP, those boilers are intended to be gas fired. The new HOB Plant will be constructed in compliance with the EU Council Directive 2001/80/EU of October 2001 related to a reduction of certain air polluting emissions from large combustion plants. After Unit 1 and Unit 2 final shutdown, those boilers will still constitute major contributors to atmospheric pollution.

The amount of pollutants emitted into the air depends on the amount of combusted fuel in the HOB Plant. The calculations for combustion of natural gas in compare with mazout for existing HOB plant are given in Figure 7-2 [5].

Figure 7-2. HOB Annual Emission of Air Pollutants (t)

Pollutant	2002	2005-2009	2010-2025
Quantity of Firing Gas, Mnm^3	Mazout 1860 t	27.4	82
Produced heat, GWh	21	230	710
SO_2	72.9	0	0
NO_x	4.7	38.6	115.7
CO	24.1	13.8	41.3
CO_2	-	524500	157046
V_2O_5	0.3	0	0
Dust	1.5	0	0

The dismantling works include the demolition of buildings, the crushing of rubble, the disassembly of plant and machinery, the movement of vehicles and machinery. All these activities will lead to the emission of non-radioactive gases, particulates and aerosols, and will affect the quality of the air.

Alterations to the regional climate would not be expected since the dismantling activities will not lead to the release of significant quantities of material or energy that might result in such impacts. However, as thermal releases will decrease, there could be some influence on the local climate (which was at the origin probably affected by INPP Commissioning). Consequently, the environmental factor that may primarily be affected is air quality.

The dismantling activities will cause an increase in the concentration of dust particles. The main activities that will produce dust are those relating to the demolition of structures, walls and floors and to rubble handling work (e.g. transport and refilling).

The most important potential source of atmospheric emissions would be a fire. The dismantling project will include a Fire Protection Plan based on the prevention of risk including the means required for both the rapid detection and extinguishing of fires.

More detailed information will be presented in the EIA Reports.

7.2 Land and Soil

The Decommissioning activities will disturb some areas on the INPP site. Demolition of buildings, the use of land for civil works installations and materials, earth deposits, etc. will affect soil quality.

There will be also refills of demolished buildings, as the underground level (decontaminated) should remain in place.

Those disturbances and potential soil contamination by accidental handling of polluting substances will be further developed in the EIA Reports.

7.3 Water

One of the main effects of the Units shutdown is the progressive (as Unit 2 should be shut down a few years after Unit 1) decrease of thermal releases into the Lake Drukshiai.

7.3.1 The Thermal Releases from the Plant

The lake Drukshiai is used for cooling purposes of INPP Units and ancillary facilities. Discharge of NPP heated-up water causes lake temperature increase and associate intensification of water evaporation, which in turn, result in water level reduction in the lake.

The lake is not granted with the "estate in severalty" status, therefore the standards [6] establish:

- the limitation on admissible warming up of the lake in summer period;
- the monitoring technique of the lake temperature mode.

Since the start-up of the INPP Units the investigations of the lake temperature modes, hydro-meteorological conditions and environmental impact of INPP thermal discharge have been many times performed. In-depth investigations of environmental impact of INPP thermal discharge are presented in reports [7–10] and temporary rules [11].

An emergency water level drop in the lake can happen only if the dams are destroyed as a result of an external impact: an airplane crash, an earthquake, a terrorist act.
In this case the minimum water level in the lake will be governed by the level of the beds of the rivers which originate in the lake and will amount to 140.3 m.

Open water intake and discharge canals are common for both Units and are designed with due account of this level. The hydro-engineering structures include the water intake area with protective dams and the inlet canal, the discharge canal and the water intake warm-up canal. The warm-up canal is intended to prevent freezing of water in the inlet canal at low water temperatures in the lake. The warm water flow rate from the discharge canal is controlled by opening gates upstream the warm-up canal.

The designed water consumption for the plant cooling system is 4.1×10^9 m^3/year, real measured water consumption for year 2000 is about 2×10^9 m^3. The maximum temperature elevation in heat exchangers is in de range of 7 to10 °C.

Discharge of service water through the discharge canal leads to lake water temperature elevation that amounts to no more than:

- 3°C on approximately 18 km^2 in summer;
- 5°C on approximately 13.5 km^2 in winter.

During the operation of one unit the heat load to the lake is more than 0.06 kW/m^3 (i.e. the amount of heat transmitted to the lake per month is $8.7x10^{15}$ J), and during the operation of two units it amounts to 0.11 kW/m^3.

At the design stage of the plants, calculations showed that the additional evaporation of the lake due to the operation of one INPP Unit at 1500 MW(e) was to be $16.2x10^6$ m^3 (i.e. 55 % from the multi-year average lake natural evaporation value) and $32.4x10^6$ m^3 for both Units at a total of 3000 MW(e). During the years of 1985-1987, the measured evaporation corresponds to computed predictions [12].

According to the performed calculations the average temperature of the lake water surface for various months in the year is increasing by 1.2°C at INPP electrical capacity increase of 1000MW.

Temperature measurements are made every day, every three hours, at the intake channel and at 6 main points in the lake (among which at the release channel). The following rule is applied:

- If the temperature at the intake channel exceeds 24.5°C (the limit value for the intake water temperature), then additional measurements are made all around the lake (more than 30 measurements):
    - If 80% of measurements < 28°C then it is acceptable
    - If 80% of measurements > 28°C then there must be a reduction of power production and related warm cooling water releases

Air-transferred heat comprises two components: heat from the process equipment and heat from the heating and ventilation systems. Thermal releases to the atmosphere amounts to 2.7% from thermal water releases, it is not possible to define actual environmental impact of thermal air discharge due to the absence of standard requirements. However it could have an influence on local microclimate, additionally to the influence of the lake water increased temperature and related increase of water evaporation.

Environmental system changes of the lake Drukshiai caused by INPP thermal release were several times investigated. Such changes are acceptable, given the fact that the lake shall be preserved for complex application including its main purpose – applicability for fishery.

INPP final shutdown will lead to ceasing the thermal heat discharges to the lake Drukshiai. After shutdown of both INPP Units and decrease of associated anthropogenic impact, the lake water condition will eventually establish similar to the one that existed prior INPP commissioning.

7.3.2 Liquid Waste Release Including Toxic and Harmful Waste

The lake Drukshiai is the main source of service water supply and the receiver for operation and rain sewerage system (RSS) discharge water.

INPP water discharge is made up as follows:

- service water;
- rain sewerage system;
- household sewerage system.

Service water discharge channel is purposed to discharge of spent water after cooling down of turbine condensers, turbine hall consumers and main reactor equipment. Service water is discharged via covered reinforced concrete canals to the siphon facility and further via open discharge canal to the lake Drukshiai.

Rain sewerage system is intended to removal of operation discharge from the process equipment of ancillary buildings of INPP site and for organized removal of precipitation. Sewerage water is discharged via covered header. There are three discharge points at INPP site: RSS 1, RSS 2, RSS 3 and one RSS of spent nuclear fuel storage facility site.

Additionally to lake water temperature, the monitoring programme also covers other 21 parameters (non radioactive). A measurement campaign is made at several sampling points around the lake, once a month.

The influence of INPP commissioning and operation on lake water quality can be found in Figure 3-15.

After the RFS of each Unit, the corresponding need of demineralised water will be drastically reduced, leading to a corresponding reduction of the salts discharges (Cl^-, SO_4^{--}, Na^+, Ca^{++}, Mg^{++} etc).

It can be stated that chemical substances emissions in INPP water discharge after RFS will be not higher than the emission level during operation (the results of the monitoring demonstrate that chemical substances concentrations in INPP water discharge are on the background level).

Releases of sanitary waste waters during dismantling are estimated to be slightly less than those with the plant in operation.

In consequence, it is needed to analyze in the EIA Reports possible changes and the balance of the sewage (process, household, surface) from now on, along the decommissioning process and its related projects (DPs).

For what concerns groundwater, its near-surface level implies that particular precautions should be taken for its protection. Drainage (potential impact on physical properties and circulation) and handling of hazardous substances (potential for chemical pollution) could cause impacts for which precautions must be taken.

More detailed information will be presented in the EIA Reports.

7.4 Flora and fauna, natural habitats

Lake Drukshiai and surroundings are important habitats; there has been an official application for classifying the major part of the lake and some terrestrial zones as a Natura 2000 territory.
The INPP Commissioning created changes in the hydrobiology of the lake. These were the subject of several researches, among which the Governmental Research Programme.

As a first hypothesis, one should expect that the INPP shutdown would let the lake come back to pre-INPP conditions. Therefore, an evaluation should be made on the basis of pre-INPP operation conditions, and other appropriate data.

The dynamics of the evolution in hydrobiology is to be investigated.

