Unoficial translation

State Nuclear Power Industry Safety Inspectorate
(VATESI)

GUIDELINES

Ignalina Nuclear Power Plant
Decommissioning General Requirements

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CONTENTS

1. INTRODUCTION

1.1 Definitions

Decommissioning of the Ignalina Nuclear Power Plant (decommissioning) – the legal, organisational and technical actions taken to put the Ignalina Nuclear Power Plant in order after it is decided that it will never again be used for the purpose for which it was intended [I.2].

Putting the Ignalina Nuclear Power Plant in order – For the purposes of this document, decontaminating and dismantling decommissioning residues, disposal of INPP waste, site clearance and other activities undertaken with the ultimate objective of allowing unrestricted use of the site or obtaining permission to construct other nuclear facilities on the site.

Unrestricted use of the site – A status of the Ignalina Nuclear Power Plant site allowing it to be used for any activity, including activities which are not regulated for radiation safety.

Decommissioning Plan – A document containing a description of the final shutdown and decommissioning strategy, and an estimate of decommissioning costs, including sources of finance.

Decommissioning strategy (Strategy) – It is a part of the Decommissioning Plan, and shows the process chosen by the Operator in order to carry out decommissioning activities until reaching the ultimate goal of the unrestricted use of the site. The decommissioning process may be divided into several stages and phases.

Decommissioning stage (Stage) – One of the three decommissioning stages proposed by the International Atomic Energy Agency (IAEA) [II.1], including the description of the physical status of INPP and its equipment and the provision of suitable supervision for the starting, intermediate and final parts of the Stage.

Decommissioning phase (Phase) – A part of the decommissioning project, selected at INPP's discretion, not necessarily coinciding with a Decommissioning Stage, including the determination of the physical status of INPP and its equipment and the provision of suitable supervision for the starting, intermediate and final parts of the Phase.

Final shutdown – The end of the operational life of INPP after the relevant resolutions have been adopted by Seimas, the Government and the Operator, together with the operations required to achieve shutdown, carried out on the basis of the Operating Licence, before the Decommissioning Licence is obtained.

Nuclear Safety – The Ignalina Nuclear Power Plant's ability to limit the effect of radiation on the public and the environment in accordance with established standards, both during normal operation and in emergencies [I.2].

Radiological Protection – The totality of legal, technical and technological means and construction and public health regulations and standards, guaranteeing the protection of the public and the environment against nuclear damage [I.2].

Radiation Safety - The totality of legal, technical and technological means and construction, public health, industrial safety and environmental protection regulations and standards used to ensure the protection of the public and the environment from the harmful effects of ionising radiation [I.9].

Nuclear Damage – The death or damage to the health of a person, loss or damage to property, or adverse environmental impact resulting from exposure to radiation associated with the operation of the Ignalina Nuclear Power Plant, or a nuclear (radiation) accident [I.2].

Mixed waste – Radioactive waste having other kinds of hazardous features.

Secondary waste – Waste generated by the processing of other waste.

Decommissioning residues (Residues) – Materials, buildings and structures resulting from decommissioning activities.

Clearance – Removal of decommissioning residues or decontaminated materials from further control, based on a decision of the regulatory body.

Unconditional clearance –For unconditional clearance, decommissioning residues not exceeding the unconditional clearance level prescribed by a government institution may be released from the site for any purpose. Government institutions do not check them for radiation safety once they have left the site.

Conditional clearance – A form of clearance whereby decommissioning residues are recycled, reprocessed or disposed of, depending on the prescribed conditional clearance levels, after a government institution has specified how they are to be recycled, reprocessed or disposed of. Waste which has obtained conditional clearance is monitored by INPP to ensure compliance with requirements.

Special Requirements – Environmental and cultural heritage protection requirements, and public health, fire safety, industrial safety, nuclear safety and other requirements relating to various kinds of human activity (including those associated with the design, construction, commissioning, operation and demolishing of installations) [I.29].

Special design conditions – Conditions setting out the special requirements of central and local government authorities, drawn up only if there are no relevant regulations, or if the requirements are associated with the location of a specific site and its environment [I.29].

1.2 Objective

The main objective of this document is to specify the basic licensing requirements for decommissioning the Ignalina Nuclear Power Station and to formulate the State Nuclear Safety Inspectorate's requirements relating to the decommissioning process itself, its preparatory stages and its supervision and safety assessment, and the special requirements relating to decommissioning project documentation and to other documentation, taking into account both the experience achieved at international level and the specific national regulatory framework.

1.3 Scope

This document applies to the preparatory work on decommissioning, and also to the whole decommissioning process of the Ignalina Nuclear Power Station following its final shutdown, and operations aimed at achieving unrestricted use of the site. It is intended for use both during decommissioning of INPP as a whole and of either one of its units. A list of the statutory instruments regulating decommissioning operations will be found in Appendix 1. Appendix 2 contains a list of IAEA recommendations and European Union statutory instruments. A list of the principal statutory instruments and regulations governing the safety of the nuclear industry in the Lithuanian Republic is contained in [I.1].

