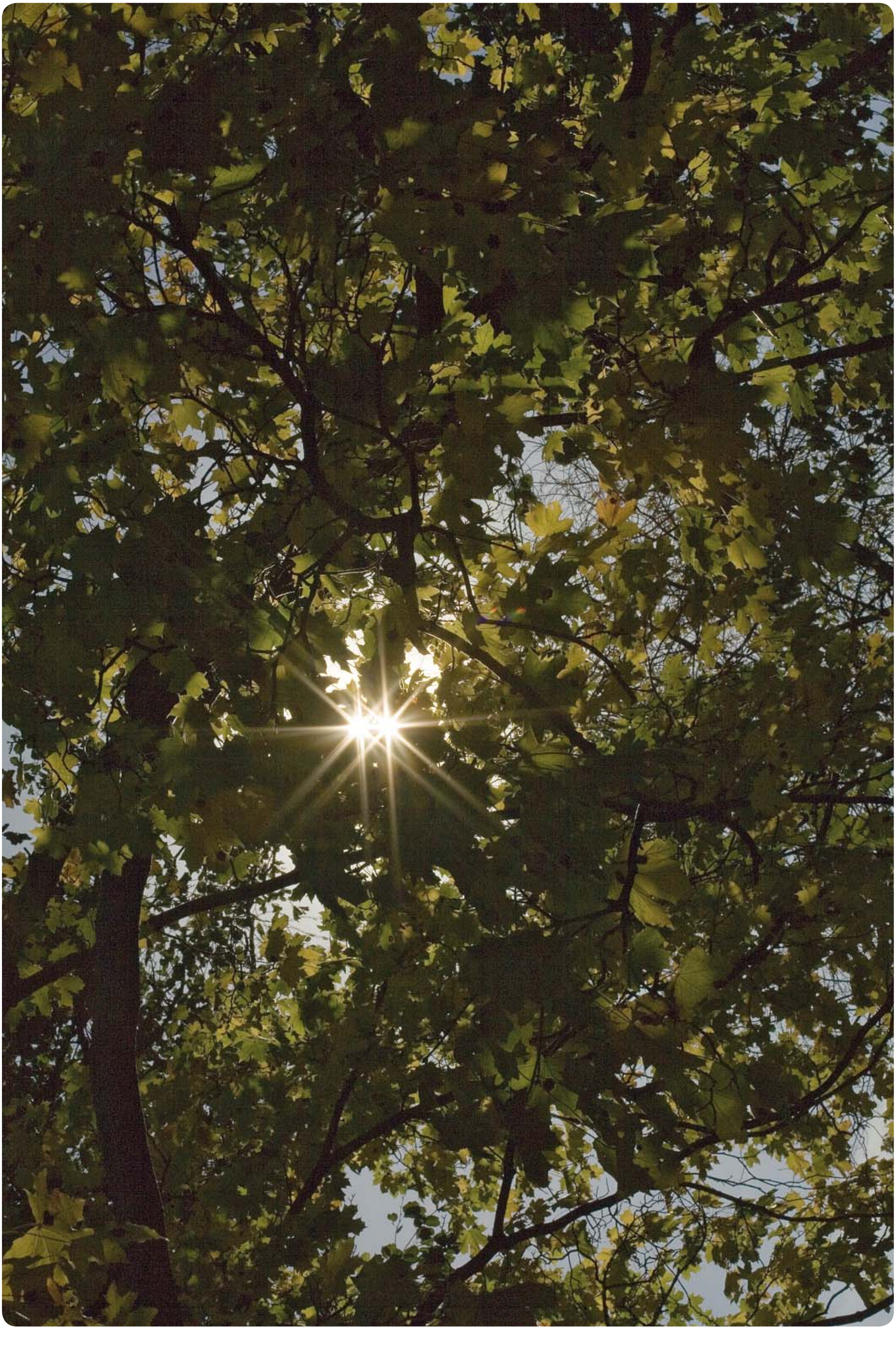
Fortum Power and Heat Oy

Supplementing the Loviisa Nuclear Power Plant with a Third Plant Unit

Loviisa EIA 3

Environmental Impact Assessment Programme

Fortum



Foreword

On the assignment of Fortum Power and Heat Oy, Pöyry Energy Oy has prepared this Environmental Impact Assessment (EIA) programme for the nuclear power plant possibly to be built on the island of Hästholmen in Loviisa .

The EIA programme refers to the plan for environmental impact assessment as well as the arrangements for communications and participation relating to the above prepared by the organisation responsible for the project, i.e. Fortum. On the basis of the EIA programme and the related statements, an environmental impact assessment report will be drawn up in a later phase of the EIA procedure.

The EIA programme has been prepared at the consulting unit of Pöyry Energy Oy. Ms. Päivi Koski, M.A, serves as the consultation project manager. The EIA programme was compiled by Pirkko Seitsalo, M.Sc. (Eng.). At Fortum, the EIA process is co-ordinated by Project Manager Reko Rantamäki. The Ministry of Trade and Industry will act as the co-ordinating authority in the project's EIA procedure.

Espoo, 8 June 2007
Pöyry Energy Oy, Consulting

Mika Pohjonen	*Päivi Koski*
Director	Project Manager

Contact information:
Pöyry Energy Oy
P.O. Box 93 (Tekniikantie 4 A)
FI-02151 Espoo, Finland
Business ID 0577450-7
Tel. +358 10 3311
Fax +358 10 33 24981
E-mail: firstname.lastname@poyry.com

Summary

Fortum Power and Heat Oy has initiated the environmental impact assessment procedure (EIA procedure) concerning a new nuclear power plant unit (Loviisa 3) possibly to be built on the island of Hästholmen in Loviisa. The objective is to improve the implementation readiness of the project and to keep a new plant in Loviisa as an alternative when the construction of new power plants eventually comes up for consideration in Finland.

The construction of a nuclear power plant with electric power of 1,000 to 1,800 MW and thermal power of 2,800 to 4,600 MW in Loviisa will be examined in the EIA procedure. Several options will be assessed for the intake of cooling water and its discharge into the sea. The site planned for the new nuclear plant on the island of Hästholmen is to the south of the existing power plant. As a zero-option, the non-implementation of the project will also be assessed.

The residents in the area affected by the project, as well as non-governmental and environmental organisations and other similar parties, will have an opportunity to take a stand on the EIA programme and the planned project. The Ministry of Trade and Industry, which acts as the co-ordinating authority in nuclear power projects, will announce the public display of the assessment programme on the announcement boards and in the newspapers of the municipalities of the affected area, as well as on the Ministry's Internet site. The announcement will provide further details on how opinions may be presented.

An EIA report will be prepared based on the EIA programme and the opinions and statements given about it. It will present information about the project and its alternatives, as well as a coherent assessment of their environmental impacts. Information about existing environmental assessments as well as those carried out during the project will be collected in the report. Planned assessments include, e.g., cooling water spreading calculations, resident survey, an assessment concerning the regional structure and economy, an assessment of the power plant's landscape impacts, and preparation of conceptual drawings. The safety of the power plant as well as the environmental impacts of exceptional situations will also be assessed. On the basis of the assessments and other information, the EIA report will describe and assess, as required by EIA legislation, the impact of the project on air quality, water systems, soil, vegetation and animals, as well as landscape and the built environment. The assessment of the impacts on people and society will also be a central part of the assessment of the project's environmental impacts.

Briefings and discussion meetings will be arranged for the general public during the EIA procedure. In these meetings the participants will have an opportunity to express their opinions and receive information about the project and its environmental impacts. The Ministry of Trade and Industry will request statements about both the EIA programme and the EIA report from a number of parties, and will also give its own statements.

The assessment of trans-boundary environmental impacts has been agreed upon in the so-called Espoo Convention (67/1997). The parties to the Convention are entitled to participate in an environmental impact assessment procedure carried out in Finland if the detrimental environmental impacts of the project being assessed could potentially affect the country in question. The Ministry of the Environment is responsible for the practical arrangements relating to the international hearing concerning the assessment of trans-boundary environmental impacts. The Ministry of the Environment will notify the environmental authorities of certain neighbouring countries about the commencement of the EIA procedure, inquiring about their willingness to participate in it.

The EIA procedure is scheduled to be completed by the end of 2008. The construction of a nuclear power plant is subject to a decision-in-principle issued by the Government and ratified by the Parliament as well as licence decisions pursuant to a number of laws. If the project proceeds to a phase where a decision is made to apply for a decision-in-principle and the required licences, the environmental impact assessment report will be appended to the decision-in-principle application and to the licence applications.

CONTACT INFORMATION

Organisation responsible for the project: Fortum Power and Heat Oy

Postal address:	P.O. Box 100, FI-00048 FORTUM, Finland
Telephone:	+358 10 4511
Contact persons:	Heikki Raumolin, Reko Rantamäki
E-mail:	firstname.lastname@fortum.com

Coordinating authority: Ministry of Trade and Industry

Postal address:	P.O. Box 32, FI-00023 Government, Finland
Telephone:	+358 9 160 01
Contact person:	Jaana Avolahti
E-mail:	firstname.lastname@ktm.fi

International hearing: Ministry of the Environment

Postal address:	P.O. Box 35, FI-00023 Government, Finland
Telephone:	+358 20 490 100
Contact person:	Seija Rantakallio
E-mail:	firstname.lastname@ymparisto.fi

For further information about the project, you can also contact:

EIA consultant: Pöyry Energy Oy

Postal address:	P.O. Box 93, FI-02151 Espoo, Finland
Telephone:	+358 10 3311
Contact person:	Päivi Koski
E-mail:	firstname.lastname@poyry.com

CONTENTS

GLOSSARY

Activity (Bq)
The number of spontaneous nuclear disintegrations occurring in a given quantity of radioactive material within a certain time. The unit of radioactivity, the becquerel (Bq) = one disintegration per second.