7.5 Landscape: the Visual Impact of INPP Decommissioning due to the Buildings to be maintained, to be demolished and to be erected – Land Use

A first overview of landscape objects are shown in Annex 2 (III Part).
A further assessment will be made of the quality of the landscape affected by INPP. This will include both objective and subjective assessment criteria in areas such as:

a) visibility, including the extent of the domain from which the installation is visible;

b) the quality of the landscape, characterized by its morphology, vegetation, plant formations, lithology and presence of large bodies of water; and

c) human presence, including the nature and extent of man made structures and other influences on the landscape.

Reuse of materials from demolition and excavation operations for refilling and topographic restoration activities will be intensively used. Modification of buildings, (e.g. size, shape and colour) to minimise visual impact will be carried out were appropriate. On the basis of the analysis of the landscape included in the environmental inventory, a design will be defined for adaptation of the buildings required for the safe storage phase.

Land use could vary in function of decisions by Authorities on the future use of the site and on the evolution of Visaginas. The EIA Reports should take into account studies carried out on this subject, as well as the Authorities' intentions in this respect.

7.6 The Production of Non-Radioactive Solid Waste

Solid waste are handed over by INPP to other companies dealing with this waste treatment and granted with permission for this activity and registered in the State Register of enterprises dealing with waste.

Waste treatment activity is performed at INPP in accordance with reference [14], developed in compliance with requirements [15]. Work performance under this programme is purposed to environment protection, reduction of waste amount subject to disposal, provision of safe waste storage.

INPP as an enterprise dealing with collection, transportation and removal of waste is registered in the State Register of enterprises dealing with waste.

INPP activity of waste handling is specified in accordance with the "Registration certificate of enterprise dealing with waste" by Utena Regional Environmental Protection Department, Ministry of Environment. INPP may carry out the following activities in accordance with the "Registration certificate":

- free release of safe waste to dumps or to other on-surface sites;
- storage of hazardous waste for more than three months;
- storage of non hazardous waste for more than one year;
- collection and transportation of safe waste;
- reloading, unpacking and sorting of safe waste for further transportation to other enterprise sites for treatment;
- collection and transportation of hazardous waste;
- reloading, unpacking and sorting of hazardous waste for further transportation to other enterprise sites for treatment.

Upon financial year (calendar year) completion and according to reference [15], INPP submits annual reports to the Utena Regional Environmental Protection Department for the purpose of state registration of waste.

Inventory of non-radioactive solid wastes and potentially toxic substances habitually stored on site, storage conditions and habitual management methods applied to these materials will be presented in the EIA Reports. The changes to the wastes production and management scheme, induced by the Decommissioning, will be presented.

Information about on-line control and tracking of the production and location of solid waste materials associated with methods promoting their recycling or reuse will be also presented.

7.7 Non-radioactive hazardous waste of INPP

7.7.1 Legal framework and INPP procedures

INPP's non-radioactive waste management activities are ruled by the "Permission to use natural resources, V-12" [4]. This document specifies the list and permitted volumes of the waste generated at INPP. Utena Regional Environmental Protection Department of the Environment Ministry is the control administration.

Being a company involved in collection, transportation, utilization and removal of waste, INPP is registered in the State Register of companies involved in waste management. INPP Registration certificate, code No. 85504702, was issued by Utena Regional Environmental Protection Department on 2001-04-30.

Note:
In the event any change occurs in the waste management activity, the company is to submit an official request for a new Registration Certificate to Utena Regional Environmental Protection Department. Registration procedure is carried out in accordance with section III of "Waste management rules" [15] (Order of the Minister of Environment No. 342 of 1999-07-14).

INPP's non-radioactive waste management activities are performed in accordance with the INPP working procedure "Non-radioactive waste management programme" [14], code PTOed-0410-1, developed in line with the requirements of "Waste management rules". The objective of this programme is the protection of environment, the decrease of the quantity of waste to be disposed off and the safe waste storage.

7.5.2. Management of hazardous waste at INPP

The list of hazardous waste produced at INPP, the approximate volumes of waste generated annually and the waste management routes are given in Figure 7-3.

Most of the types of hazardous waste produced at INPP are delivered to external companies for appropriate elimination. These companies have permission for such activities and are registered in the State Register.

Apart from that, a few types of hazardous waste are stored at INPP site (waste types numbered 15 to 17 in Figure 7-3). It cannot be removed from the site since currently there are no companies capable of accepting such waste. Barium chloride and metal thallium belong to this category of waste. This waste is temporarily stored following safety precautions, which exclude waste contact with environment.

Waste to be processed by third parties is transferred to them in accordance with contracts concluded annually. Companies are selected on a Tender basis in compliance with Law of Lithuanian Republic on open procurement and other legislative acts.

Note: Chemicals

In Building 131, the following reagents are used for the conditioning of the heating plant and the regeneration of the resins of the plant water makeup system:

- H_2SO_4 (100%) = 365 tons/y;
- NaOH (100%) = 14 tons/y.

The spent reagents are not contaminated. After neutralization, they are discharged into the lake.

The non-radioactive hazardous materials to be produced during decommissioning are not expected to lead to specific problems, as they are routinely managed at the plant.

Figure 7-3. List of hazardous waste of INPP

No.	Hazardous waste type	Statistical code[10]	Code of list[11]	Amount, t/year	Processing methods
1	Acid of alkaline accumulators	01 22	16 06 06	2.0	Processed by chemical shop of INPP
2	Luminous tubes (lamps)	07 13	20 01 21	20 000 pieces	Processed under contracts concluded with contractors, i.e. when accumulated, the waste is transferred to the companies which have appropriate permissions for such waste processing.
3	Asbestos-containing insulation materials	13 12	17 06 01	1.5	
4	Sealing material hot water accumulation tanks	02 12	08 04 02	15.0	
5	Waste generated as a result of cleaning of tanks used for oil products storage	13 22	16 07 06	0.5	
6	Oiled filter materials	07 63	13 06 01	2.0	
7	Oiled cotton waste	07 63	13 06 01	2.5	
8	Sand contaminated with oil products	13 21	13 06 01	10.0	
9	Lead-acid accumulators	08 41	16 06 01	5.0	
10	Oil-in-water emulsion (total for various types of oil: machinery, transformer, turbine)	01 32	13 05 05	15	
11	Spent turbine oil	01 32	13 05 05	0.1	
12	Spent machine-tool oil	01 32	12 01 07	1.8	
13	Spent transformer oil	01 32	13 05 05	0.5	
14	Asbestos	13 12	17 06 01	-	Since 1992 residuary asbestos is on sale gradually. About 20.0 t of waste remains at the moment[12]. It is expected that this material will be evacuated before dismantling works start. If not, (part of) it could have to be treated as waste.
15	Chemical agents with expired useful date	03 14	16 05 02 16 05 03	0.2	About 6.0 t of waste is accumulated at the moment[9].
16	Thallium holders	03 14	16 05 02	-	0.025 t of waste is temporarily stored.
17	Barium chloride	03 14	16 05 02	-	1.5 t of waste is temporarily stored.

[10] Statistic code – 4-digit code in accordance with Attachment 12 "Waste management rules";
[11] Code of list – 6-digit code in accordance with the list of waste in Attachment 2 "Waste management rules";
[12] Data provided for 2003-11-01.

7.8 The Emission of Noise Related to the Plant Operation and Decommissioning Activities

Noise as a physical harmful factor, is present mainly in the Ignalina NPP work environment.

As mentioned earlier, noise emissions should not be a nuisance to closest neighbours provided appropriate measures are taken.

During decommissioning, silencers on vehicles and machinery and the minimisation or elimination of blasting operations will be generally used. In addition to the machinery, consideration will be given to the noise caused by the activities themselves, especially those relating to the transport, handling and treatment of waste materials.

Account will be taken of the possibility of multiple noise sources emitting simultaneously. If necessary, the noise level in the open air will be measured at locations in which such noise is perceived most clearly.

7.9 Possible Transboundary Aspects

Reliable Heat and Steam Sources will be built for INPP and Visaginas. The total Heat Only Boilers thermal power will amount to 160 megawatts. Therefore, according the Convention On Environmental Impact Assessment in a Transboundary Context, adopted at Espoo on 25 February 1991, Lithuania does not have to come to an agreement on it with other countries. Other INPP non radiological decommissioning activities will have much less environmental impact.

7.10 Occupational Hazards and Industrial Safety

The decommissioning project implies certain activities that give rise to a series of occupational risks. The Ignalina NPP Decommissioning Project and its associated documentation will identify such risks and methods to prevent or minimise them. The most important of these risks to the workers are associated with the following:

- exposure to toxic products (e.g. aerosols containing lead, asbestos);
- exposure to high concentrations of dust;
- falls, contact with electricity and other risks typical of construction works; and
- exposure to high noise levels.

The residual risks to the public will be established and documented. It may be expected that these will be considerably lower than those existing during the operational phase of the INPP.

More details will be described in the EIA Reports.