2. THE RIGHTS AND TASKS OF DECOMMISSIONING PROJECT PARTICIPANTS

2.1 The main participants

The main participants in the decommissioning process are:

- The Operator (Ignalina Nuclear Power Plant, INPP)
- The regulatory body responsible for the decommissioning of INPP (the National Nuclear Safety Inspectorate, VATESI)
- Central and local government authorities

2.2 INPP's main tasks

INPP will have the following main tasks:

- To set up a suitable organisation with a clear division of the functions and responsibilities of all persons involved in the decommissioning process and who are capable of retiring the facility from service.
- To ensure safe shutdown
- To obtain a decommissioning licence from VATESI
- To obtain the relevant permits from central and local government authorities or to comply with their requirements for decommissioning and associated activities
- To comply with the requirements of VATESI

2.3 INPP's rights

INPP will have the right to:

- Choose a decommissioning strategy which it finds acceptable, and the decommissioning phases, having agreed them with VATESI and central and local government authorities
- Apply to VATESI for a single licence covering the whole decommissioning process or for a licence covering an individual phase of decommissioning.

2.4 VATESI's rights and tasks

VATESI will have the following rights and tasks:

- To propose to the Lithuanian Government and the Ministry of the Economy the shutting down (taking out of service) of the Ignalina Nuclear Power Plant before the end of its service life, if safety is not ensured
- To submit proposals for drafting or amending legislative instruments relating to decommissioning, decommissioning strategy, radioactive waste handling and funding the decommissioning process to the Government and other competent authorities.
- To specify decommissioning licensing requirements
- To grant a decommissioning licence, or provide valid reasons for refusal
- To suspend, prolong or revoke the decommissioning licence
- To draw up decommissioning planning requirements, and to review and approve the plans
- To assess safety during the final shutdown and decommissioning period
- To draw up additional safety requirements for the final shutdown and decommissioning period
- To issue permits for individual decommissioning activities
- To draw up and implement inspection programmes
- To confirm that decommissioning has been completed and that the site can be released for unrestricted use, or permit other nuclear facilities to be installed at the site.

2.5 The participation of central and local government authorities in the decommissioning process

The participation of central and local government authorities in the decommissioning process is defined in [I.2].

Regulation and supervision of decommissioning activities is subject to the provisions of the law and of other statutory instruments.

3. FUNDING AND CIVIL LIABILITY FOR NUCLEAR DAMAGE

3.1 Funding

Before any decommissioning activities take place, sufficient funds must have been accumulated. Decommissioning costs must include all activities described in the decommissioning plan, i.e.: the final shutdown, engineering design work, licensing costs, the development of special technologies, decontamination, dismantling and conducting a final survey. They should also include the cost of management of radioactive waste and of waste generated during operation and during decommissioning.

The cost of maintenance, surveillance and physical protection of INPP has to be taken into account, especially if any phase (stage) of decommissioning is deferred. If this is the case, it must be ensured that the decommissioning funds can be retained throughout the safe enclosure period and thereafter [II.2]. General nuclear installation funding provisions apply also to decommissioning. They are set out in Section 12 of [I.2]. Contributions to the INPP decommissioning fund and its management are described in [I.3].

3.2 Civil liability for nuclear damage

Pursuant to Section [I.2], INPP is liable for nuclear damage caused during decommissioning.

Civil liability for nuclear damage is also defined in [I.4-6].

4. PLANNING THE DECOMMISSIONING PROCESS

INPP must plan how to take the plant out of service in a safe manner.

The planning process has been divided into three phases, with three corresponding decommissioning plans: initial, ongoing and final [II.2]. Planning the decommissioning process also covers organisational measures and technical decisions relating to the operation of INPP, which must take account of the proposed shutdown, and the maintenance of operating documentation.

At the close of operations and during the decommissioning period, the decommissioning plan will be the principal document serving to prepare detailed plans (projects) of decommissioning activities.

4.1 The initial decommissioning plan

The initial decommissioning plan should be prepared before the operating licence is issued. INPP should prepare the initial operating plan and submit it to VATESI together with its application for an operating licence. The initial decommissioning plan should state in general terms that the plant can be taken out of service, and provide an outline of decommissioning methods and technologies. The initial decommissioning plan must specify the likely quantity of waste and provide an estimate of decommissioning costs.

4.2 Ongoing planning of the decommissioning process

While it is in operation, INPP must update its decommissioning plan at least every 3 years. The updates are intended to reduce the impact of decommissioning on the public and the environment, and to ease the process by allowing for changes in decommissioning technologies and in radioactive waste management. Ongoing decommissioning plans should be corrected if systems and installations have been significantly altered, or if incidents or accidents have taken place resulting in unforeseen contamination of the INPP site and its systems.

During the ongoing planning period, decommissioning costs will also be updated accordingly.

The ongoing plans must be submitted to VATESI, with INPP taking VATESI's comments into account and amending the plans accordingly.

4.3 The final decommissioning plan

INPP must prepare a final decommissioning plan, Art. 38 of [I.2]. The plan must be agreed with the central and local government authorities specified in Article 38 of

[I.2] and submitted to VATESI five years before the proposed final shutdown of the unit. VATESI must approve the plan.