Bar
Unit of pressure (1 bar = 100 kPa). Atmospheric pressure is approximately 1 bar.

Base-load station
A large power plant operating steadily at full power to meet the continuous minimum requirement for electrical power.

Boiling water reactor
A light-water reactor in which water used as the coolant boils as it passes through the reactor core and the resulting steam is used for driving a turbine.

Bq (Becquerel)
The measurement unit of radioactivity. Equates to one radioactive disintegration per second. The concentration of radioactive substances in foodstuffs is expressed in becquerels per unit of mass or volume (Bq/kg or Bq/l).

Cooling water
Cooling water is cold seawater used for cooling the steam coming from the turbines in a condenser back into water, which will be pumped back to the steam generator. Cooling water does not come into contact or mix with the process waters of the nuclear power plant.

Decommissioning waste
Activity containing waste created during the decommissioning that occurs after the utilisation of the power plant or other nuclear facility.

Decision-in-principle
The use of nuclear power for the generation of electricity is subject to a decision-in-principle issued by the Government and ratified by the Parliament. The prerequisites for a positive decision-in-principle include, e.g., a positive attitude towards the project from the municipality intended to be the site of the facility, and a positive safety report from the Finnish Centre for Radiation and Nuclear Safety.

EIA
Environmental impact assessment. The objective of the statutory EIA procedure is to promote the assessment of environmental impacts and increase the opportunities for citizens to receive information, become involved in the planning of projects and express their opinion.

Efficiency (η)
The ratio of the amount of electric energy produced by the power plant and the thermal energy produced by the reactor.

Electrical power (W)
Capacity by which a plant generates electrical energy supplied into a power grid.

Final disposal
The permanent disposal of radioactive waste in such a manner that the repository site would not need to be monitored and the radioactivity of the waste will not be a hazard to nature.

Fission
The splitting of a heavy atomic nucleus into two or more new nuclei accompanied by the release of a large amount of energy and neutrons.

GWh
Gigawatt-hour, unit of energy (1 GWh = 1,000 MWh).

Ion
An electrically charged atom or molecule. Radiation that produces ions when interacting with matter is called ionising radiation.

Ion-exchange resin
Material used for removing ionic impurities from water.

Ionising radiation
Electromagnetic or particle radiation that produces free electrons and ions when interacting with matter, i.e. it is capable of breaking chemical bonds. Ionisation damages DNA molecules, the genetic material of cells. Therefore, ionising radiation is hazardous to human health.

Isotope
Isotopes are different forms of the same element differing from each other in the number of neutrons in their nucleus and the characteristics of the nucleus. Almost all natural elements occur as more than one isotope. For example, hydrogen has three isotopes: hydrogen, deuterium and tritium, from which tritium is radioactive.

Light water reactor
Reactor type in which regular water is used for cooling and as a moderator. Most nuclear power plant reactors in the world are light water reactors.

MW
Megawatt, a unit of power (1 MW = 1,000 kW).

Nuclear fuel
Uranium (or plutonium) intended for use in the reactors of nuclear power plants and manufactured into elements that either as such or combined together with supporting structures can be used for producing a chain reaction based on nuclear fission.

ONKALO
An underground rock characterisation facility for the final disposal of spent nuclear fuel located in Olkiluoto and owned by Posiva Oy.

Pressurised water reactor
A light-water reactor in which the water used as coolant and moderator is kept under such high pressure that prevents it from boiling regardless of the 300°C temperature. The water that has passed through the reactor core releases its heat to the secondary circuit water in separate steam generators, where the secondary circuit water is vaporised and used for driving a turbine.

Radioactivity
Radioactive materials decay spontaneously into lighter elements or lower energy states of the same element. The process releases ionising radiation that is either electromagnetic or particle radiation.

Radiation
Radiation can be either electromagnetic waves or particle radiation.

Sievert (Sv)
The unit of radioactive dose that represents the effect of radiation on the human body. As it is a very large unit, millisieverts (mSv) and microsieverts (μSv) (1 μSv = 0,001 mSv = 0,000001 Sv) are more commonly used.

Solidification facility
Concreting and bituminisation facility, where liquid waste is converted into a solid form by mixing it with concrete and letting the concrete dry, or by mixing it with hot bitumen.

Spent nuclear fuel
Nuclear fuel becomes spent fuel when it has been inside the reactor for energy production and removed from the reactor. Spent nuclear fuel contains fission products of uranium, such as cesium, and it is highly radioactive.

Steam generator
From the pressurised water reactor, the water (about 300 degrees hot and non-boiling) is conducted to the steam generator, where the steam carried to the turbines is generated.

Thermal power (W)
Capacity by which a plant generates thermal energy.

TWh
Terawatt-hour, unit of energy (1 TWh = 1,000,000 MWh).

Uranium (U)
An element with the chemical symbol U. Uranium comprises 0.0004% of the earth's crust (four grams in a tonne). All uranium isotopes are radioactive. Natural uranium is mostly in the form of isotope U-238, which has a half-life of 4.5 billion years. Only 0.71% of natural uranium is in the form of isotope U-235, which can be used as a nuclear fuel.

1 PROJECT

Fortum Power and Heat Oy (hereinafter "Fortum") is examining the construction of a nuclear power plant unit with approximate electric power of 1,000 to 1,800 MW and thermal power of 2,800 to 4,600 MW on the island of Hästholmen in Loviisa, which is the location of two existing nuclear power plant units (Loviisa 1 and 2). In order to improve its facilities for constructing additional production capacity, the company has initiated the Environmental Impact Assessment (EIA) procedure.

The construction of a new nuclear power plant is subject to a decision-in-principle issued by the Government and ratified by the Parliament. The EIA process must be completed before submitting any application for a decision-in-principle concerning a new power plant. The last comprehensive environmental impact assessment of the Loviisa nuclear power plant took place in connection with the EIA procedure for the Loviisa 3 nuclear power plant project in 1999.

In order to improve its readiness for constructing additional production capacity and to increase the opportunities for citizens to receive information, Fortum has initiated a new environmental impact assessment (EIA) procedure. By initiating the EIA procedure, Fortum and aims at keeping a new plant in Loviisa among the potential alternatives when the construction of new power plants eventually comes up for consideration in Finland. No decisions on construction have been made, nor has the actual design process been started. If the decision-in-principle is ratified and, in addition to environmental issues, the technical and economic prerequisites for construction are fulfilled, the decision on the construction of the plant can be taken in the early 2010s.

1.1 Organisation responsible for the project

The organisation responsible for the project is Fortum Power and Heat Oy, a wholly owned subsidiary of Fortum Corporation. Fortum Corporation is a leading energy company in the Nordic region and other parts of the Baltic Rim. The company's activities cover the generation, distribution and sale of electricity and heat, as well as the operation and maintenance of power plants. Fortum Power and Heat Oy owns and operates the two existing nuclear power plant units in Loviisa. The company holds a 26% share in the current nuclear power plants (Olkiluoto 1 and 2) of Teollisuuden voima, and a 25% share in the nuclear power plant (Olkiluoto 3) under construction. In addition, the company is a shareholder in Swedish nuclear power plants (Oskarshamn and Forsmark). In 2006, 46% of Fortum's electricity production was produced by nuclear power. In the same year, 83% of Fortum's electricity production was carbon dioxide-free. At the end of 2006 the Government of Finland held 50.8% of the share capital of Fortum Corporation. Fortum Corporation and its subsidiaries employ a total of over 8,000 people, about 3,000 of whom work in Finland.

Fortum Power and Heat Oy is the owner of the Loviisa nuclear power plant, which consists of two units, Loviisa 1 and Loviisa 2, as well as other associated buildings and storage facilities required for the management of nuclear fuel and nuclear waste. Loviisa 1 began generating electricity to the national grid in 1977 and Loviisa 2 in 1981. The Loviisa plant is a pressurised water reactor station. The net electrical power of each plant unit is approximately 490 MW. The operations of the Loviisa power plant have been certified to the ISO 14001 Environmental Management Standard.

1.2 Purpose and justification for the project

The consumption of electricity in Finland continues to grow. Finland consumed approximately 90 TWh of electricity in 2006. The 80 TWh mark was exceeded in 2001, 70 TWh in 1996, 60 TWh in 1989 and 50 TWh in 1985. Electricity consumption has doubled in a quarter-century. The annual consumption is estimated to exceed 100 TWh in 6 to 8 years (Figure 1–1). (Finnish Energy Industries ET 2007)

According to the Finnish Ministry of Trade and Industry WAM (With Additional Measures) scenario updated in 2005, the total consumption of energy in Finland will be about 102 TWh in 2020 and about 105 TWh in 2025.

Total energy consumption per capita is relatively high in Finland. Energy consumption is boosted by our northern location, cold climate, sparse population and long distances, as well as the structure of our basic industries.

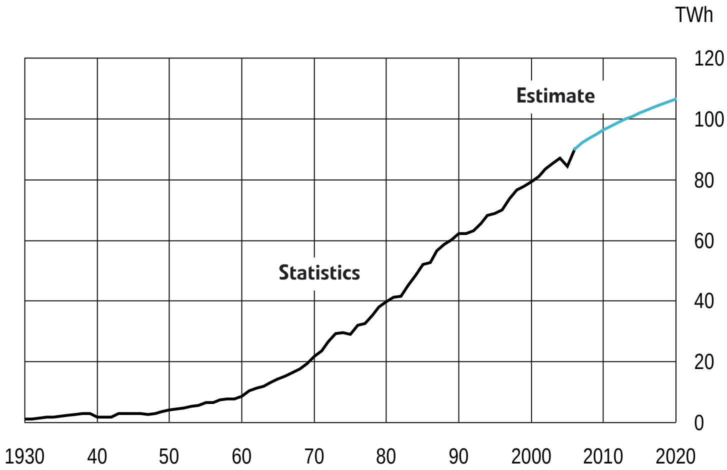


Figure 1-1. Total consumption of electricity in Finland and a forecast of the consumption trend up to 2020 (Finnish Energy Industries ET 2007).