7.11 Conclusion

As mentioned before, the INPP Decommissioning will be subject to several Decommissioning Projects (DPs), themselves subject to an EIA Report. Each EIA Report will focus on the impacts of the related DP and take into account previous results of impact assessment.

7.12 List of References

1. Calculating methodology of hazardous and toxic waste content in industrial release, ОНД-86.
2. Standards of prescribed limits of toxic substances release to atmosphere in INPP vicinity, "Spartis" Ltd., Vilnius, 1996.
3. Inventory of sources of hazardous and toxic substances released to atmosphere, OOTот-0445-3, approved by Technical Director of INPP, dated 21.06.2000.
4. License for using the natural resources, No. V-12.
5. Technical Note. Information on Screening for the obligatory Environmental Impact Assessment New Heat Only Boiler Plant for Ignalina NPP and Visaginas, B5/TN/0003, 2003.
6. Norms of admissible warming up of the Lake Drukshiai and temperature monitoring technique, LAND 7-95/M-02.
7. LEI Report "Study of hydrothermal processes in the lakes not subject to warming up and in reservoirs-coolers and heated water impact to environment", 1984.
8. LEI Report "Study of hydrothermal mode of the lake Drukshiai", 1986.
9. LEI Report "Study of hydrothermal mode of the lake Drukshiai as a heat sink of Ignalina NPP", 1992.
10. Measurement performance techniques in respect of chemical release impact in water media, OOTэд-0428-1.
11. "Basic provisions of temporary rules for using the lake Drukshiai resources", Kaunas, 1993.
12. Thermal power generation and environment: Basic state and aquatic animal populations and communities in lake Drukshiai, Mokslas publishers, Vilnius, Vol. 5, 1986 (In Russian).
13. Programme of non-radioactive waste handling at INPP, ПТОэд-0410-1.
14. Waste handling rules, Order of Minister of Environment, No. 342 dated 14.07.1999.

8 Impact Minimisation and Mitigation Measures

Detailed description of impact minimisation and mitigation measures will be provided in the EIA Report, according to highlighted environmental impacts.

Adequate EIA measures will be identified to prevent, minimise or mitigate the negative consequences of the decommissioning and to maximise possible positive aspects. The effects of these measures will be taken into account in assessing the impacts of the proposed dismantling strategy, and the residual impacts (those remaining even after the mitigation measures) will be clearly indicated.

The INPP dismantling implies the set up of a series of measures to address the negative effects of the project. The scope and duration of these measures will depend on both the project itself and on the characteristics of the site and of the activities to be performed.

These measures may be preventive if they remove the impact by modifying the project activity causing it, or mitigating if they cancel, attenuate or modify the impact once it has been caused.

A generic set of measures designed to correct the possible negative impacts caused is listed below:

- minimisation of atmospheric emissions of contaminants by means of the best and most cost-effective techniques available. These techniques will include the use of emission capturing systems, high efficiency filters, dust emission control systems such as moveable covers, confined enclosures, spraying with coagulant and fixing solutions and the careful planning of operations for the handling and transfer of dust-producing materials;

- minimisation of releases to surface waters and of concentrations of contaminants through the recycling and re-use of waste waters, the conditioning of solid radioactive wastes and/or their treatment using the best and most economical techniques available;

- control of leachates in collecting areas and rubble tips;

- on-line control and tracking of the production and location of waste, associated with methods promoting their recycling or re-use;

- control of landfills and the clearing of areas;

- the safe arrangement of the main areas used for the handling and storage of radioactive, toxic and other waste materials. Those areas, in which the quantities of materials and the risk are highest, will need to incorporate construction characteristics and equipment preventing flooding, leakage, spillage and uncontrolled or inadvertent releases, and to achieve confinement and control if such events were to occur. The design of such areas will include measures preventing uncontrolled access and the risk of fires;

- minimisation of the extent of land required for the storage of radioactive wastes and installations during the latency period. This will require the intensive use of waste production minimisation techniques such as the following:

    I. Detailed identification and characterisation of materials prior to dismantling.

II. Classification at the point of origin, elimination of intermediate stages of and decontamination prior to dismantling.

III. Minimum secondary waste treatment.

IV. Prevention of cross-contamination and recontamination through the control of contaminated materials and of transport vehicles.

V. Reduction of potential sources of risk, preventing the dispersion of materials from storage facilities and intermediate collecting areas and reduction of transport operations.

- application of a flexible fire protection system; flexibility is an essential element, given the changing nature of the situation of the Ignalina NPP during dismantling;
- adequate personnel training, for all the levels and areas of the organisation;
- truck washing station to prevent problems of mud on the roads;
- periodic revision of obligatory safety elements, e.g. fire extinguishers and alarms;
- maintenance of hygienic conditions in the toilets for the operations personnel and other users; and
- measures to promote employment, including use of the available operations personnel and promotion of sub-contracting in Visaginas and areas around Ignalina NPP.

Among the measures that could enhance the positive aspects of INPP decommissioning can be listed:

- intensifying the very slow natural process of re-naturalisation of degraded landscapes by planting forests and draining the flooded forest and field areas;
- fish population restoration and amendment can be speeded by reproducing valuable fish species, because throughout INPP operation, the population of fish has changed – increased population of not valuable species and decreased population of valuable ones.

Although these measures, and others that might be specified for a particular projects, will be incorporated into the Ignalina NPP Decommissioning Project, they will be defined in the EIA Reports also to a degree of detail sufficient to demonstrate not only that attempts have been made to carry them out but also that further improvements would not be justified.

9 Environment Monitoring Programme

9.1 Introduction

This Chapter of the EIA Programme describes the monitoring programme that can be implemented in order to follow up the evolution of environment quality and, if necessary, take appropriate measures to correct unexpected deviations from what was assessed. It is the role of the EIA Report to define, for the Decommissioning Project the EIA covers, the specific measures to be taken, in order to avoid or decrease the environmental impacts.

It also introduces the Environmental Monitoring Programme to be implemented along the decommissioning of INPP which, as far as the Units themselves are concerned, will occur according Immediate Dismantling option.

The Lithuanian Law on Environmental Monitoring provides the requirements for the country overall environmental monitoring system. Parts of this system, called "monitoring of the environment of economic entities" are performed by the physical and juridical entities that affect the environment and that use natural resources.

Monitoring is the collection of specific data about selected environmental variables (impact indicators) in space and time, with the objective of supplying information on the amplitude and rate of change in these variables (impact indicators) so that, in turn, allow to assess related environmental impacts. The purpose of the environmental monitoring programme is to detect impacts as they occur, to estimate their magnitude and ensure that they are the consequence of a well identified project or activity. Monitoring includes the follow up of impacts and their verification against predictions. Monitoring allows also assessing effectiveness of mitigation and remedial measures, this information should be the basis for modifying either the activity or the mitigation measures.

There could be also a Social and Economic Monitoring Programme, to be carried out by an appropriate institution.

9.2 INPP Environment Monitoring Programme

The INPP Environment Monitoring Programme includes:

a) monitoring of water quality in the lake and of groundwater (physical – chemical parameters);

b) monitoring of nuclides concentration in the air and atmospheric fallouts;

c) monitoring of chemical content of sewage and drainage water from the INPP site;

d) monitoring of nuclides concentration in the lake and underground water;

e) dose and dose rate monitoring in the buffer (3 km) and supervised (30 km) areas;

f) monitoring of nuclides concentration in the fish, algae, soil, grass, sediments, mushrooms, leaves;

g) monitoring of nuclides concentration in food products (milk, potatoes, cabbage, meat, grain-crops).

The INPP Environment Monitoring Programme includes the monitoring of all the environmental exposure pathways that may exhibit long term concentration effects, such as the sediments, silts, algae, mussels and milk.

The locations of the sampling points, the periodicity of analyses and the sample analytical techniques are determined in the INPP Environment Monitoring Programme (ПТОэд-0410-3).

The INPP Environment Monitoring Programme should be regularly adapted along the decommissioning to cope with the changes in the nature or importance of performed activities and their related environmental impacts (e.g. changes in abiotic parameters such as lake water level and its natural change, temperature and concentration of pollutants, changes in the organisms communities). This statement will be reviewed more efficiently in the EIA Reports.

After shutdown and defueling of both INPP Units, the radiological scope of the INPP Environment Monitoring Programme could be reduced with approval of the Ministry of Environment and of the Radiation Protection Centre:

- after shutdown and defueling of both INPP Units, the releases of noble gases and of ^{131}I via the gaseous waste will no longer occur. At this stage, practically no ^{3}H release is anticipated any more via the liquid waste. This could allow to adapt the scope of the plant releases monitoring;
- along systems and equipment isolation and dismantling, corresponding sampling points should be removed or eventually relocated.