The final decommissioning plan [II.3] must include:

a) A description of INPP and the INPP area which could be affected by the decommissioning process.
b) INPP's operating history, and the use to be made of its plant and site during the decommissioning process and thereafter.
c) A list of the standards, regulations and other statutory instruments forming the legal framework of the decommissioning process.
d) The chosen decommissioning strategy and its supporting argument
e) A description of the proposed decommissioning activities and their timetable
f) A conceptual safety and environmental impact assessment, including the impact of ionising radiation and other effects on the public and the environment.
g) A description of the environmental monitoring programme proposed for the decommissioning period.
h) A description of the decommissioning organisation: its responsibilities, resources, qualifications and the skills of its personnel.
i) The opportunities for using various engineering, management and decommissioning methods, as well as dismantling, decontamination, and cutting technologies, and an assessment of the remote control equipment which will be needed for safe decommissioning.
j) A description of the proposed methods of waste management, including the sources, quantities, description and type of waste, sorting criteria, primary waste processing and the methods of its final processing, transportation, storage and disposal, together with an indication of the suitability of decommissioning residues for reprocessing or recycling, and radiation criteria; expected release and discharge into the environment of radioactive and non-radioactive materials and the ultimate fate of radioactive waste.
k) A description of the safety and radiation safety procedures to be used during decommissioning
l) A description of the quality assurance system
m) Descriptions of other important administrative and technical requirements, such as IAEA safeguards, physical protection, emergency preparedness etc.
n) Monitoring programmes intended to confirm that the site complies with free release criteria, including their description, equipment and methods to be used
o) An estimate of decommissioning costs, including the cost of waste disposal, existing funds and other sources.

4.4 Maintenance of operating documentation

During operation, INPP must maintain and store operating documentation (drawings, system descriptions, procedures, engineering solutions, descriptions of new systems, components and structures, and documentation relating to incident investigation, with special attention paid to incidents which led to system or component damage or could have led to radioactive contamination, information about site monitoring before the construction of INPP and during its operation), since they could contain valuable information for the decommissioning period. Care should be taken to ensure that these documents are easily and quickly accessible during all decommissioning phases [II.2].

4.5 Preparatory work to be carried out during operation to facilitate decommissioning

While in operation, INPP should take steps to facilitate the decommissioning process. This relates above all to reducing radioactive contamination of systems, components and structures, supervision of the construction of protective covers and new easily decontaminated protective covers and barriers, the use of easily accessible and dismountable structural components in engineering and design during the period of operation, disposal of process waste etc.

All preparatory and survey work should be carefully documented.

4.6 Amendment of the final decommissioning plan

The final decommissioning plan must also be reviewed, and if necessary amended in the light of experience gained in the decommissioning process or in line with new safety requirements, and also if there are any policy or financing changes that could affect decommissioning. The decommissioning plan can only be amended in the prescribed manner, with the agreement of VATESI and other government institutions.

5. DECOMMISSIONING SAFETY REQUIREMENTS

5.1 Ensuring nuclear safety during the decommissioning period

During the decommissioning period, safety must be ensured as long as INPP qualifies as a nuclear installation or there exists a real possibility of unplanned spread of radioactive and other hazardous substances and of damage to the population and the environment. All decommissioning operations must be conducted in accordance with project requirements, limits and conditions. General safety requirements for INPP during its operation are regulated [I.7-8].

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

5.2 Decommissioning safety assessment

Decommissioning must be preceded by an exhaustive, systematic safety assessment. The assessment must be firmly supported by documentation, which should be continually updated in the light of decommissioning experience and new significant safety information. All new decisions and changes in project requirements, limits or conditions must be assessed from the point of view of safety, and may be implemented only after VATESI's agreement has been obtained.

5.2.1 Accident analysis

In carrying out the decommissioning safety assessment, due weight must be given to any accidents and emergency situations due to internal and external natural causes or to human activity which occurred while INPP was in normal operation. The assessment should be based on the analysis of accidents during the construction and operation of INPP, but must be reviewed and assessed in line with changing

requirements, and also if there are changes in events leading to accidents or emergency situations.

Additional accident analysis must be performed for planned decommissioning activities that could change the status of INPP or for its individual systems when additional systems are installed.

Accident analysis must include, but need not be limited to the following events: fire, leakage from vessels or systems, falls, equipment failures, criticality accidents (so long as fuel not has been completely removed from the reactor or spent fuel pools), penetration of water through barriers and systems, external impacts (earthquakes, storms, floods, penetration of gases etc.).

Proper consideration should also be given to other events which could create emergency situations or accidents, or could arise from chemical compounds located at INPP used for decommissioning purposes or materials remaining after shutdown.

5.3 Radiation protection during the decommissioning period

The radiation safety optimisation and limitation principles contained in [I.9], Sections 2 and 3, Article 3 apply to removal from service. INPP must ensure that employees and the local population are protected from ionising radiation during the decommissioning process. Radiation exposure of INPP employees and the local population during the decommissioning period is regulated by [I.10]. Aspects of protection against ionising radiation adopted internationally or by international organisations are covered in [II.4-6].

5.4 Environmental protection

When planning decommissioning it is essential to consider the environmental impact of specific decommissioning activities. [I.11-13] regulates environmental impact assessments and other environmental protection issues. During the decommissioning process, INPP must assess the use of natural resources and the emission of contaminants into the environment, and obtain the relevant permits [I.14-15].

Decommissioning should be accompanied by environmental monitoring based on [I.16].

Aspects of environmental impact assessment in the European Union are presented in [II.7].

5.5 Waste management

5.5.1 Radioactive waste

Decommissioning may take place only if decommissioning residue and radioactive waste can be safely managed and if the fate of radioactive waste before disposal has been determined. For this purpose, when planning decommissioning it is essential to determine in advance the categories, forms, groups and the corresponding quantities of radioactive waste.

Based on this information, the most appropriate radioactive waste management strategy and the methods of its initial processing, processing and final processing, transportation, storage and disposal should be selected. Radioactive waste management should be guided by the established radioactive waste classification and by succession criteria.

The principles of radioactive waste management and issues of radioactive waste processing equipment are regulated by [I.17].