The purpose of the Loviisa 3 project is to increase the production capacity of environmentally-benign and low-cost electricity. Nuclear power plants are characterised by high capital costs and low operating costs. This is why the new power plant would primarily be used for continuous production. Power companies in the Nordic electricity market are currently mapping the possibilities of increasing production capacity to meet increasing demand and to replace retiring capacity.

Assessing the environmental impacts of the Loviisa 3 project will also increase the decision-making readiness to construct additional environmentally-benign capacity and to replace old fossil-fuel-based production capacity with more environmentally-benign production. At this stage, the Loviisa 3 project is being developed solely by Fortum Power and Heat Oy. It is also possible that the new nuclear power plant could be implemented in co-operation with other electricity producers or users. No decisions on the construction of the Loviisa 3 nuclear power plant have been made, nor has the actual design process been started.

The decision on the new nuclear power plant will be made based on current environmental protection and climate

policy aspects, economic conditions and the situation in the electricity market. Due to the large construction-period investments, the commercial viability of the project needs to be ensured prior to the implementation decision. Before the implementation decision can be made, the environmental impact assessment needs to be followed by a favourable decision-in-principle issued by the Government and its ratification by the Parliament.

1.3 Location and need for land

Fortum's current nuclear power plant is located in the village of Lappom on the island of Hästholmen about 12 kilometres from the city centre of Loviisa, and the new power plant would be co-located on the same site. The location of the Loviisa power plant is illustrated in Figure 1–2. Power plant structures and buildings are located in the northern part of the island. The island may be reached by a 200-metre causeway and bridge over the Kirmosund inlet. Some buildings and structures required for power plant support functions, such as security and accommodation for transient refuelling outage workers, are located on the mainland.

Figure 1-2. Location of the Loviisa nuclear power plant.

The planned location of the new nuclear plant on the island of Hästholmen is to the south of the existing power plant (Figure 1-3. Location of the current power plants (Loviisa 1 and 2) and planned location the new power plant (Loviisa 3). The site planned for the new power plant is to the south of the existing plant.) The area required by the new power plant is about 10 hectares. An area of about 30 hectares on the island south of the existing power plant units is available for site operations, if the sea-filling allowed by the land use plan is implemented in full. The site of the new power plant is located in an area designated as a zone for industrial and warehouse buildings.

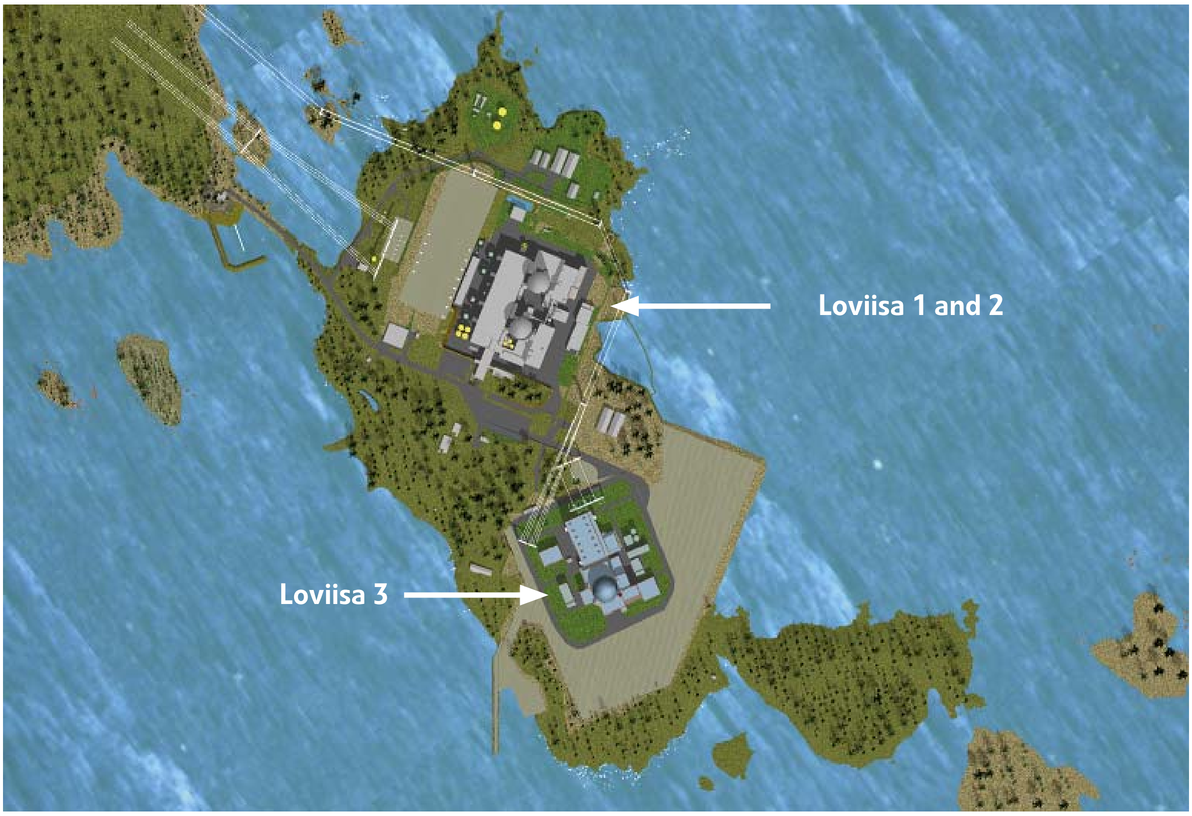


Figure 1-3. Location of the current power plant units (Loviisa 1 and Loviisa 2) and the planned location of the new power plant unit (Loviisa 3). The site planned for the new power plant unit is to the south of the existing plant.

1.4 Project schedule

No decision to build a new power plant or to submit an application for a decision-in-principle to the Government of Finland has been made. If the project is implemented, the aim is to start construction of the new nuclear power plant in or around 2012. Thus the plant can be commissioned around 2018.

1.5 Links to other projects, plans and programmes

Strengthening of power transmission links and reserves

Transmitting the electricity produced by the new power plant unit to the national grid requires that the current power transmission links be strengthened. A new 400 kV transmission line connection to the national grid will be built from the switching station next to the current power plant on Hästholmen. This EIA procedure will examine the environmental impacts of the power transmission link required between the new power plant unit and the switching station. From the switching station onwards, any modifications required in the power transmission grid and related environmental impact assessments are the responsibility of the national grid operator Fingrid Oyj.

The new power plant also requires the strengthening of the 110 kV transmission lines. The strengthening will be implemented with a new 110 kV connection, the environmental impacts of which will be assessed in conjunction with this EIA procedure.

The new power plant unit may also require an increase in national reserves. This will be further determined during EIA procedure.

Disposal of spent nuclear fuel

Posiva Oy is a company established in 1995 that is responsible for the transportation of Fortum's and TVO's spent nuclear fuel from the power plants to the disposal site and the actual disposal of spent nuclear fuel, as well as research associated with disposal, and other expert tasks belonging to its scope of operations. Posiva Oy is owned by Fortum Power and Heat Oy and Teollisuuden Voima Oy, who are under an obligation to ensure the management of the spent fuel they produce up until the closure of the final repository, and under an obligation to be responsible for the costs of nuclear waste management.

The ultimate goal of nuclear waste management is permanent disposal of waste in accordance with the Nuclear Energy Act and Decree, which refers to disposal in Finnish bedrock. The EIA procedure concerning the disposal of spent nuclear fuel was completed in 1999. With regard to the impacts of the disposal of spent nuclear fuel originating from the new nuclear power plant, the EIA completed in 1999 will be utilised so that the disposal of spent fuel will also be described to a sufficient extent in the environmental impact assessment report for the new power plant.

The UN climate convention and the Kyoto protocol

The UN Conference on Environment and Development held in Rio de Janeiro in 1992 approved the UN Framework Convention on Climate Change, also known as the UNFCCC or the Climate Convention. It entered into force in 1994.

The Conference of Parties to the UNFCCC held in Kyoto in December 1997 approved the EU objective of reducing total greenhouse gas emissions by 8% below the 1990 baseline, which was 4,238 million tonnes (EU-15). The obligation must be achieved in 2008 to 2012, which is known as the first commitment period. The EU countries agreed upon their mutual allocation of this emissions reduction objective in June 1998. The objective for reductions in Finland's greenhouse gas emissions was set at 0% below the 1990 baseline, which means that emissions in 2008–2012 must be at the level of 1990 (71.09 million tonnes).

Finland's greenhouse gas emissions converted to equivalent tonnes of carbon dioxide were 69.3 million tonnes CO_{2eq} in 2005. The figure takes into account the CO_2-absorbing effect of the forests (*Statistics Finland 2006*). According to estimates, emissions in 2008–2012 will exceed the permitted emission amounts by about 60.4 million tonnes, or by an average of 12.1 million tonnes per year (*Government Decision on the National Allocation Plan Proposal 2007*).

EU energy policy

Each EU Member State is independently responsible for its energy policy and, particularly, its policy on the use and further construction of nuclear power capacity. However, EU policies also have a significant impact on the energy business. An Energy Policy for Europe was published on 10 January 2007. According to its starting points, the energy policy must answer the question of how the EU can secure a competitive and clean supply of energy while responding to the control of climate change, the increasing global demand for energy and uncertainties in energy production.