In support to the pre-decommissioning and decommissioning activities, several new installations will be implemented: radioactive waste retrieval, conditioning and interim storage; spent fuel interim storage; new heat and steam plant. Separate EIA Process will be conducted for these new installations. If necessary, additional monitoring measures (parameters and/or other biota) will be included in the INPP Environment Monitoring Programme.

9.3 Radioactive Releases

Final Decommissioning Plan of INPP anticipates about 25 years of dismantling works. The activities to be carried out in beginning of dismantling are comparable to those of large routine maintenance outages with a lower amount of maintenance activities and an increased amount of cleaning, decontamination, equipment handling and radioactive waste conditioning operations. Therefore in beginning of dismantling the actual yearly discharges of atmospheric and liquid waste will be comparable to the current discharges during the routine operation of units 1 and 2 with, however, the following differences:

a) absence of noble gases releases via the atmospheric releases and of short lived iodine nuclides (mainly ^{131}I) 2-3 months after reactor final shutdown via both the atmospheric and liquid releases.

b) significant reduction of ^{3}H releases via the liquid waste.

The current INPP annual operational and maximum allowable discharge limits for the liquid waste and Long Lived Aerosols atmospheric releases, and existing Environment Monitoring Programme (ПТОэд-0410-3) implemented by INPP in the supervised area remain applicable in beginning of decommissioning. At the EIA Report preparation stage activities connected with flushing, decontamination and treatment of waste will be analysed. If needed, the Environment Monitoring Programme will be updated.

9.4 Emissions of Non-Radioactive Pollutant

The dismantling works include the demolition of buildings, the crushing of rubble, the disassembly of plant and machinery, the movement of vehicles and machinery. All these activities will lead to the emission of non-radioactive gases, particulates and aerosols, and will affect the quality of the air. The dismantling activities can also cause an increase in the concentration of dust particles in the atmosphere. If necessary, specific measurements will be included into the INPP Environment Monitoring Programme.
Account will also be taken of emission of noise.

The need for additional monitoring of the above-named emissions during the decommissioning will be discussed in more detail in the EIA Report.

9.5 Environment Monitoring Programme Data Reporting

The data concerning monthly monitoring of air and water releases should be submitted to the Ministry of Environment and VATESI at the latest week after end of month.

Annual report on results of Environmental Monitoring should be submitted to the Ministry of Environment, VATESI, Radiological Protection Center and Local Authorities before first of April of next year. This report should include:

a) results of all measurements, anticipated in the Monitoring Programme;

b) activities of released radionuclides by months;

c) general information concerning realized activities (fulfilled works, generated and treated waste);

d) comparison of released radionuclides activities with limits;

e) releases and contamination changing trends and their analysis;

f) evaluative doses of members of critical groups, caused by released radionuclides; analysis of extraordinary releases of radionuclides into environment;

g) other important information.

Ecological Safety Service (Environment Protection Laboratory and Hazardous Chemical Materials Control Laboratory) of INPP Radiation Protection Department will carry out all activities concerned with environmental monitoring.

It is worth to mention that a proposal for a further Monitoring Programme was made in 2000 by the Institutes of Botany and Geography in order to continue the State Scientific Research

Programme carried out between 1993-1997, under the title "INPP Region neutral Environment specialized Monitoring Programme". Additionally to the INPP environment monitoring programme, it would produce scientific results for the follow-up of the restoration of Lake Drukshiai, without NPP operation.

II Part. Attached Documents

There are attached copies of these documents:

- **EIA subjects approval letters,**
- **Announcements about the upcoming EIA in the press,**
- **List of the public proposals regarding the EIA.**

The EIA programme approval letter of Visaginas municipal administration

27/10/2003 16:47 +370-66-61-092 VISSAV. PROJ. KOORD. PAGE 01

SEKRETORIATAS
Gauta
2003 10 28 Nr 2872

VISAGINO SAVIVALDYBĖS MERAS

VĮ Ignalinos AE generalinio direktoriaus pavaduotojui – ENT vadovui
Sauliui Urbonavičiui

2003-10-24 Nr. (4.21)-1-2371
Į 2003-10-02 Nr. 10S-5430-(15.15)

DĖL PASTABŲ

Visagino savivaldybė Ignalinos atominės elektrinės eksploatavimo nutraukimo poveikio aplinkai vertinimo programai esminių pastabų neturi.

Meras Vytautas Račkauskas

Robertas Juknevičius, 31 372

S.Š.

Kodas 8871192 | Parko g. 14, LT-4761 Visaginas | Tel. (8 – 3 8 6) 31 233, Faks. (8 – 3 8 6) 31 286, El. p. meras@visaginas.lt | Atsiskaitomoji sąskaita Nr. 10042144361, AB banke „Hansabankas", Banko kodas 73000

The EIA programme approval letter of Utena county administration

SEKRETORIATAS
Gauta
2003-08-19 Nr 2222

UTENOS APSKRITIES VIRŠININKO ADMINISTRACIJA

Kodas 8862574. Aušros g. 22, LT-4910 Utena. Tel. (8~389) 5 75 00, faks. (8~389) 5 95 36

VĮ Ignalinos atominei elektrinei

2003-08-13 Nr. (1.15)-6-883
Į 2003-07-16 Nr. 10S-4028-(15.15)

DĖL EKSPLOATAVIMO NUTRAUKIMO POVEIKIO APLINKAI VERTINIMO PROGRAMOS DERINIMO

Susipažinę su IAE Eksploatavimo nutraukimo projektų valdymo grupės parengtą „Eksploatavimo nutraukimo poveikio aplinkai vertinimo programa“, pastabų neturime ir šią programą deriname.

Apskrities viršininkas Vilius Cibulskas

Jonas Spietinis, tel. (8~389) 5 17 23

The EIA programme approval letter of Utena Regional Environmental Protection Department of the Environment Ministry

SEKRETORIATAS
uta
03-08-11 Nr. 2128
1

LIETUVOS RESPUBLIKOS APLINKOS MINISTERIJA
UTENOS REGIONO APLINKOS APSAUGOS DEPARTAMENTAS

Kodas 9074286 Metalo g.11, LT-4910 Utena, Tel. 69106 Faks. 69662, El-paštas: utenos.aa@is.lt

Valstybinei įmonei Ignalinos atominė elektrinė (IAE-ENPVG)	2003-08-06 Į 2003-07-16	Nr. (5.1)-s-768 Nr. 10S-4028-(15.15)

DĖL EKSPLOATAVIMO NUTRAUKIMO POVEIKIO APLINKAI VERTINIMO PROGRAMOS

Išnagrinėjus pateiktą Ignalinos atominės elektrinės eksploatavimo nutraukimo poveikio aplinkai vertinimo programą, pastabų bei pasiūlymų neturime.

Direktoriaus pavaduotojas Pranas Kudaba

S.Urbonas, 69302

The EIA programme approval letter of VATESI

Gauta 2003.10.13 Nr. 274

VALSTYBINĖ ATOMINĖS ENERGETIKOS SAUGOS INSPEKCIJA (VATESI)

Kodas 8863987 Šermukšnių g. 3, LT-2600 Vilnius Tel. 624141, 2661584 Faks. 2614487 El.p. atom@vatesi.lt

p. Sauliui Urbonavičiui
IAE generalinio direktoriaus
pavaduotojui-ENT vadovui

2003-10-10 Nr. (14.05.17)-22.1-833
2003-10-02 Nr. 10S-5429-(15.15)

DĖL EKSPLOATAVIMO NUTRAUKIMO POVEIKIO APLINKAI VERTINIMO PROGRAMOS DERINIMO

VATESI, išnagrinėjusi „Eksploatavimo nutraukimo poveikio aplinkai vertinimo programą" ir įvertinusi atliktas pataisas, derina ją be pastabų.

VATESI viršininkas Saulius Kutas

E.Vaitkus, tel 2661583, vaitkus@vatesi.lt

The EIA programme approval letter of Ministry of Health Protection

SEKRETORIATAS
Gauta
2003 10 16 Nr 2780

LIETUVOS RESPUBLIKOS SVEIKATOS APSAUGOS MINISTERIJA

Kodas 8860347, Vilniaus g. 33, LT-2001 Vilnius, tel. (8~5) 2661400, faks. (8~5) 2661402, el. p. ministerija@sam.lt, www.sam.lt

Valstybės įmonės Ignalinos atominės elektrinės Generaliniam direktoriui Viktor Ševaldin

2003-10-15 Nr. 10-4350
Į 2003-10-02 Nr. 10S-5428-(15.15)

DĖL EKSPLOATAVIMO NUTRAUKIMO POVEIKIO APLINKAI VERTINIMO PROGRAMOS DERINIMO

Sveikatos apsaugos ministerija, išnagrinėjusi ir įvertinusi valstybės įmonės Ignalinos atominės elektrinės pateiktą Eksploatavimo nutraukimo poveikio aplinkai vertinimo programą (antrąją redakciją), derina ją be pastabų.