5.5.2 Hazardous waste

Waste generated in the decommissioning process must be classified in accordance with [I.18] and managed in accordance with [I.19].

5.5.3 Mixed waste

Mixed waste should be treated as radioactive waste, while taking into account other possible hazardous features. INPP must implement special procedures to ensure appropriate management of mixed waste.

5.5.4 Other waste

The management of other waste, not regulated under 5.5.1-5.5.3, is specified in [I.20-21].

5.6 Emergency preparedness

In order to maintain appropriate emergency preparedness during the decommissioning process, existing emergency plans and procedures should be used, with allowance for the specific conditions obtaining during decommissioning.

General requirements for the emergency preparedness of nuclear facilities are specified in [I.2, 7-8].

5.7 Physical protection and safeguards

Appropriate physical protection and site maintenance must be maintained during decommissioning. This must be given particular consideration if any phase of decommissioning is deferred for a specific period. If the site contains material subject to safeguards, the Operator must adhere to the relevant safeguards principles specified in [I.22-26].

5.8 Quality assurance and documentation programme

INPP must develop and implement a quality assurance system covering all activities having an impact on safe decommissioning.

In implementing the quality assurance system, the Operator must draw up a quality assurance programme, outlining in it specific quality assurance measures, the allocation of responsibilities and resources, and implementation procedures for

specific projects. QA system requirements are specified in [I.27]. Quality Assurance principles are contained in [II.8].

INPP must preserve documents relating to the operation, final shutdown and decommissioning of the facility. After decommissioning, the documentation must be duly handed over to authorised agencies for long-term storage. The stored documentation must cover the status of the facility, personnel qualifications, and relations with subcontractors, waste processing organisations, the regulatory authority and other central and local government authorities.

Special attention must be paid to the storage of documents on waste batches, employee exposure rates and the final decommissioning report [II.3].

5.9 The management of decommissioning

INPP must ensure that a decommissioning management organisation is in operation at all stages of the decommissioning process. It must include properly qualified and experienced personnel, whose duties, responsibilities and interactions are clearly defined in [II.2]. The decommissioning process must involve management structures and methods established during operation, while taking into account new tasks arising during the decommissioning process. The objective is to retain an internal document structure similar to that used during operation. The principal document which must be used as a guide in ensuring the stability of INPP is the Operating Manual. Final shutdown should be based on the Operating Manual compiled while the facility was in operation, and as decommissioning starts, this Manual should be changed in line with the nature of the decommissioning operations and their completion. Other decommissioning documents should also be prepared, such as procedures, instructions, methods, job descriptions and others. INPP personnel should be familiar with these documents and use them in their work.

5.10 Personnel training

INPP will be responsible for the qualifications and training of its own personnel and that of subcontractors involved in the decommissioning process.

The personnel training programme should also include basic decommissioning activities, such as decontamination, dismantling, the operation of remote control equipment, basic safe working principles, the development of practical skills, where necessary using training stands and specially prepared mock-ups simulating the basic conditions of the proposed operations as closely as possible. Both during training and during refresher courses, special attention should be paid to emergency response (noting the interaction between individual employees). When training decommissioning personnel, it is necessary to explain the consequences of any errors for INPP, its employees, the general public and the environment. Before independent work starts, skills must be tested on the basis of existing standards and regulations. Periodic refresher courses are mandatory. The main principles of personnel selection, training, admission to independent work and supervision are outlined in [I.7, 23].

5.11 Safety culture

INPP must promote a safety culture during decommissioning. The concept of safety first must retain its importance as phases of operation change and the overall degree of risk is reduced. Great attention should be paid to safety culture when the nature of decommissioning work changes and with it the potential hazard [II.3].

The main aspects of safety culture are outlined in [II.9].

6. SPECIAL SAFETY REQUIREMENTS FOR DECOMMISSIONING AND THE INDIVIDUAL STAGES OF THE DECOMMISSIONING PROCESS

6.1 Activities during final shutdown

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

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

6.2 Systems necessary for decommissioning

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

When using operating systems for decontamination and dismantling, it is essential to check whether their functionality, power and safety features meet decommissioning requirements.

The check should include, but not be limited to, the following systems: safety, power supply, emergency power supply, ventilation, liquid, gas and aerosol discharge monitoring, environmental monitoring, water supply, process gas supply, fire safety, decontamination, telecommunications, radiation protection monitoring, radioactive waste handling, channelling, lifting and transportation and physical protection. If new or additional safety systems are installed during decommissioning, they must be checked for safe operation and safe interaction with existing systems and components.

6.3 Fuel unloading and removal

The objective is not to carry out any decommissioning operations until all spent fuel has been unloaded from the reactor and spent fuel pools, and removed from site. Licensed procedures must used to unload and remove fuel. Otherwise, the proposed activities must be analysed for their safety in relation to fuel safety. Before disconnecting systems supporting INPP cooling pond functions and before the spent fuel pools themselves are dismantled, the resultant impact on the intermediate spent fuel pools on the INPP site must be assessed. Quality assurance procedures must be

carried out to confirm that all fuel has been unloaded from the reactor and that all spent fuel (including fuel assemblies and their fragments which had fallen into the spent fuel pools or had been left in other equipment), has been removed from the pools.

6.4 Radiation protection

The existing radiation protection procedures and the organisation established during the operating period should be used as a basis, but special attention must be paid to potential radioactive contamination due to the production and release of dust, aerosols and liquids during decommissioning processes.