A ten-point action plan for the implementation of the policy has been issued. One of the points in the action plan is the future of nuclear power. The Commission views nuclear power as a viable source of energy if the Member States are to achieve strict emissions targets in the future. According to the Commission, the advantages of nuclear power include its relatively stable and low production costs and low carbon dioxide emissions. According to the International Energy Agency, the use of nuclear power is increasing globally, and for this reason the Commission wants the EU to retain and develop its technological lead in this sector. The Commission advises the authorities of Member States to improve the efficiency of their nuclear licensing procedures and eliminate unnecessary restrictions to enable the industry to act quickly if required in the context of decisions concerning additional nuclear power construction.

One of the quantitative objectives for the energy policy is a 20% reduction in greenhouse gas emissions associated with energy consumption by 2020.

National energy and climate strategy

On 24 November 2005 the Government approved a report to Parliament concerning its planned near-term actions in energy and climate policy (Government report VNS 5/2005). In this report the Government presents a strategy for action that enables Finland to achieve the obligations under the UN Climate Convention to reduce greenhouse gas emissions and the reduction obligation in accordance with the EU's internal burden-sharing. The strategy takes into account Finland's starting points for international negotiations to limit global greenhouse gas emissions after the Kyoto period. According to the strategy, any low-emission or emission-neutral and cost-efficient production forms will not be excluded in the future when constructing new capacity. The Parliamentary Finance Committee approved the report on 2 June 2006 (Statement of the Finance Committee TaVM 8/2006). Parliament approved the Finance Committee's statement on the Government report on climate and energy strategy on 6 June 2006 (Minutes of the Plenary Session PTK 66/2006).

2 EIA PROCEDURE

The directive (85/337/EEC) issued by the European Communities (EC) has been enforced in Finland based on Annex twenty (XX) of Treaty establishing the European Economic Community by virtue of the EIA Act (468/1994) and Decree (713/2006) on environmental impact assessment. According to Section 4 of the EIA Act, projects subject to the environmental impact assessment procedure shall be specified in more detail by Government Decree. According to point 7 b) in the list of projects within Chapter 2, Section 6 of the EIA Decree, nuclear power plants are included in projects subject to the assessment procedure.

According to the Nuclear Energy Act, the process for the construction of a new nuclear power plant starts with the filing of an application for a decision-in-principle from the Government. The EIA report must be appended to the decision-in-principle application.

The objective of the environmental impact assessment (EIA) procedure is to promote the assessment and uniform observation of environmental impacts in planning and decision-making. Another objective of the procedure is to increase the opportunities for citizens to receive information, become involved in the planning of projects and express their opinion.

Thus the EIA procedure does not make any decisions concerning the project or resolve any licensing issues; its objective is to produce information to serve as a basis for decision-making.

The EIA procedure includes a programme stage and a report stage. The environmental impact assessment programme (EIA programme) is a plan for arranging an environmental impact assessment procedure and for the required reviews.

The EIA programme shall be submitted to the coordinating authority at the initial stage of the EIA procedure. The Ministry of Trade and Industry acts as the coordinating authority for projects associated with nuclear facilities as referred to in the Nuclear Energy Act. The Ministry of Trade and Industry will announce the public display of the assessment programme by such means as local newspapers and the Ministry's Internet site. The announcement will specify the period during which opinions on the EIA programme may be presented by the public.

The Ministry of Trade and Industry will compile the statements and opinions on the EIA programme and provide its own statement. An EIA report will be prepared on the basis of the EIA programme and the opinions and statements. The key stages of the EIA procedure are illustrated in Figure 2–1.

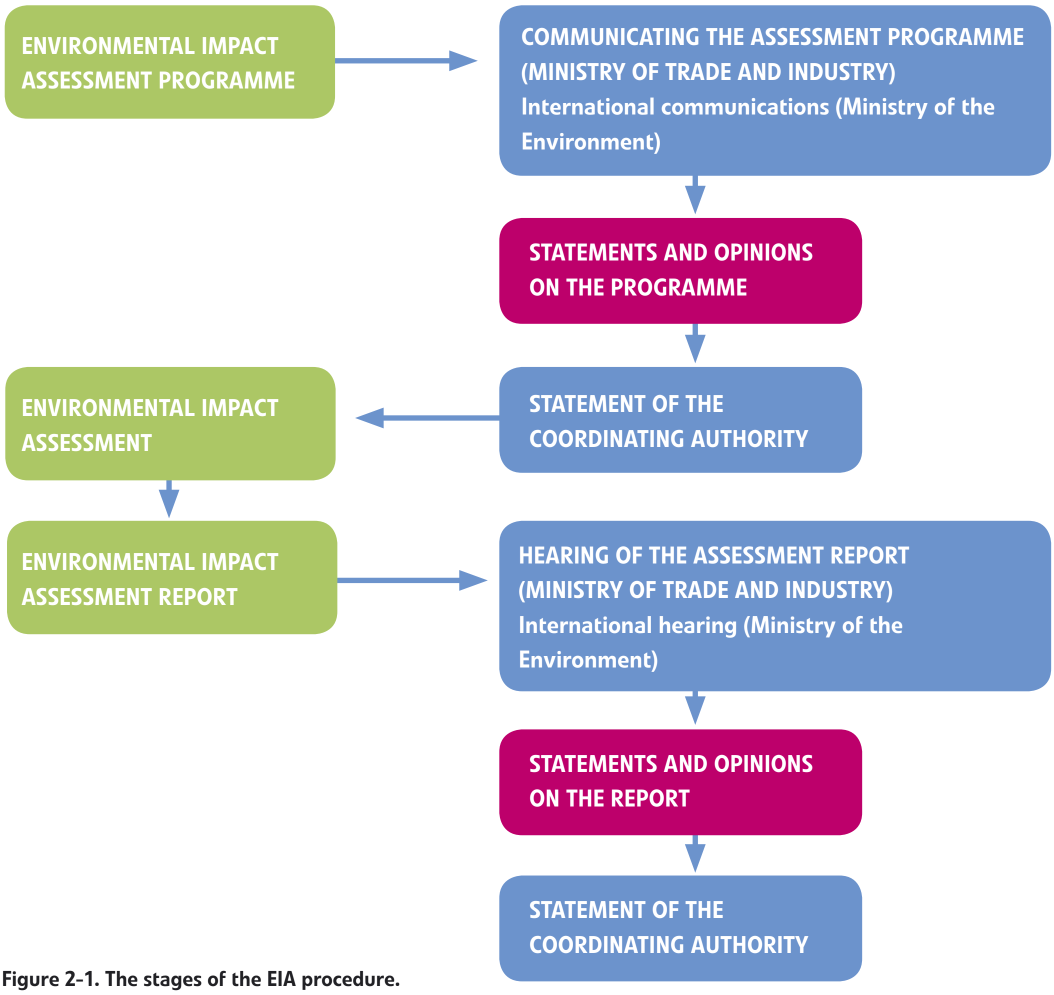


Figure 2-1. The stages of the EIA procedure.

The EIA report will present information about the project and a coherent assessment of its environmental impacts resulting from the assessment procedure. The EIA report will present:

- The options under assessment
- The present state of the environment
- The environmental impacts of the various options and the zero-option, as well as the significance of these impacts
- A comparison of the assessed options
- Measures to prevent and mitigate adverse impacts
- A proposal for an environmental impact assessment monitoring programme
- Actions taken to facilitate interaction and involvement during the EIA procedure
- How the Ministry of Trade and Industry's statement on the EIA programme has been taken into account in the assessment.

Once the EIA report is completed, citizens may present their opinions on it. Official bodies will provide statements on the EIA report.

The EIA procedure is completed when the Ministry of Trade and Industry provides Fortum with its statement on the EIA report. The licensing authorities and Fortum will use the assessment report and the Ministry's statement as base material for their decision-making. In its permit decision the environmental permit authority will present how the assessment report and the associated statement have been taken into account. The planned schedule of the EIA procedure is illustrated in Figure 2–2.