Ministerijos sekretorius Eduardas Bartkevičius

A.Mastauskas, 2644720

The EIA programme approval letter of Lithuanian Fire and Rescue Service

SEKRETORIATAS
Gauta
2003-07-30 Nr. 2013
2003-07-29

PRIEŠGAISRINĖS APSAUGOS IR GELBĖJIMO DEPARTAMENTAS PRIE LIETUVOS RESPUBLIKOS VIDAUS REIKALŲ MINISTERIJOS

Valstybės įmonei
Ignalinos atominei elektrinei

2003-07-29 Nr. 9/4-8.1.-10

Į 2003-07-16 Nr. 105-4028-(15.15)

DĖL VĮ IGNALINOS ATOMINĖS ELEKTRINĖS EKSPLOATAVIMO NUTRAUKIMO POVEIKIO APLINKAI VERTINIMO PROGRAMOS

Priešgaisrinės apsaugos ir gelbėjimo departamentas prie VRM išnagrinėjo Valstybės įmonės Ignalinos atominės elektrinės eksploatavimo nutraukimo poveikio aplinkai vertinimo programą ir informuoja Jus, kad pastabų bei pasiūlymų neturi.

Direktorius
vidaus tarnybos generolas

Kazys Zulonas

Rimantas Steponavičius, 271 6894

Kodas 8860131. Švitrigailos g.18, LT-2600 Vilnius. Tel. (8 ~ 5) 271 6866. Faks. (8 ~ 5) 216 3494. El.p. pagd@vpgt.lt

The EIA programme approval letter of Heritage protection department

SEKRETORIATAS
Gauta
2004.03.15 Nr. 836
1-1/ugr

KULTŪROS VERTYBIŲ APSAUGOS DEPARTAMENTAS
PRIE LIETUVOS RESPUBLIKOS KULTŪROS MINISTERIJOS

Valstybės įmonei Ignalinos atominei elektrinei 2004-03-08 Nr. (11.8)-2-205
Į 2004-03-01 Nr. 10S-1135(15.15)

DĖL EKSPLOATAVIMO NUTRAUKIMO POVEIKIO APLINKAI VERTINIMO PROGRAMOS DERINIMO

Išnagrinėję pateiktą „Eksploatavimo nutraukimo poveikio aplinkai vertinimo programą", siūlome keisti programos 3.9 skyriaus pavadinimą ir išdėstyti taip: „Aplink elektrinę esančių saugomų zonų ir gamtos bei kultūros vertybių aprašymas".

Direktorė Diana Varnaitė

2004.03.15

Algimantas Degutis, 2724100, alde@heritage.lt

Kodas 8869268, Šnipiškių g. 3, LT-2600 Vilnius, tel. (8~5) 273 42 56, faks. (8~5) 272 40 58, el.paštas: centras@heritage.lt

Announcement in *Lietuvos Rytas*, 2002 06 13

15.1 laipsnio šilumos. Aukščiausiai šią dieną oro temperatūra buvo pakilusi 1999 metais – iki 32 laipsnių karščio, žemiausiai nukritusi 1942 metais – iki 2 laipsnių šilumos.

Birželio 14 d. Lietuvoje kai kur bus trumpi lietūs, temperatūra naktį 6–11, dieną 16–21 laipsnis šilumos.

Birželio 15 d. Lietuvoje beveik nelis, temperatūra naktį 7–12, dieną 18–23 laipsniai šilumos.

Šiandien Latvijoje daug kur trumpai palis, galima perkūnija. Aukščiausia temperatūra dieną 16–21 laipsnis šilumos.

Per kitas dvi paras Latvijoje kai kur trumpai palis, galima perkūnija, temperatūra naktimis 5–10, dienomis 16–21 laipsnis šilumos.

Šiandien Baltarusijoje kai kur 17–22 laipsniai šilumos.

Per kitas dvi paras Kaliningrado srityje trumpai palis, vietomis galima perkūnija, temperatūra naktimis 8–13, dienomis 15–20 laipsnių šilumos.

* * *

Šiandien – Antano, Antanės, Akvilinos, Kunoto ir Ninos vardo diena.

Vandens temperatūra vakar 8 val.

Nemune ties Druskininkais	+19
Neryje ties Vilniumi	+19
Kauno mariose ties Birštonu	+20
Totoriškių ežere ties Trakais	+20
Tauragno ežere ties Tauragnais	+21
Kuršių mariose ties Nida	+20
Baltijos jūroje ties Nida	+12
Baltijos jūroje ties Klaipėda	+17
Baltijos jūroje ties Palanga	+14

Saulė		Mėnulis				Zodiakas
3:42	20:56	VI 11	VI 18	VI 24	VII 02	Dvyniai
Teka	Leidžiasi	Jaunatis	Priešpilnis	Pilnatis	Delčia	05 21 – 06 21

Temperatūra pasaulyje birželio 12-ąją vidurdienį

Almata	+23	Lisabona	+24	Roma	+23
Amsterdamas	+17	Londonas	+17	San Franciskas (5.12)	+12
Atėnai	+27	Los Andželas (5.12)	+16	Santjagas (8.12)	+4
Alžyras	+28	Madridas	+30	Seulas	+18
Belgradas	+24	Majamis (8.12)	+24	Sofija	+20
[illegible]	+18	[illegible]	+26	[illegible]	+22
Briuselis	+18	[illegible] (7.12)	+15	[illegible]	+21
Budapeštas	+24	Minskas	+16	Šanchajus	+34
Buenos Airės (9.12)*	+1	Monrealis (8.12)	+12	Talinas	+16
Čikaga (7.12)	+21	Niujorkas (8.12)	+24	Tel Avivas	+27
Dublinas	+14	N.Orleanas (7.12)	+26	Tbilisis	+23
Frankfurtas	+20	Oslas	+17	Tokijas	+18
Gibraltaras	+20	Otava (8.12)	+12	Torontas (8.12)	+18
Havana (8.12)	+23	Paryžius	+20	Tunisas	+27
Helsinkis	+18	Pekinas	+26	Varšuva	+21
Jakutskas	+24	Praha	+21	Vašingtonas (8.12)	+23
Kairas	+30	Rabatas	+25	Venecija	+24
Kijevas	+26	Reikjavikas	+15	Viena	+24
Kopenhaga	+13	Rio de Žaneiras (9.12)	+21	Vilnius	+20
Larnaka	+27	Ryga	+22	Ženeva	+23

* – vietos laiku.

„Lietuvos rytas" 2002-06-13

Dėl visuomenės informavimo ir dalyvavimo planuojamos ūkinės veiklos poveikio aplinkai vertinimo procese

Valstybės įmonė Ignalinos atominė elektrinė planuoja ūkinę veiklą „IAE eksploatacijos nutraukimas". Planuojamos ūkinės veiklos tikslas yra saugiai nutraukti IAE 1-ojo bloko eksploataciją bei sutvarkyti radioaktyviąsias atliekas ir panaudotą branduolinį kurą.

Su planuojamos ūkinės veiklos poveikio aplinkai vertinimo dokumentais galima susipažinti IAE Eksploatacijos nutraukimo tarnyboje, 411 kabinete, 31V pastate, IAE, LT-4761.

Motyvuotus (pagrįstus) pasiūlymus planuojamos ūkinės veiklos poveikio aplinkai klausimais, laikantis LR aplinkos ministro 2000 07 10 įsakymo Nr. 277 reikalavimų, prašome teikti Ignalinos AE ENT, Visaginas, LT-4761.

Telefonas pasiteirauti: (8-266) 24378, V. Ledzinskas, IAE ENT.

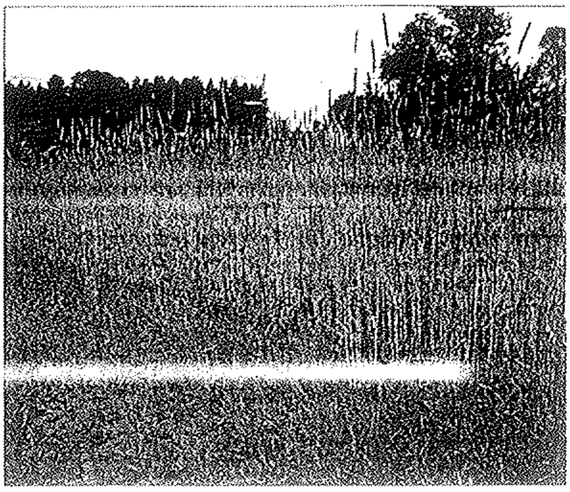
[illegible]

Sausra nebegresia, bet drė[...]

Naglis Šulija

Lietuvoje pagaliau palijo. Žinoma, vis po truputį palydavo ir anksčiau, tačiau jau gana ilgą lai[...] ko tarpą nebuvo taip, kad lietu[...] gana gausiai palaistytų žemę vi[...]soje Lietuvoje.