To plan adequate radiation protection measures and carry out the decommissioning process, INPP must:

a) Ensure that optimisation and limitation principles are applied [I.9-10]
b) Predict the labour content and the associated collective and individual dose for workers for each decommissioning activity
c) Predict the collective dose for members of the public for each decommissioning phase
d) Monitor the exposure of employees and work places and exposure during work with specific decommissioning tools or instrumentation, and analyse the resultant data, striving to optimise the work and reduce exposure to a minimum.
e) Evaluate and determine the radiological situation at the beginning and at the end of every decommissioning phase
f) Predict the quantity of radioactive waste generated during each decommissioning phase and asses exposure during handling
g) [*text missing*] releases of radioactive contaminants into the environment, emission control and keeping discharges within authorised limits, establishing control levels and optimising environmental pollution
h) Ensure proper use of clearance principles and clearance levels in relation to materials released for unrestricted use, or removed from INPP under conditional or unconditional clearance.

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

6.5 Prevention of ionising radiation and the spread of other hazardous substances from INPP

To prevent the uncontrolled spread of radioactive and other hazardous substances during decommissioning, the sealing systems, barriers, equipment and buildings used during operation should be retained for as long as possible [II.3]. It should be established for how long they will remain effective (this is especially important during the safe enclosure period), and procedures should be developed and used to ensure their effectiveness while residual ionising radiation and hazardous materials are present at INPP.

During decommissioning activities, when dismantling or replacing sealing systems, barriers, equipment or buildings, it is important to assess the nature and quantity of residual ionising radiation and hazardous materials. Planning should include the

implementation of measures (the use of effective protection devices, installation of new barriers or radioactive material filters on water discharge and air emission sources etc.) to ensure effective prevention of the spread of residual ionising radiation, radioactive substances or other hazardous matter from those systems into the environment, prevent permissible emission levels from being exceeded or the formation of additional radioactive or other waste and the creation of undesirable occupational exposure or unacceptable working conditions.

6.6 Inventories

To collect the reference data for the decommissioning project, the Operator must investigate and describe the current status of INPP. The description should include: an inventory of parts of the facility (geographical and system-related), of plant buildings, residual activity, local activity distribution in buildings, structures, systems and components, the type of contamination, dose distribution in the facility (radiological protection map) and an inventory of hazardous material (inflammable, toxic etc.).

6.7 Decontamination and dismantling

In selecting decontamination and dismantling methods, it is important to assess their effectiveness and negative consequences of their use. Conventional decontamination and dismantling methods should be preferred. For licensing purposes, it is sufficient to name them and establish the conditions of their use. If previously untested methods are to be used, their suitability will need to be demonstrated at the time of licensing. If the operational reliability of the equipment cannot be directly proved, or if specific characteristics of INNP must be taken into account, proof of suitability will need to be provided (preliminary tests, acceptance and functional tests and safety analysis). In this case, detailed planning of the decontamination and dismantling sequence must be submitted with the licence application documents, in order to be able to check whether the design of machinery and equipment complies with the specific requirements. To optimise the dismantling sequence, preliminary tests should be done, if necessary, on mock-ups reproducing the basic conditions of the proposed operations as closely as possible.

When choosing a method of decontamination, it is important to assess the radioactive contamination of the selected facility, as well as the desired contamination level and the method's ability to achieve the desired effect, and whether it will be possible to measure how effective the decontamination has been, and whether it will improve working conditions. In assessing the adverse effects of the selected decontamination method, it is important to consider whether aerosols or toxic substances will be formed, what impact it will have on the integrity of the decontaminated facility (if this is important, and the facility is to be used as a preventive barrier or for another purpose), the compatibility of secondary waste with the existing waste management system etc.

When starting decontamination, it is important to check that at least one of the following conditions will be fulfilled as a result: there will be a reduction in individual and collective doses, or the quantity of residues to be disposed of, or the quantity of secondary waste formed in the course of decontamination and dismantling, and conditions will be created for an alternative use of the facility or the site.

When selecting decontamination methods, it is necessary to consider the technical conditions (size, location, surroundings, accessibility of the material and components), the radiological protection conditions (types and amount of activity present, the possibility of aerosol formation, contamination hazard, containment of mobile activity, and measures to limit the individual and collective dose and for avoiding releases), and plans for further processing of the residue and its decontamination (burial at a disposal site or at a repository). Before dismantling, process systems and lines which contained radioactive media must first be decontaminated.

Both decontamination and dismantling methods must ensure that the reduction in the quantity of radioactive materials does not lead to an increase in the quantity of emissions and effluent [II.3].

Buildings should be demolished as described in [I.29].

6.8 Safe enclosure period

If INPP is not to be immediately decontaminated and dismantled for unrestricted use, the facility or a unit may be placed under safe enclosure for a specific period of time. During this period, it must be properly guarded, with surveillance and monitoring set up in buildings and on the site.

Appropriate steps must be taken to prevent the spread of radioactive and hazardous substances into the environment and into uncontaminated parts of INPP (especially if some structures, systems or components are already being dismantled). In order to stabilise INPP buildings and ensure acceptable environmental conditions, environmental control parameters must be set and used to monitor the safety of INPP and introduce protective measures.

If safe enclosure is applied, due attention must be paid to financing. Costs must be reviewed and compared with the cost of decommissioning and radioactive waste management, allowing for any changes in financing, such as growth of inflation and others.