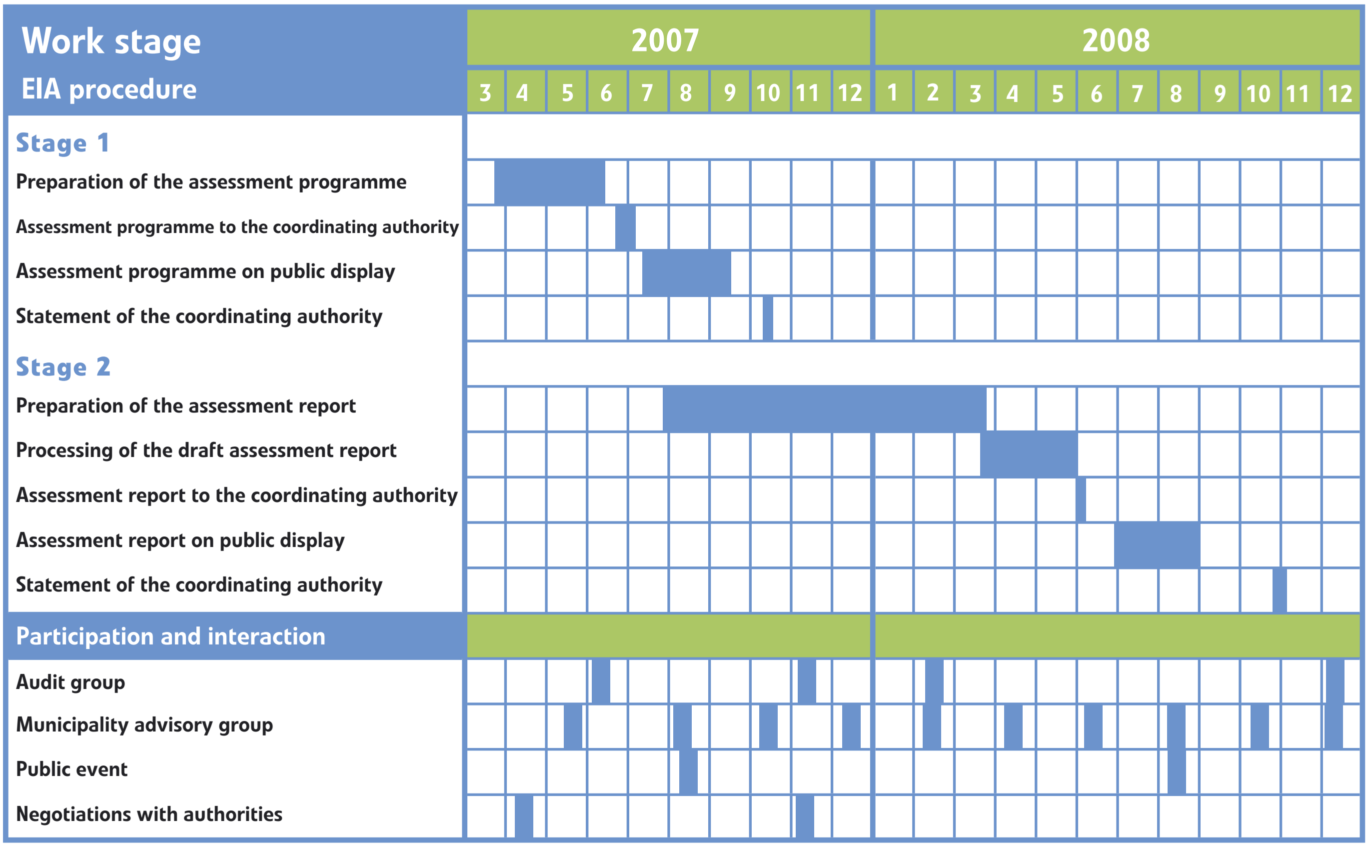


Figure 2-2. Planned schedule of the EIA procedure.

3 PLAN FOR COMMUNICATIONS AND PARTICIPATION

One of the crucial objectives of the EIA procedure is to promote communications about the project and improve the opportunities for citizens' participation. The communications and interaction plan for the current EIA procedure is presented in the following chapters in accordance with the stages of the EIA procedure. The planned schedule of Fortum's EIA procedure is illustrated in Figure 3–1.

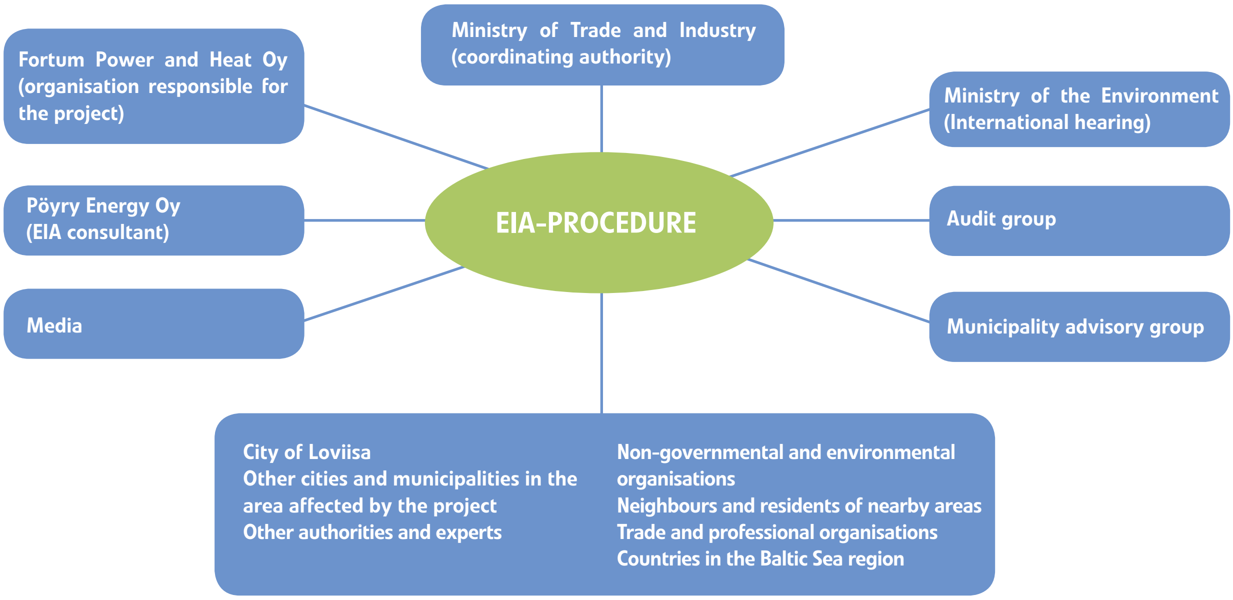


Figure 3-1. Parties involved in the EIA procedure.

3.1 Audit group

An Audit Group consisting of different interest groups has been established by Fortum to monitor the EIA procedure. The purpose of the Audit Group is to promote the flow and exchange of information between the organisation responsible for the project, the authorities and other interest groups. The following parties were invited to the Audit Group:

- City of Loviisa
- Municipality of Lapinjärvi
- Municipality of Liljendal
- Municipality of Pernaja
- Municipality of Pyhtää
- Municipality of Ruotsinpyhtää
- Ministry of Trade and Industry
- Radiation and Nuclear Safety Authority (STUK)
- State Provincial Office of Southern Finland
- Uusimaa Regional Environment Centre
- Uusimaa Employment and Economic Development Centre
- Regional Council of Itä-Uusimaa
- Safety Technology Authority (TUKES)
- Western Finland Environmental Permit Authority
- Loviisa Region Healthcare Joint Municipal Authority
- Eastern-Uusimaa Fire and Rescue Service

In the Audit Group, these authorities shall act as experts in their particular fields. Opinions expressed in the Audit Group will not be binding on the parties nor on the possible statements later made by the authorities.

At its meetings the Audit Group will monitor the progress of the environmental impact assessment and present opinions on the preparation of the EIA programme, the EIA report and the supporting reviews. The Audit Group convened once during the EIA programme stage. The meeting was held on 6 June 2007 and presented the project, the EIA procedure, interaction and the draft for the EIA programme to the Audit Group representatives.

Comments and clarifications received during and after the meeting were taken into account in the preparation of the EIA programme to the widest possible extent as far as they concerned the EIA programme. Otherwise, any comments will be taken into account in the implementation of the EIA procedure and in the EIA report.

The Audit Group will convene for the second time after the coordinating authority's statement on the EIA programme. The Audit Group will convene for the third time to discuss the EIA report in the draft stage, and for the fourth time after the Department of Trade and Industry's statement on the EIA report.

3.2 Municipality advisory group

To facilitate participatory planning and map the views of various stakeholders, Fortum has established a Municipal Advisory Group in addition to the Audit Group. In addition to the Fortum's representatives, the Executive Director of the Regional Council of Itä-Uusimaa, City Manager of Loviisa and the Municipal Managers of Lapinjärvi, Liljendal, Pernaja, Pyhtää and Ruotsinpyhtää or their deputies have been invited to the Municipal Advisory Group.

The Municipal Advisory Group will monitor the EIA procedure at a strategic level. The Group will convene at two-month intervals during the EIA procedure. The first meeting of the Municipal Advisory Group was held on 29 May 2007.

3.3 Information and discussion events on the project's environmental impacts

Information and discussion events open to the public will be arranged during the preparation of the environmental impact assessment programme and report. At the events the general public will have the opportunity to express their opinions on the EIA work and its sufficiency. The first public event will be arranged at the Loviisa Sports Hall on 23 August 2007. The public will have the opportunity to receive information and discuss the EIA procedure with Fortum and the authors of the EIA programme. The next information and discussion events will be arranged during the EIA report phase.

A "neighbourhood party" was held for the nearest neighbours of the power plant on 19 June 2007. The event included presentations of the contents of the EIA programme, as well as discussion on the project.

If necessary, Fortum will arrange small group meetings during the EIA procedure. This will allow various interest groups to express their views on issues and impacts important to them, if they so wish.

3.4 Public display of the assessment programme

Once the assessment programme is completed, the Ministry of Trade and Industry will announce its public display on the announcement boards in Loviisa and the neighbouring municipalities, in the main newspapers of the region and in major national papers.

The announcement will specify the location where the programme will be on display during the assessment procedure. Written opinions on the EIA programme must be submitted to the Ministry of Trade and Industry within the specified deadline. According to the EIA Act, the deadline shall be no less than 30 and no more than 60 days after the publication of the announcement. The Ministry of Trade and Industry will also request statements on the EIA programme from a number of parties.

3.5 The coordinating authority's statement on the EIA programme

The Ministry of Trade and Industry will compile the statements and opinions on the EIA programme provided by different parties and also provide its own statement within one month of the conclusion of the period of public display. The statement will be on public display at the same locations in which the EIA programme was available.

The EIA report will be prepared on the basis of the EIA programme, the opinions and statements received on it, and the statement of the Ministry of Trade and Industry.

3.6 Public display of the assessment report

The Ministry of Trade and Industry will announce the public display of the assessment report once Fortum has submitted the report to the Ministry. The public display will be arranged similarly to that of the assessment programme. According to the EIA Act, the deadline for submitting opinions and statements to the Ministry of Trade and Industry shall be no less than 30 and no more than 60 days after the publication of the announcement.