Dėl to šen bei ten jau buvo ga[...]



Drėgmės stygius pasėliams nebegresia. V.Kapočiaus nuot[...]

Galvosūkis

KETVIRTADIENIS

Išbraukite raidžių tankumyne duotus žodžius. Jie paslėpti vertikaliose, horizontaliose ir įstrižose eilutėse. Iš likusių raidžių horizontaliai perskaitysite frazę.

AFIŠA, AKMUO, AUŠRA, BAIMĖ, BLAKĖ, BUOŽĖ, CEZIS, DAŽAI, DEŠRA, DRAMA, DUKRA, DULKĖ, DUOBĖ, DURYS, EKETĖ, FERMA, FORMA, FRAZĖ, GAIVA, GALVA, GATVĖ, GELDA, GENYS, GERVĖ, GIRNA, GLOBA, GRAFA, GRUPĖ, GUZAS, HIENA, IDILĖ, IDĖJA, IETIS, ILGIS, INDAS, ITRIS, IŠARA, IŽDAS, JAUJA, KAINA, KAKTA, KALVA, KAPAI, KARNA, KARTA, KAUKĖ, KETUS, KILMĖ, KILPA, KINAS, KLASĖ, KLIKA, KNYGA, KOBRA, KOLBA, KORTA, KORYS, KOVAS, KRONA, KRUŠA, KUBAS, KULKA, KUOPA, KUPRA, KURAS, KŪDRA, KŪNAS, LAIDA, LAKTA, LANKA, LAUMĖ, LAŠAI, LEDAI, LENTA, LIEPA, LOKYS, LUBOS, LYSVĖ, MAKNA, MALDA, MANTA, MARKĖ, MATAS, MEILĖ, METAS, METRO, MEŠKA, MIGLA, MINIA, MORKA, MŪRIS, NAMAS, NOSIS, OMEGA, OSMIS, RŪBAS, SROVĖ, TAKAS, VANTA, ĮMONĖ, ĮTAKA, ČEKIS, ŠALIS.

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Birželio 12 d. „Lietuvos ryte" spausdinto kryžiažodžio a[...]

Vertikaliai: Epas. Belga. Pasas. Rani. Taka. Raito. Pankai. Timp[...] Latras. Statyk. Sočis. Salsa. Nile. Rasa. Sesė.

Horizontaliai: Preparatas. Baalas. „Nike". Apis. Asignavimai. Rai[...] Rate. Mineli. Stasys. Natos. Tesla. Sakė.

Announcement in *V Kazdyj Dom* (Visaginas), 2002 06 14

731. R.111.

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АНИЮ.
086. R.2396.

Ежедневные ГРУЗО-ПАССАЖИРСКИЕ ПЕРЕВОЗКИ, а также отправление в Вильнюс (Гарюнай, Сантаришкес, посольства, аэропорт) с 5.30 до 6.00 от гостиницы «Aukštaitija». Поездки в Палангу, Минск, Гомель, Чернигов, Киев, Одессу. ☎61-115, ☎(8-698)09732.

ПРИГЛАШАЕТ МЕЖДУНАРОДНЫЙ ОЗДОРОВИТЕЛЬНЫЙ ЛАГЕРЬ В ПАЛАНГЕ (походы, дискотека, экскурсии). И море! ☎61-115. ☎(8-687)26905. R.2298.

НАРАЩИВАЮ НОГТИ. Гарантия 1 месяц. Гель. Акрил. Ольга Суворова. ☎раб.71-344, ☎(8-611)18162.

БЕСПЛАТНО НАЙТИ в Италии ДРУГА, МУЖА (любой возраст). ☎+37067132635.

РЕМОНТ КРОВЛИ ГАРАЖЕЙ. Столярно-плотницкие работы. Перенос розеток и выключателей. Навеска шкафчиков. ☎73-564, ☎71-564. R.2326.

ДОКУМЕНТАЛЬНОЕ, ХУДОЖЕСТВЕННОЕ ФОТО У РОМАНОВСКОГО. Цены умеренные, качество гарантируется. Принимаются нестандартные заказы. Тайкос, 80-75. R.2350.

Недорого. ИЗГОТОВЛЕНИЕ И УСТАНОВКА МЕТАЛЛИЧЕСКИХ ДВЕРЕЙ И РЕШЕТОК. Сварочные работы. ☎72-682.

Каждую субботу в 8.00 в с/т «Pavasaris», возле бывшего пивного киоска, БУДУТ ПРОДАВАТЬСЯ ЗЕРНО, МУКА, ОТРУБИ И КОМБИКОРМ.

РЕМОНТИРУЕМ телевизоры, радио- и видеоаппаратуру, стиральные машины-автоматы, холодильники. Даем гарантию. ☎71-444, ☎(8-688)89359, ☎(8-699)29431, Седулинос ал., 14/3.

ПРОКАТ СВАДЕБНЫХ НАРЯДОВ по Космосо, 4-55 (аксессуары – фата, веночки, перчатки). Работаем с 13.00 до 18.00 с понедельника по пятницу, ☎31-800, ☎(8-611)43057. R.2406.

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- возможность изучения английского и немецкого языков (по выбору)
- обучение основам экономики через игру
- использование компьютерных обучающих программ
- основы безопасности жизни (гимназический курс)
- уроки физкультуры в бассейне
- применение активных методов и нетрадиционных форм обучения
- увлекательное изучение трудных тем
- создание ситуации успеха
- группа продленного дня до 16.30 и возможность дополнительных индивидуальных занятий с учителем

Тел. секретаря 7-10-08

„V každyj dom" 2002-06-14

Dėl visuomenės informavimo ir dalyvavimo planuojamos ūkinės veiklos poveikio aplinkai vertinimo procese

23*06

Valstybės įmonė Ignalinos atominė elektrinė planuoja ūkinę veiklą "IAE eksploatacijos nutraukimas". Planuojamos ūkinės veiklos tikslas yra saugiai nutraukti IAE 1-ojo bloko eksploataciją bei sutvarkyti radioaktyviąsias atliekas ir panaudotą branduolinį kurą.

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Motyvuotus (pagrįstus) pasiūlymus planuojamos ūkinės veiklos poveikio aplinkai klausimais, laikantis LR aplinkos ministro 2000-07-10 įsakymo Nr. 277 reikalavimų, prašome teikti Ignalinos AE ENT, Visaginas, LT-4761.
Telefonas pasiteiravimui: (8-266) 24378, V. Ledzinskas, IAE ENT.

Об информировании и участии общественности в процессе оценки воздействия планируемой хозяйственной деятельности на окружающую среду

Государственное предприятие Игналинская атомная электростанция планирует хозяйственную деятельность "Снятие с эксплуатации ИАЭС".
Цель планируемой хозяйственной деятельности – безопасный вывод из эксплуатации 1-го блока ИАЭС и обращение с радиоактивными отходами и отработанным ядерным топливом.

С документами по оценке воздействия планируемой хозяйственной деятельности на окружающую среду можно ознакомиться в Службе снятия с эксплуатации, помещение 411, здание 31В, ИАЭС, LT-4761.

Мотивированные (обоснованные) предложения по вопросам оценки воздействия планируемой хозяйственной деятельности на окружающую среду, согласно требованиям приказа министра окружающей среды ЛР № 277 от 2000-07-30, просим представлять в Службу снятия с эксплуатации, ИАЭС, Висагинас, LT-4761.
Телефон для информации: (8-266) 24378. В. Ледзинскас, ССЭ ИАЭС.

PHARE 2000 Ekonominės ir socialinės sanglaudos programa Utenos tiksliniame regione

Phare

MOKYMAI RENGTI PARAIŠKAS Į ŽMONIŲ IŠTEKLIŲ PLĖTROS FONDĄ

Šių metų birželio mėn. 17 dieną 10 val. Visagino savivaldybės salėje (Parko g. 14) bus surengti mokymai rengti paraiškas į Žmonių išteklių plėtros fondą ("Mokymai ekonominei ir socialinei sanglaudai ir mokymo iniciatyvos").
Kviečiame dalyvauti mokymo paslaugas teikiančias įmones, kurios veikia ir yra registruotos Lietuvoje, Utenos apskrityje įsikūrusius ir registruotus juridinius asmenis, kurie gali teikti mokymo ir konsultavimo paslaugas bei Utenos apskrityje įsikūrusius ir registruotus juridinius asmenis, kuriems reikia nurodyti paslaugų.

Informacija teikiama telefonais: (8-270)52597, (8-270)30602.

23*02 Zarasų verslo informacijos centras

...ndą dėl tėvelio mirties nuoširdžiai užjaučiame
Visagino ikimokyklinių įstaigų vadovės

...tgimimo" выражает глубокое соболезнование Георгию ...вичу в связи со смертью любимого отца.