In addition to the safe enclosure plan and other required documents, INPP must submit to VATESI documents containing descriptions of:

a) Additional equipment, methods, and building, installation, system and component conservation technologies
b) The maintenance of buildings and installations
c) The physical security of INPP
d) Ventilation, monitoring and other mandatory systems whose function is to control the status of INPP and maintain the required conditions at the facility
e) The surveillance and inspection plan
f) The environmental monitoring programme
g) Accident analysis
h) Emergency preparedness
i) Organisational diagram, allocation of responsibilities and quality assurance programme

During the safe enclosure period, all modifications must be documented, environmental values recorded and other important decommissioning information retained [II.2].

Safe enclosure may also be applied to any part, building, structure, system or component of INPP, after its conditions have been defined.

6.9 Decommissioning residue management

Bearing in mind the principle of reduction of radioactive waste described in Article 2, Section 3 of [I.17], efforts must be made to produce as little radioactive waste as possible during decommissioning. Therefore, decommissioning residue contaminated with radioactive materials may be processed, recycled or disposed of, in accordance with the clearance principles. Decommissioning residues which cannot be granted clearance, or to which it is inappropriate to grant clearance, should be treated as radioactive waste.

6.10 Free release of decommissioning residues

Decommissioning residues can be released if their radioactive contamination level is below the unconditional clearance levels prescribed by government authorities. Such residues may be released from the INPP site without restriction and without further radiation safety regulation. Decommissioning residues granted conditional clearance may also be recycled, processed or disposed of. Conditional clearance levels may be specified by government authorities. Where they have not been specified, INPP may specify them itself.

When specifying conditional clearance levels, it must be demonstrated that the recycling or processing of decommissioning residues or their disposal in the proposed manner will not result in an individual dose-rate in the critical group exceeding 10μSv per year, and that the collective dose-rate will remain below 1man-Sv per year. If the waste obtains conditional clearance, INPP must check whether it has been used, processed or disposed of in accordance with the specified conditions.

The principle of free release may also be applied to the INPP site or a part of it, when the dose requirements set out above have been fulfilled.

6.10.1 Methods of measurement for clearance

The following methods may be used for measurement for clearance of alpha/beta/gamma contaminated material:

- Total gamma activity
- Gamma spectroscopy
- Beta surface measurement
- Alpha activity measurement

The conditions for the use of a particular measuring instrument must first of all be described in a preliminary study. In this study samples of radionuclide contaminated material should be used to determine the radionuclide content and the proportions of the individual radionuclides (the nuclide vector) and their geometric distribution.

The key nuclides have to be established for the radionuclide mix and these can then be used together with the nuclide vector to establish total activity. Together with additional information gained during operation, the preliminary study forms the basis for selecting the nuclide vector and choosing the measurement technique and instrumentation.

6.10.2 Clearance

The materials for clearance must be formed into the most homogeneous material batches possible, taking account of activity distribution and radionuclide content. Gamma spectrometric measurement can be used to determine the radionuclide composition of the characteristic radionuclides emitting gamma rays and X-rays, and special activity, can be determined in material samples.

In this measurement, it is necessary to take into account the radioactive decay rate of each radionuclide.

The measurement technique can be used in the context of clearance:

- To determine the mix of gamma emitters and their spatial distribution, using random instruments and material batches, as part of preliminary analysis, to check observance of the criteria in the clearance procedure using a sample of the material with homogeneous activity distribution (in the case of metals, simply samples from one melt). The size of the sample and the method of sampling must be such that the special contamination activity represented by the random sample is not reduced.

7. LICENSING

7.1 The preconditions for licensing decommissioning

Decommissioning of INPP or one of its units may commence only after the publication of a special INPP or INPP unit decommissioning law and the adoption of the relevant Government resolution [I.2].

Neither INPP nor any other nuclear installations may be decommissioned in the absence of a State Nuclear Safety Inspectorate licence issued pursuant to Article 26 of [I.2].

7.2 The decommissioning licensing procedure

The decommissioning licensing procedure must follow the general licensing requirements set out in [I.30], as well as requirements governing the submission and examination of applications, inspections during the licensing procedure, decisions to grant a licence, the form of the licence, monitoring compliance with its terms and the use of sanctions. During the licensing procedure, the provisions of [I.30] and of this document relating to the duties and liabilities of the licensor and experts shall apply.

7.3 Licensing documentation

To obtain a decommissioning licence, INPP or the decommissioning organisation must submit an application on the form shown in [I.30] to the State Nuclear Safety Inspectorate. INPP may apply for one licence covering all decommissioning activities or for a licence covering a single phase of operations. In addition, as specified in [I.30], the decommissioning licence application must state:

- The reasons for the request for a decommissioning licence
- A description of activities performed after the final shutdown or an earlier decommissioning phase, or currently under way
- A list and a clear description of all decommissioning activities for which the applicant is seeking authorisation

The application must be accompanied by the administrative, financial and technical documentation listed in Clauses 103-104 of [I.30]. In addition, INPP or the decommissioning organisation must submit the following documentation to the State Nuclear Safety Inspectorate:

a) Safety analysis report
b) The decommissioning project
c) Project appraisal by the State Expert Appraisal Committee
d) Natural resources user's licence and an emission licence
e) Radiation protection programme
f) Waste management programme
g) Environmental monitoring programme
h) Safe enclosure plan and other associated documentation (if safe enclosure forms part of this stage of the decommissioning programme)
i) Organisational structure of the decommissioning organisation
j) Decommissioning and surveillance regulations
k) Emergency preparedness plan
l) Physical security plan
m) The experience and skills acquired during an earlier decommissioning phase, the lessons learned and their implementation during preparations for licensing of the next decommissioning phase

7.4 Safety analysis report

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

The safety analysis report should consider and describe:

a) Major prerequisites on which the INPP decommissioning project is based
b) The proposed conditions which, if met, would ensure that INPP can be safely decommissioned, and any risk factors which could affect INPP
c) The parameters of safe decommissioning, such as ionising radiation levels on the INPP site and outside it, releases etc.