3.7 The coordinating authority's statement on the EIA report

The EIA procedure is completed when the Ministry of Trade and Industry provides its statement on the EIA report. This will take place within two months of the deadline set for submitting opinions and statements.

3.8 Resident survey

A survey will be conducted among local residents during the EIA procedure for the purpose of increasing interaction by providing Fortum with information on public attitudes towards the project and providing local residents with information on the project and its impacts on their living environment.

3.9 Other communications

Fortum will provide information on the project through press releases or press briefings. Two summary brochures will also be prepared for communication. The first summary will be prepared once the EIA programme is completed and will present the project, the EIA programme and the remaining stages of the EIA procedure. The second summary will be prepared once the EIA report is completed and will present the project and the most important outcomes of the environmental impact assessment.

The EIA programme and the EIA report will also be available for viewing at public libraries in the local area.

Information on the progress of the EIA procedure will be distributed to households in the area with the delivery of local newspapers.

Fortum has established a website for the EIA procedure at www.fortum.com/loviisa. The website provides up-to-date information on the progress of the EIA procedure. The EIA programme, as well as the EIA report, will be available for viewing on the website of the Ministry of Trade and Industry (www.ktm.fi > Energy > Nuclear energy > FIN6 EIA > EIA of the Loviisa 3 option).

3.10 International hearing

The assessment of trans-boundary environmental impacts has been agreed upon in the so-called Espoo Convention (Convention on Environmental Impact Assessment in a Trans-boundary Context). Finland ratified this UNECE Convention (67/1997) in 1995. The Convention entered into force in 1997.

The parties to the Convention are entitled to participate in an environmental impact assessment procedure carried out in Finland if the detrimental environmental impacts of the project being assessed could potentially affect the country in question. Correspondingly, Finland is entitled to participate in an environmental impact assessment procedure concerning a project located in the area of another country if the impacts of the project could potentially affect Finland.

The Ministry of the Environment is responsible for the practical arrangements relating to the international hearing. The Ministry of the Environment will notify the environmental authorities of neighbouring countries (countries of the Baltic Sea region) about the commencement of an EIA procedure associated with the Loviisa nuclear power plant project, inquiring about their willingness to participate in it. The notification will be accompanied by a Swedish and/or English translation of the EIA programme and an international hearing document translated into the other necessary languages.

4 THE OPTIONS UNDER ASSESSMENT

The project examines the construction of a new nuclear power plant on the island of Hästholmen in Loviisa. Fortum does not have any other options for the locations, and they will not be examined because it is essential for the project to utilise existing infrastructure.

The reactors of the existing Finnish nuclear power plants, like most of the nuclear power plants in the world, are so-called light water reactors (LWR). There are two types of LWR units: the boiling water reactor (BWR) and the pressurised water reactor (PWR). The reactor of the new power plant will be either a boiling water reactor or a pressurised water reactor.

In addition to the power plant itself, the project also includes the interim storage of the spent nuclear fuel produced by the new power plant, the treatment, storage and final disposal of low and intermediate-level operating waste, and the decommissioning of the power plant followed by the treatment and final disposal of the decommissioning waste, all occurring at the plant site.

The project also includes:

- The intake and discharge arrangements for cooling water, which in some of the options require the construction of an approximately 5 kilometre-long cooling water tunnel
- Drinking water supply system
- Waste water treatment system
- The construction of an unloading and loading facility for sea transportation
- The strengthening of power transmission links

The construction of the new power plant requires filling of the sea area. This will be done to the extent permitted by the town plan. The fill area will serve as a storage and work area during the construction.

4.1 Zero-option

The so-called zero-option is the non-implementation of the Loviisa 3 project. In this case, Fortum will not implement any other type of power plant on the power plant site in Loviisa in place of the new nuclear power plant, and will leave the site vacant for the moment.

As a responsible player in an electricity market that requires long-term commitment and where decisions are sometimes made for decades, Fortum wants to keep the site next to the current nuclear power plant units in Loviisa as a potential construction site for a new nuclear power plant unit for later preparation and decision-making.

In the zero-option, 8–14 TWh of electricity produced with nuclear power will be removed from Fortum's annual production capacity. In this case, Fortum can acquire new production capacity located outside the Loviisa power plant site, or purchase more electricity for resale direct from the wholesale market. Replacement options would probably consist of several different types of measures, one of which could be, for example, participation in the new Olkiluoto nuclear power plant project, if it is implemented. The production method or location of the electricity procured from other electricity producers cannot be predicted that far into the future, and, similarly, opportunities to participate in the new projects of other players cannot be predicted.

The environmental impacts of the zero-option are assessed by taking a brief look at whether the option that the development of Loviisa continues as before has any impacts, and by presenting a summary of public estimates of the environmental impact of different methods of electricity production.

When looking at the effects of the zero-option on the Loviisa area, observations are limited to situations where the existing units of the power plant are still operational. The decommissioning beginning at least 20 years from now is not considered, and neither is the time after decommissioning.

4.2 Option excluded from the investigation

The starting point for the Loviisa 3 project is the construction of environmentally-benign production in accordance with Fortum's climate strategy, and the reduction in greenhouse gas emissions. This strategy includes energy conservation, more efficient utilisation of renewable energy sources and the construction of new, environmentally sound production capacity. The total demand for electricity depends on the overall economic and social development, which are beyond Fortum's sphere of influence. Fortum does not have access to any energy conservation means that would allow replacement of the quantity of electricity produced by the Loviisa 3 plant unit to satisfactorily meet the needs of its customers. For this reason, energy conservation will not be examined as an alternative to the Loviisa 3 project.

The thorough analysis of competing projects in the same sector and the options available to other energy producers as an alternative to the Loviisa 3 project is not possible because it is impossible to predict the electricity production methods or locations of other electricity producers over ten years into the future. For this reason, site-specific power generation outside the Loviisa power plant site will be excluded from the analyses as an alternative to the Loviisa 3 project, regardless of the production method.

4.3 The present state as a point for comparison

The present state of the environment serves as the starting point for comparison and assessment of the implementation options. The present state is characterised on the basis of available material describing the state of the environment.

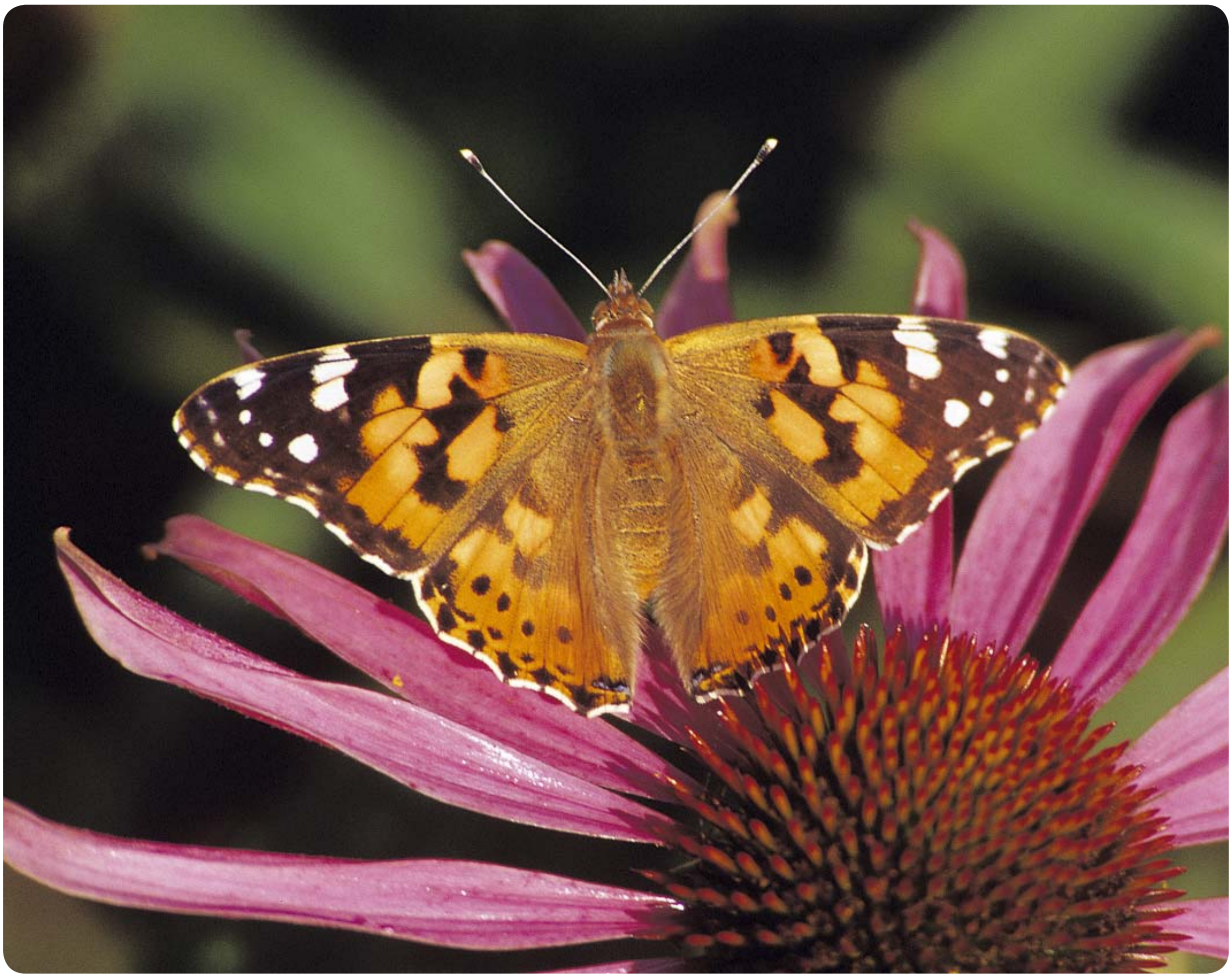
4.4 Limits of environmental impact assessment