...соболезнование Дмитрию Маслякову в связи ...
Коллектив ЗАО "Specialus autotransportas"

...Т "Russkaja volna"
...UGARDAS"
...типографии газеты "Летувос ритас", ... район, 4008 Скайдишкес, Соду, 83.
...ираж 10500. Заказ №

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Announcement in *Naujoji Vaga* (Ignalina), 2002 06 29

8

„Naujoji Vaga" 2002-06-29

DĖL VISUOMENĖS INFORMAVIMO IR DALYVAVIMO PLANUOJAMOS ŪKINĖS VEIKLOS POVEIKIO APLINKAI VERTINIMO PROCESE

Valstybės įmonė Ignalinos atominė elektrinė planuoja ūkinę veiklą "IAE eksploatacijos nutraukimas". Planuojamos ūkinės veiklos tikslas yra saugiai nutraukti IAE 1-ojo bloko eksploataciją bei sutvarkyti radioaktyviąsias atliekas ir panaudotą branduolinį kurą.

Su planuojamos ūkinės veiklos poveikio aplinkai vertinimo dokumentais galima susipažinti IAE Eksploatacijos nutraukimo tarnyboje, 411 kabinetas, 31 V pastatas, IAE, LT– 4761.

Motyvuotus (pagrįstus) pasiūlymus planuojamos ūkinės veiklos poveikio aplinkai klausimais, laikantis LR aplinkos ministro 2000 07 10 įsakymo Nr.277 reikalavimų, prašome teikti Ignalinos AE ENT, Visaginas, LT– 4761.

Telefonas pasiteirauti (8-266) 24378, V. Ledzinskas, IAE ENT.

ĮVAIRŪS

Simpatiškoms merginoms ir moterims (nuo 18 iki 30 metų) siūlo labai gerai apmokamą darbą Vilniuje. Apgyvendiname.
Tel. (8-689) 91798

Buhalterė, turinti didelį darbo stažą, ieško darbo. Tel. (8-229) 52237

Reikalingi žmonės, galintys parodyti parduodamus namus, sodybas [illegible] mija nuo 1000 Lt (sąžiningai sumokėsime).
Tel.: (8-270) 30903, (8-698) 03444

Montuoja automobilių apsaugos sistemas. Tel. (8-687) 36753

Savo pievas Juodalaukyje kviečiu nusišienauti veltui. Tel. 36194

Nebrangiai, su šiuolaikiniu mechaniniu purkštuvu, nuo maro, sausligės, kolorado ir t.t. chemiškai apdorojame bulves ir kitus pasėlius. Kaina sutartinė.
Tel. 53672 (nuo 18 val.)

Jauna šeima ilgesniam laikui išsinuomotų Ignalinoje 2-jų kambarių butą. Tel.: 36306, (8-687) 34683

Ieškau darbo, galiu atlikti įvairius statybos darbus, mūriju, remontuoju krosnis ir židinius.
Tel. 52589 (nuo 19 val.)

PARDUODA

Jonėnų kaime (Vidiškių sen.) gerą, pieningą 5 veršelių karvę Tel. 36036

Penkių veršelių pieningą karvę.
Tel. (8-650) 89482

Ignalinos centre 2-jų kambarių butą (antras aukštas, visi skaitikliai).
Tel. (8-671) 73315

Netoli ežero gerą sodybą.
Tel. (8-688) 50126

Skubiai Vidiškėse 3-jų kambarių butą (yra skaitikliai, ūkinis pastatas, daržas prie ežero). Kaina 9000 litų. **Tel. 46370 (nuo 17 val.)**

Dūkšte pusę namo (3 kambariai, sandėliai, prie ežero yra obelų). Kaina 7000 litų. **Kreiptis: Rimšė, į Vandą Kirdeikienę**

Veršingą telyčią. Tel. 36055
(Kukutėlių k., Tverečiaus sen., Stasė Gaidelienė)

Medinį namelį, 2 ha miško, 5 ha žemės (5 km nuo Ignalinos).
Skambinti vakare tel. (8-217) 52583

5 metų arklį, pieningą karvę, 3 [illegible]
Tel. (8-613) 64873

Skubiai pradėtus statyti garažus (su rūsiu ir be rūsio, dideli), GAZ-53, bortinis, galima keisti. Tel. 36339

Juodmargę šešerių metų karvę.
Tel. 41843

Ignalinos rajone, netoli Dringio ežero, mišką su žeme (3,08 ha).
Tel.: (8-686) 33215, (8-287) 48489

Darbinę kumelę. Tel. (8-299) 43982

„GAZ-SAV -53" užpakalines linges, kairės pusės priekinį ir užpakalinį stiklą, sparną, padangas (2 vnt.), pakabinamą guolį (komplekte), duris, greičių dėžei guolius. Kaina sutartinė. Tel. 36760

Announcement in *ZarasuKrastas* (Zarasai), 2002 06 14

„Zarasų kraštas"

Nr. 47 (8215). 2002 m. birželio 14 d. ZARASŲ

Zarasų rajono savivaldybės objektų privatizavimas viešo aukciono būdu 2002 metų birželio mėnesį

Vaikų darželio pastatas (plotas 1427,01 kv. m, pastatas mūrinis, 2 aukštų) ir šiam objektui priskirtas 4720 kv. m žemės sklypas Užtiltės kaime, Dusetų seniūnijoje.

Pradinė objekto pardavimo kaina 12 700 Lt, iš kurios objektui priskirto žemės sklypo pradinė pardavimo kaina 4000 Lt.

Pradinės mokyklos pastatas (plotas 120,99 kv. m, pastatas medinis, 1 aukšto), sandėlis ir šiam objektui priskirtas 5130 kv. m žemės sklypas Vencavų kaime, Dusetų seniūnijoje.

Pradinė objekto pardavimo kaina 8000 Lt, iš kurios objektui priskirto žemės sklypo pradinė pardavimo kaina 3500 Lt.

Aukcionų vykdymo laikas 2002 06 20. Vieta: Sėlių a. 22, kabinetas Nr. 36, Zarasai. Objekto apžiūros laikas 2002 06 13 – 2002 06 18.

Dokumentų dalyvauti aukcione registracijos pradžia 2002 06 13, pabaiga 2002 06 18, darbo dienomis 8-16 val. Vieta: Sėlių a. 22, kabinetas Nr. 52, Zarasai.

Privatizavimo institucijos darbuotoja, atsakinga už programos vykdymą, vyresnioji specialistė Alina Eizintienė, telefonas 53743, faksas 51240.

Dėl visuomenės informavimo ir dalyvavimo planuojamos ūkinės veiklos poveikio aplinkai vertinimo procese

Valstybės įmonė Ignalinos atominė elektrinė planuoja ūkinę veiklą "IAE eksploatacijos nutraukimas". Planuojamos ūkinės veiklos tikslas yra saugiai nutraukti 1-ojo bloko eksploataciją bei sutvarkyti radioaktyviąsias atliekas ir panaudotą branduolinį kurą.

Su planuojamos ūkinės veiklos poveikio aplinkai vertinimo dokumentais galima susipažinti IAE Eksploatacijos nutraukimo tarnyboje (kabinetas Nr. 411, 31V pastatas) Visagine.

Motyvuotus (pagrįstus) pasiūlymus planuojamos ūkinės veiklos poveikio aplinkai klausimais, laikantis LR aplinkos ministro 2000 07 10 įsakymo Nr. 277 reikalavimų, prašome teikti Ignalinos AE ENT Visagine. Telefonas pasiteirauti (8*266) 24378, V. Ledzinskas, IAE ENT.

Sveikina

Lai būna dienos saulėtos
ir šviesios,
Be ūkanų ir be skausmų širdy...
O džiaugsmas, ranką
Tau ištiesęs,
Telydi visada gyvenimo kely!
Leisk dar kantrybės palinkėti,
Sėkmės, sveikatos,
ištvermės stiprios,
Pavasarių – bežydinčių,
saulėtų,
Ir švelnios ant lūpų šypsenos.

Vardadienio ir gimtadienio proga Antaną SAMĖNĄ, gyvenantį Antazavėje, sveikina **žmona ir vaikai su šeimomis.**

Reikalinga

Žmonės, galintys nurodyti parduodamą sodybą, kitą pastatą ar žemės-miško sklypą prie ežero. Premija 1000 Lt (sąžiningai atsilyginsime).

Skambinti telefonais 30877, (8*698) 03444.

Karvės s
Švedijos ž
ma.
Kiaulės:
Paslaugų

Namą
pingas), Z
Skam
96140, (8

Dviejų
m²) Zaras
pastatas. I
Skam
(nuo 19 v
17 val.).

Dviejų
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kelioninę
naudotą š
rankinę ž
pilnavidu
plokštes,
Skam

Pusę n
Kreip
(netoli au

4 kam
Zarasų mi
visi skaiti
Skam

3 kam
Zarasų mi
2 balkona
veiklai.
Skam
(8*610) 1

2 kam
Yra ūkinis
Skam

Nebrar
barių butą
Skam
49668.