The safety analysis should consider:

a) The status of INPP or its unit (including its radiation status) at the start and end of decommissioning (or of an individual decommissioning phase)
b) Methods used in dismantling and decontamination, equipment and tools and their operating parameters, any new methods, equipment and instrumentation to be used, and tests associated with their use, and an assessment of the effectiveness of decontamination activities
c) Safety-significant systems and components
d) The decommissioning process and a preliminary sequence of operations
e) The safe enclosure period (if included in the decommissioning project)
f) Common equipment used on the second operating unit, and the impact of decommissioning on the unit remaining in operation
g) Organisational and technical measures ensuring radiation protection
h) Administrative aspects of decommissioning (procedures, control, monitoring etc.)
i) Other important administrative and technical requirements, e.g. IAEA safeguards, physical security, emergency preparedness etc.
j) Waste and decommissioning residue management
k) Clearance of the site, buildings, structures and materials
l) The design process, its criteria, methods and models, and the boundary conditions and assumptions used in the models

The safety analysis report description should be such as to make it clear to the evaluating expert that the project is technically sound and can be carried out with the available equipment or after reasonably acceptable improvement, and that estimates and calculations have been properly carried out. It should also be made clear that the whole design process, including data gathering, evaluation and project preparation, the safety analysis, and the preparation of the safety analysis report were based on quality assurance procedures, and that the corresponding general quality assurance programme will be developed during project implementation and on shutdown.

Safety analysis should take into account the requirements of this document and of other applicable regulatory documents. The content of the safety analysis report must be agreed with VATESI.

7.5 General and special decommissioning project requirements and special design conditions

7.5.1 General requirements

The decommissioning project must be prepared, agreed with central and local government authorities and appraised in the manner required by the law and by other statutory instruments [including I.2, 13 and 19].

7.5.2 Special requirements

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

The project must be prepared with due regard to the statutory instruments and regulatory documents listed in [I.1], and to the requirements of this document.

The project must include the preparation of the necessary radioactive waste disposal sites and interim storage facilities and methods of disposal or interim storage of hazardous waste and the burial, disposal and processing of decommissioning residues.

The facilities should have sufficient capacity, and should be built or installed before the start of the decommissioning phase which will generate waste or residues.

The decommissioning project must include [I.31, 32], [II.2, 3]:

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

n) A description of other significant administrative and technical requirements, such as IAEA safeguards, physical security, emergency preparedness etc, and the associated project solutions
o) Design conditions, a list of standards, rules, regulations and other statutory instruments on which the design is based.

7.5.3 Special design conditions

The State Nuclear Safety Inspectorate may issue special design conditions for the decommissioning project [I.29].

7.6 Surveillance and inspection

7.6.1 General

VATESI is responsible for inspecting INPP during the licensing period and for monitoring compliance with the terms of the licence. INPP is responsible for supervising decommissioning work undertaken by other organisations and for issuing the relevant work permits. The rights and duties of the Licensor and Licensee as well as inspection and surveillance requirements are specified in [I.2, 30].

If requested by VATESI, INPP must provide documents describing work procedures and the sequence of operations, work schedules, work permit procedures, waste clearance procedures and other documents describing decommissioning activities.

7.6.2 Organisation of decommissioning activities

The decommissioning licence may be based on a preliminary work sequence, which should be updated in the final work sequence description, compiled for each component and set out in sufficient detail to serve as a guide to the actual performance of the specific task. Final work sequence descriptions should cover:

- Progress of work
- Cutting methods
- Equipment to be used
- Decontamination methods
- Auxiliary equipment
- Waste handling facilities
- Preparation for transport
- Transport procedures
- Radiological protection measures and radiological protection equipment
- Activity concentration and nuclide distribution

7.6.3 Work permit procedure

During decommissioning, all activities should be subject to an established work permit procedure.

Documents and auxiliary measures shall be used in accordance with the work permit procedure and can be used to record all decommissioning procedures, the collective

occupational dose associated with a specific work sequence, and to acquire decommissioning experience.

7.6.4 Clearance procedure for radioactive materials

As part of the supervisory process, VATESI should check that the clearance criteria and methods of measurement stipulated in the licence are observed and how the sampling procedure is carried out and evaluate the effectiveness of the clearance procedure for the instruments and methods used.