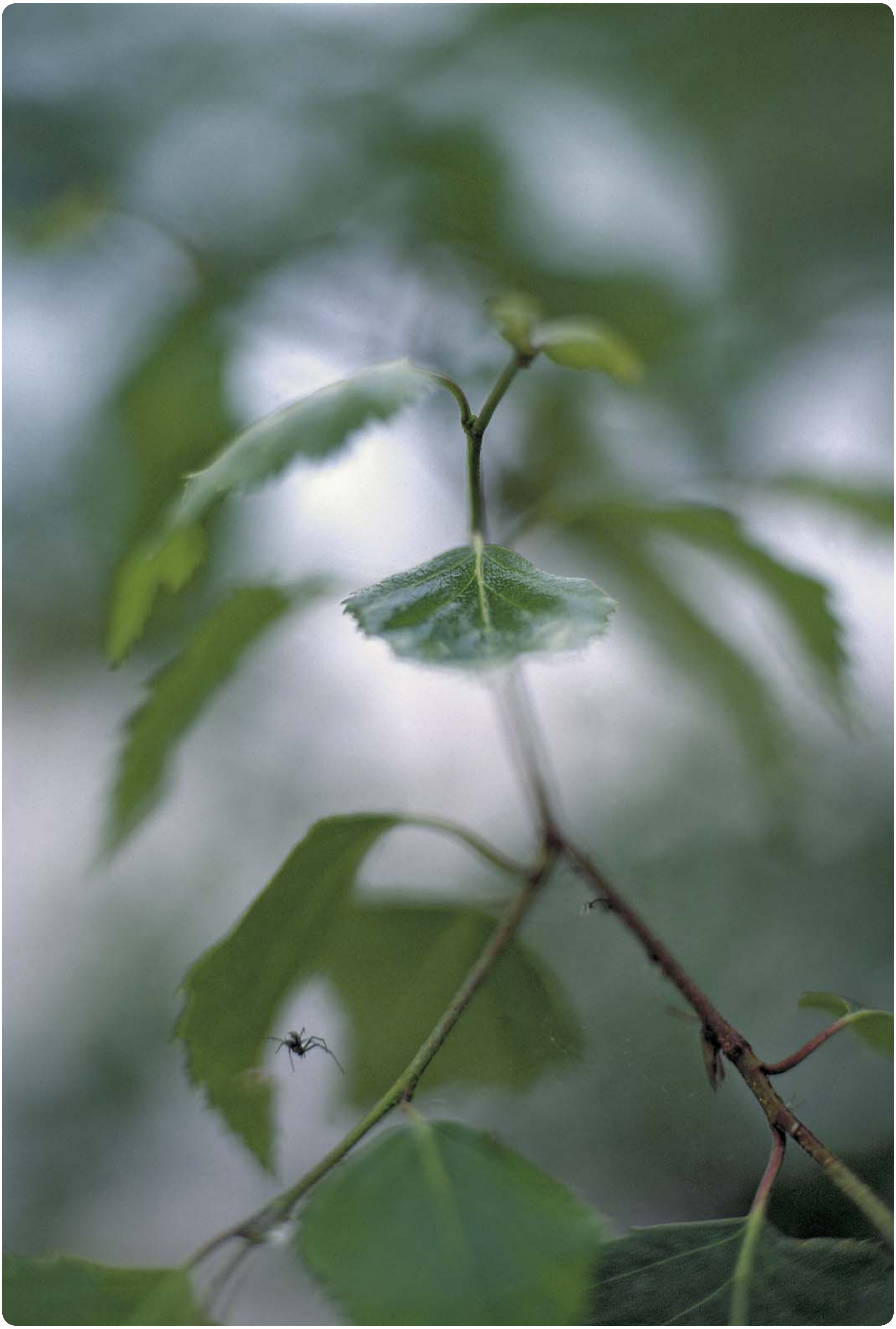
The EIA implementation options will primarily examine the environmental impacts of operations taking place on the power plant site. Operations extending outside the site include, for example, traffic during the construction and operation of the plant, and the construction of the power transmission link. The impacts of these operations will also be assessed to the required extent. In connection with the EIA procedure, it will also be assessed whether an accident will have impacts extending beyond Finnish territory.

The impact of the transport and interim storage of nuclear fuel and waste produced at the plant will be assessed. Furthermore, the impacts of handling and disposal of waste will be assessed to the required extent. The environmental impacts of producing nuclear fuel will be presented.

At this stage, no combined effects with other planned projects known at this time have been identified. This issue will be examined in more detail in connection with the environmental impact assessment. Combined effects with present operations will be examined as part of the impact assessment.

This EIA procedure will examine the environmental impacts within areas specifically defined for each type of impact. The extent of the observed area depends on the environmental impact being examined. Environmental impacts are likely to occur in an area smaller than the observed area. The affected areas will be presented in the assessment report.





5 PROJECT DESCRIPTION

5.1 Operational principles of a nuclear power plant

The main difference between a nuclear power plant and a traditional steam power plant is the heat production method. The nuclear reactor corresponds to the boiler of a steam power plant. As a fuel, a nuclear power plant uses enriched uranium dioxide (UO_2). The use of uranium as a fuel is based on the heat it yields when the atomic nucleus splits.

The uranium fuel heats water, and the heat is used to produce steam at a high pressure. The steam is conducted to a turbine that drives an electric generator. From the turbine, the steam is conducted to the condensers, where the cold seawater cools it and turns it back to water. The seawater used for cooling warms up and is led back to the sea. Radioactive water from the reactor will not mix with the cooling water at any stage.

The fuel is compressed into small pellets and packed in gastight metal pipes, called the fuel rods. The fuel rods are bundled together as fuel assemblies. New unused fuel can be handled and transported safely with no protective equipment.

The new power plant would be a base load station, meant to run continuously except for the annual maintenance outage. The estimated service life of the plant is approximately 60 years. Table 5-1 presents some technical data on the planned power plant unit. The figures are preliminary.

Description	Value and unit
Electrical power	Approx. 1,000–1,800 MW
Thermal power	Approx. 2,800–4,600 MW
Overall efficiency	Approx. 35-40%
Fuel	Uranium dioxide UO_2
Consumption of uranium fuel	Approx. 20–40 tonnes/year
Average degree of fuel enrichment	Approx. 3–5% U-235
Amount of uranium in the reactor	Approx. 100-150 t
Annual electricity production	Approx. 8–14 TWhe
Need for cooling water	Approx. 40–60 m^3/s

Table 5-1. Preliminary technical information for the planned new Loviisa power plant unit.

5.1.1 Plant type options

The reactors of the existing Finnish nuclear power plants, like most of the nuclear power plants in the world, are so-called light water reactors (LWR). An LWR uses regular water to maintain the chain reaction and to transfer the heat away from the reactor core. There are two types of LWR units: the boiling water reactor (BWR) and the pressurized water reactor (PWR).

Boiling water reactor

In a boiling water reactor the fuel heats up the water so that it boils and energy is transferred with the steam from the reactor direct to the turbine turbine (Figure 5-1. The operational principle of a boiling water reactor.). The existing Olkiluoto power plant units (OL1 and OL2) of Teollisuuden Voima Oy have boiling water reactors.

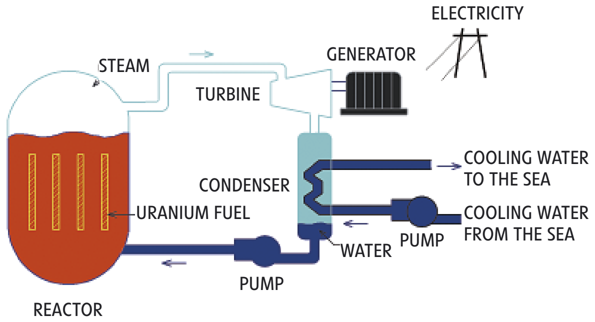


Figure 5-1. The operational principle of a boiling water reactor.

Pressurized water reactor

In a pressurized water reactor the fuel heats up the water, but the water is pressurized to prevent it from boiling. The energy is transferred with the water to separate steam generators, from which the steam is conducted to the turbines (Figure 5-2. The operational principle of a pressurized water reactor.). The existing Loviisa reactors and the new Olkiluoto unit under construction (OL3) are pressurized water reactors.

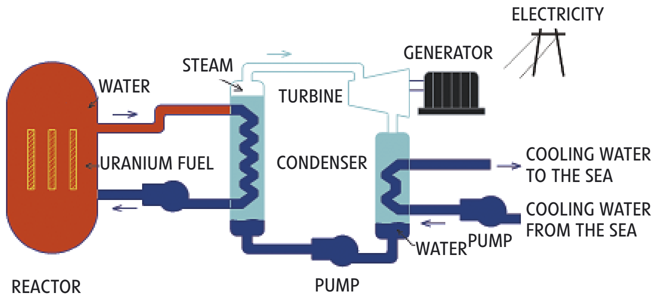


Figure 5-2. The operational principle of a pressurized water reactor.

5.2 Nuclear safety

A nuclear power plant must be designed in accordance with nuclear energy legislation and YVL Guides (NPP guides) published by the Radiation and Nuclear Safety Authority in order to ensure the safety of plant operation. The safety of nuclear power plants and the requirements set for the safety have been and will be continuously developed based on experience and the results of safety surveys. The nuclear power plant currently under the preparation process represents advanced technology and fulfils the Finnish safety requirements.