1 kam
Zarasų mi
liai.
Skam
74963, (8

Darbin
Skam
(8*650) 1

Proposals of the public regarding the EIA

There was not received any proposals of the public regarding the INPP Decommissioning EIA until 2004-04-19.

III Part. Graphic Materials

Annex 1. Land use map

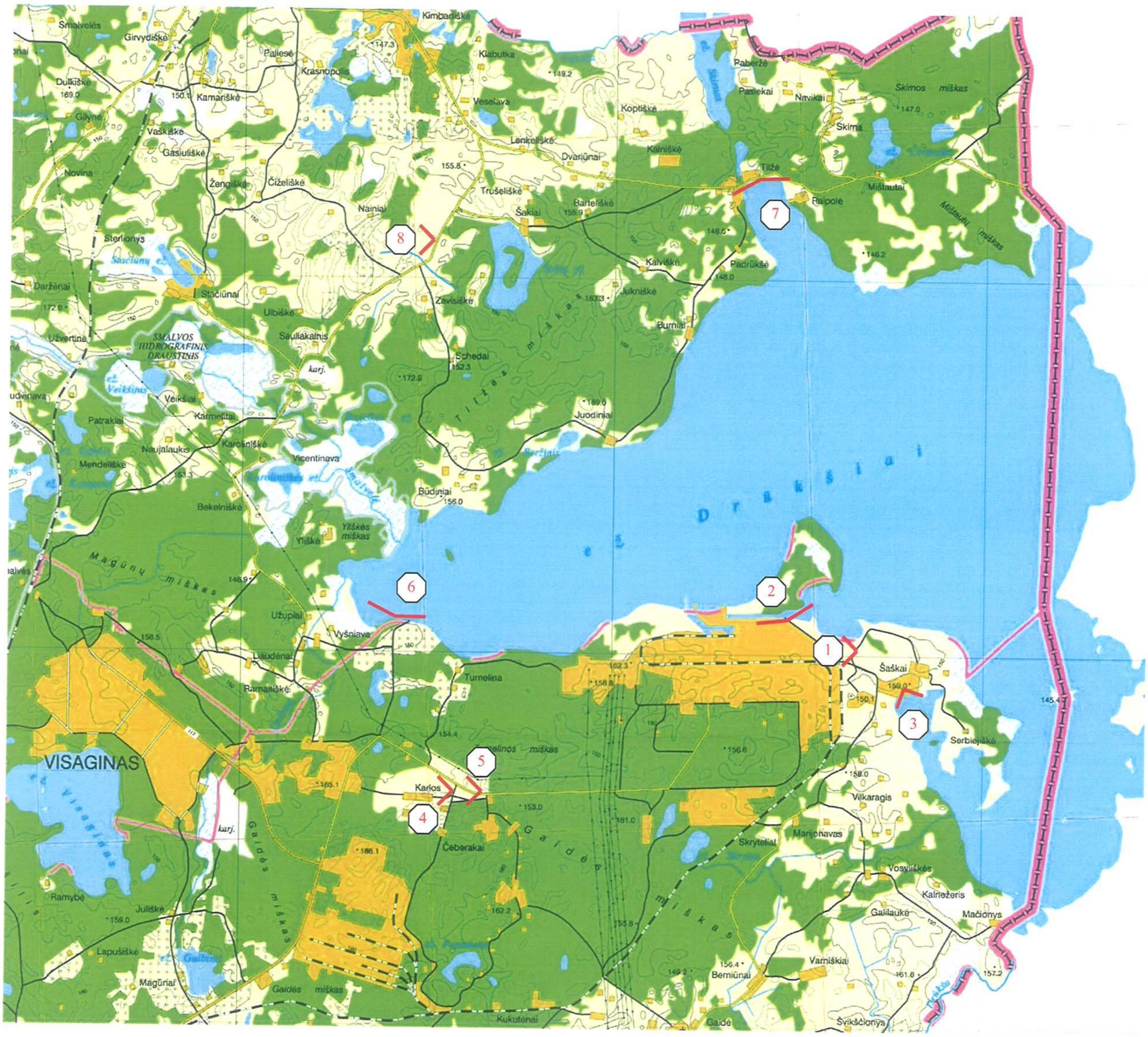

Figure 1. View from the east, on INPP Units 1 & 2, and partly built (abandoned) Unit 3.

Figure 2. View on the south-eastern part of Lake Drukshiai. Some islands can be seen.

Figure 3. View on the warmed cooling water release and outtake channel

Figure 4. View on the closest dwellings (few houses) to the INPP.

Figure 5. View on the road from INPP to Visaginas. The landscape is composed of pineyards, marshes and some agricultural parcels

Figure 6. View on the south western part of the Lake Drukshiai. The Vyšniava village is behind the photographer.

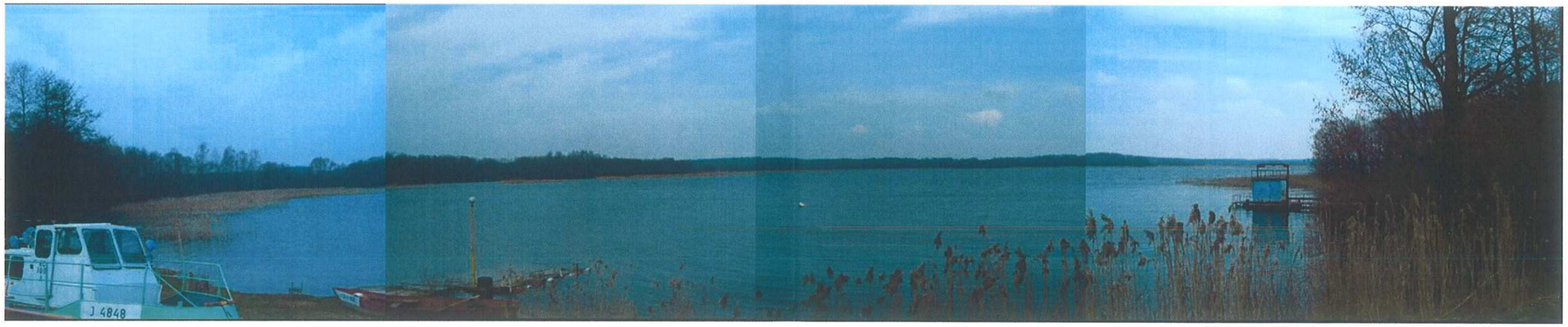

Figure 7. View of the lake from the northern bank. The INPP stacks are hidden by the peninsula on the right.

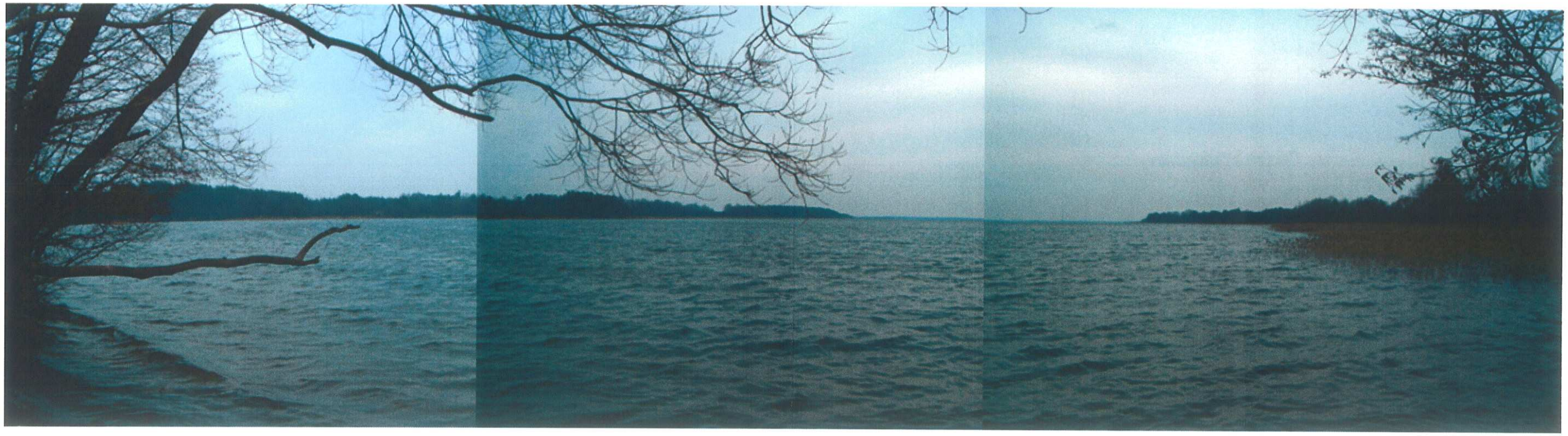

Figure 8. Typical marsh landscape.