INPP must apply to VATESI for the free release of buildings, structures and materials. Control by VATESI related to the issue of such permits, includes the following actions:

- Checking the documentation
- Checking the suitability of the methods of measurement and measuring devices, the correction of measuring devices and the qualifications of measuring personnel
- Making control measurements and, where necessary, issuing a free release permit under the terms of the licence

7.7 Withdrawal of licence after decommissioning

INPP or the decommissioning organisation remain responsible for the safety of INPP and the site until the State Nuclear Safety Inspectorate has withdrawn the decommissioning licence and confirmed that decommissioning has been completed and that the site may be used without restriction, or granted permission for the construction of other nuclear installations on the site. INPP or the decommissioning organisation must submit to the State Nuclear Safety Inspectorate a Final Decommissioning Report, containing:

a) A description of completed decommissioning operations
b) A description of the equipment and instrumentation used during decommissioning and an assessment of their effectiveness
c) A description of the safety procedures employed
d) A description of the systems and installations remaining on site, including foundations
e) A final radiological study of the INPP site, including a detailed assessment of any residual activity, enclosing assessments and verification by independent experts
f) Project objectives (including radiological protection) and clearance levels for equipment, materials, buildings and the site
g) An assessment of the effectiveness and a substantiation of the methods and procedures, based on the release of equipment, materials, buildings and the site from regulatory control, stating that clearance levels were complied with in their application
h) Compliance of project objectives with the completed operations and compliance with the requirements of government authorities
i) A description of significant unplanned events occurring during the decommissioning period and the safety procedures applied
j) Information about occupational and public doses received during decommissioning

k) The quantities of radioactive waste generated, its characteristics and ultimate destination
l) The types and amounts of radioactive materials which were processed or recycled, and the relevant regulatory documentation
m) The quantity and characteristics of other materials released for processing, recycling or disposal as non-radioactive waste, the quantity of other generated waste (including hazardous and mixed waste) and its final destination
n) actual cost of decommissioning and comparison with cost estimate
o) Lessons learned during the decommissioning process
p) The future use of the INPP site

The Final Decommissioning Report could cover other possible survey reports carried out by the Operator at the end of the relevant decommissioning phases, and is to be submitted in accordance with the approved decommissioning strategy.

INPP or the decommissioning organisation are responsible for the preservation of all important documents and shall ensure that the documents are duly retained for safe keeping when the facility has been retired and the decommissioning licence has been withdrawn.

Statutory instruments regulating nuclear safety in Lithuania

[I.1] A list of the principal statutory instruments and enactments regulating nuclear safety in the Republic of Lithuania (a document periodically issued by VATESI)
[I.2] Republic of Lithuania Nuclear Energy Act
[I.3] Lithuanian Government Resolution No. 1403 of 2 November 1995, approving the Statute on the Ignalina Nuclear Power Station Decommissioning Fund and the Costs associated with the Fund and with the Management of Spent Fuel
[I.4] The Law on the Entry into Force of the Vienna Convention on Civil Liability for Nuclear Damage of 21 May 1993 and on the Joint Application of the Vienna and Paris Conventions of 30 November 1993
[I.5] The Joint Protocol on the Application of the Vienna and Paris Conventions of, 24 December 1993
[I.6] Vienna Convention on Civil Liability for Nuclear Damage, International Treaties of the Republic of Lithuania, Convention of 24 December 1996
[I.7] General Regulations for the Nuclear Safety of Nuclear Power Stations, VATESI VD-B-001-0-97
[I.8] Nuclear Safety Regulations for Nuclear Power Station Reactors, VATESI VD-T-005-0-96
[I.9] Republic of Lithuania Radiation Safety Act
[I.10] Lithuanian Public Health Standard HN 73-1997, "Basic Radiation Safety Standards", Ministry of Health Order No. 708 of 24 December 1997
[I.11] Republic of Lithuania Environmental Protection Act
[I.12] Republic of Lithuania Environmental Impact Assessment Act
[I.13] Republic of Lithuania Land Development Act
[I.14] Republic of Lithuania Pollution Tax Act
[I.15] Republic of Lithuania State-Owned Natural Resources Tax Act
[I.16] Republic of Lithuania Environmental Monitoring Act
[I.17] Republic of Lithuania Radioactive Waste Management Act
[I.18] Schedule of hazardous materials (Classifier). Ministry of the Environment, 25 June 1997, Order No. 103
[I.19] Act of 22 March 1989, Basle Convention on International Transport of Dangerous Waste and Control of their Circulation
[I.20] Republic of Lithuania Waste Management Act
[I.21] Republic of Lithuania Waste Disposal Act
[I.22] Non-Proliferation Treaty signed on 1 July 1968 in London, Moscow and Washington, Republic of Lithuania Seimas, 25 June 1991
[I.23] Convention on the Physical Protection of Nuclear Materials, Lithuanian Government Resolution of 16 November 1993
[I.24] Lithuanian Government Resolution of 8 September 1997 on State Accounting and Control of Nuclear Materials
[I.25] The Principles of Physical Protection of Nuclear Facilities, VATESI, 12 February 1997
[I.26] The Principles of Accounting and Control of Nuclear Materials at Nuclear and Non-nuclear Facilities, VATESI, 1 December 1997
[I.27] Requirements for Quality Assurance Systems at Nuclear Power Plants and other Nuclear Facilities, VATESI VD-KS-02-99

[I.28] Basic provisions for the selection, training, certification and monitoring of nuclear power plant personnel during operation. VATESI, order No. 113, 30.12.1996
[I.29] Republic of Lithuania Building Act
[I.30] Lithuanian Government Statute on Licensing Nuclear Power Industry Operations. 28 January 1998
[I.31] Public Health Regulations for the Design and Operation of Nuclear Power Plants, SPAS-88, 1988
[I.32] Radiation Safety Regulations for the Operation of Nuclear Power Plants, PRB AS-89, 1989.

Appendix 2

Principal IAEA Safety Recommendations,
International Commission on Radiological Protection publications
and European Union statutory instruments

(See list in English attached to Russian text)