According to the Nuclear Energy Act, the nuclear power plant must be safe and it must cause no danger to people, the environment or material property. The use of nuclear power plants is often overshadowed by people's concern for the environmental effects of possible radioactive emissions caused by accidents. In the nuclear industry, systematic safety principles have evolved to limit the risks. These principles focus on preventing accidents and limiting the consequences. The design of a nuclear power plant has its foundation in ensuring safety by structures and arrangements that prevent radioactive substances from entering the environment, even in the most unlikely accident situations.

The Finnish nuclear power legislation and safety instructions are based on decades of development work and international cooperation that utilises nuclear safety research and experience of the use of nuclear power plants in many countries. With this development work, safety requirements have been further defined and tightened, and the requirements set for new plants are more stringent than the requirements applied to the existing plants.

The multiple isolation principle is applied to the design, construction, use and decommissioning of nuclear power plants. Several consecutive structural barriers prevent the release of radioactive substances into the environment. The layout of physical barriers is successive. The metal cladding pipe of the fuel rods is the innermost barrier. The reactor core is placed in a pressure vessel, which is part of the leak-proof reactor cooling circuit. The reactor circuit is surrounded by a gas-tight containment, consisting of various steel and concrete structures. The containment is covered by the thick concrete outer wall of the reactor building, protecting the plant against possible external impacts.

In addition to the main cooling system used in the energy production process, the plant has several redundant emergency cooling systems. The electrical supply to these systems has been backed up by several redundant and independent systems. The purpose of these systems is to prevent fuel damage in all situations, including very unlikely accidents. According to the Finnish authoritative requirements, the frequency of the so-called severe reactor accidents involving melting of the core or severe damage to the fuel must be less than once in 100,000 years. In spite of this, nuclear power plants are also equipped with severe accident management systems that prevent significant emissions to the environment, even in the case of a severe accident.

The Government Decision 395/1991 includes regulation for radiation exposure and emissions of radioactive substances, both during normal and emergency operation. A postulated accident involving no significant damage to the core should only cause very small doses to the population of the area. The limit for the possible release of radioactive substances arising from a severe accident is a release that causes neither acute harmful health effects to the population in the vicinity of the nuclear power plant nor any long-term restrictions on the use of land and water. Although a severe accident must be very unlikely and a significant release caused by it even more unlikely, extensive preparations must be made to protect the population of the area, too.

In the licensing process, the various safety issues of the new nuclear power plant will be studied in greater depth and more detail as the process progresses. In the EIA and decision-in-principle stages, safety is considered based on general design information and safety requirements, since the Nuclear Energy Act does not permit selecting a plant supplier at this stage. According to the Nuclear Energy Act, a power company cannot enter into any financial commitments with power plant suppliers before a positive decision-in-principle. Detailed safety reviews can only be conducted in the construction licensing phase, when the plant supplier has been decided on. The final safety report will be delivered to the Radiation and Nuclear Safety Authority together with the operating license application.

According to the Guide YVL 1.10 of the Radiation and Nuclear Safety Authority, principal rule is that only power plant related operations are allowed in a region that reach to an approximate distance of one kilometre from the plant. The plant area is surrounded by a protective zone approximately 5 kilometres wide. In the protective zone, there are limitations on the use of the land concerning for example population centres, the presence of large groups of people and production operations that a nuclear accident could have an effect on. The number of permanent residents should remain below 200. The emergency planning zone extends to a distance of 20 kilometres from the plant. The authorities must prepare rescue plans for this area, with special attention to the efficiency of the rescue operations.

5.3 Procurement of fuel

The new plant unit will consume approximately 20 to 40 tonnes of enriched uranium fuel per year. This equals approximately 180 to 270 tonnes of uranium concentrate.

The procurement process of nuclear fuel consists of the following phases: quarrying and ore cleaning, conversion, isotopic enrichment, and manufacture into fuel assemblies.

These production phases will be purchased from the market, mostly with long-term agreements with the producers. The major uranium producers of the world include Canada, Australia and Kazakhstan. Other significant producers include Russia, the USA, Brazil and some African countries. The most significant conversion plants are located in France, Canada, the USA and Russia. The enrichment market is dominated by four suppliers: AREVA (France), Urenco (England, Germany, the Netherlands), Tenex (Russia) and USEC (the USA). Additional enrichment capacity can be found for example in Japan, China and Brazil. The manufacture of fuel assemblies is dependent on the plant type. The necessary production capacity can be found within the EU and in Russia.

5.4 Nuclear waste management

The basis of nuclear waste management is the permanent isolation of waste from the environment. According to the Nuclear Energy Act, nuclear waste must be handled, stored and permanently disposed of in Finland. The Nuclear Energy Decree further defines the nuclear waste to be permanently disposed of in the Finnish ground or bedrock. The disposal of nuclear waste will be designed in a way that does not call for continuous supervision to ensure long-term safety. According to international and Finnish surveys, the necessary nuclear waste management measures can be implemented in Finland in a controlled and safe manner.

Waste originating in nuclear power plants includes:

- spent fuel
- low and intermediate-level operating waste (for example maintenance waste and waste originating in the water cleaning processes)
- the so-called decommissioning waste originating from the decommissioning of the plant.

The basis of the waste management of the new plant is to utilise existing solutions (designed or already in use). The capacity is extended when necessary.

5.4.1 Spent nuclear fuel

Nuclear fuel becomes highly radiating in the reactor. The fuel spent in Finland is not processed further, but remains highly radioactive nuclear waste.

After removal from the reactor, the spent fuel will be stored for several years in storage pools at the power plant. The activity and heat production of the waste drop significantly during this storage. From the plant, the spent fuel will be transferred for a few decades to the spent fuel storage pool located in connection with the Loviisa power plant, or a separate interim storage will be built for the fuel. During the storage, the activity and heat production of the spent fuel will continue to drop.

After the storage period in Loviisa, the spent fuel of the Loviisa 3 power plant is planned to be permanently disposed of in the bedrock of Olkiluoto, Eurajoki, in the final repository to be built approximately 400–500 metres below ground level. Posiva Oy, jointly owned by Fortum and TVO, carried out the EIA procedure in 1997–1999 for the final disposal of the spent fuel from six nuclear reactors (the running reactors at Loviisa 1 and 2 and Olkiluoto 1 and 2, the Olkiluoto 3 reactor under construction plus the new reactor) at Olkiluoto. After receiving a positive decision-in-principle for the spent fuel from the four existing plant units in 2001 and for the spent fuel of the unit under construction in 2002, Posiva began the construction of the underground rock characterization facility ONKALO in the Olkiluoto bedrock. Posiva will apply for a construction licence for the final repository by 2012. The application is based on the information received from the ONKALO project, among others. Posiva means to begin the final disposal of spent fuel in 2020. Posiva also means to expand the Olkiluoto final repository to accommodate the spent fuel from Loviisa 3, and to apply for the necessary licenses.

5.4.2 Power plant waste and other wastes

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

The low-level and intermediate-level operating waste and decommissioning waste will be disposed of in the final repository constructed for them, located approximately 110 metres below the ground level in the Hästholmen bedrock. Wet waste will be solidified in the solidification facility. The operating and decommissioning waste of the new power plant will be solidified, dried and absorbed in a suitable medium. The existing final repository of operating waste will be expanded to accommodate the waste from the new plant.

The power plant also generates conventional waste (such as paper and plastic waste and food waste), as well as hazardous waste (such as fluorescent lamps and waste oil). Wastes are managed as required by the power plant's environmental permit.

5.5 Radioactive emissions

Radioactive liquids and gases generated in a nuclear power plant are collected, delayed to reduce radioactivity, and filtered. Even after filtering, minor amounts of radioactive substances are released into the atmosphere and water. Atmospheric emissions occur through the vent stack. Water released into the sea is mixed into the cooling water flow in the discharge channel.

The power plant will be designed to meet the strict conditions set for the total radiation burden caused to the environment by the new and existing plants.

5.6 Other emissions

The power supply of the nuclear power plant will be secured by emergency diesel generators. Test runs of emergency power sources generate some nitrogen oxide, sulphur dioxide and particle emissions. The possible oil-heated backup heating boiler also generates minor emissions of a similar nature.

5.7 Water requirements and supply

5.7.1 Tap water

Currently, the tap water of the Loviisa power plant is produced at a water purification plant from water pumped from the Lappominjärvi lake. The current water supply is inadequate for the needs of the construction stage and the new power plant. Estimates on the required water volume and the organisation of the water supply to the new power plant are included in the construction. Organisation of the water supply is planned in cooperation with local operators.

5.7.2 Sewage water

Waste water generated at the power plant and on the site includes water from the raw water treatment and demineralisation plant, water from the liquid waste treatment plant, water used for flushing the travelling band screens, sanitary waste water and laundry waste water. The waste water is processed appropriately in a sewage treatment plant before being conducted to the sea. Estimating the new plant's sewage water treatment is a part of the project. The possibilities of cooperation with local operators will be examined.

5.7.3 Cooling water

The power plant uses cooling water for cooling the turbine condensers. The existing power plant takes its cooling water (average of 44 m^3/s) from Hudöfjärden, west of Hästholmen. Cooling water is conducted back to sea at Hästholmsfjärden, 8–11°C warmer.

The cooling water intake and discharge locations examined in the previous EIA report in 1998–1999 and the later location survey have been marked in figure 5-3. The presented intake and discharge locations are viable alternatives in the new estimation as well, but they may not all be looked into.

The cooling water for the new plant (40–60 m^3/s) will be taken either from Hudöfjärden or further away from Vådholmsfjärden. The used cooling water would be conducted either to Hudöfjärden, Hästholmsfjärden or further away, to Vådholmsfjärden. The alternative cooling water intake and discharge locations can be found in the area marked with an ellipsis in figure 5-3. At the present stage, exact locations are not presented, because the purpose is to find the environmentally and practically most favourable alternative without excluding any options.

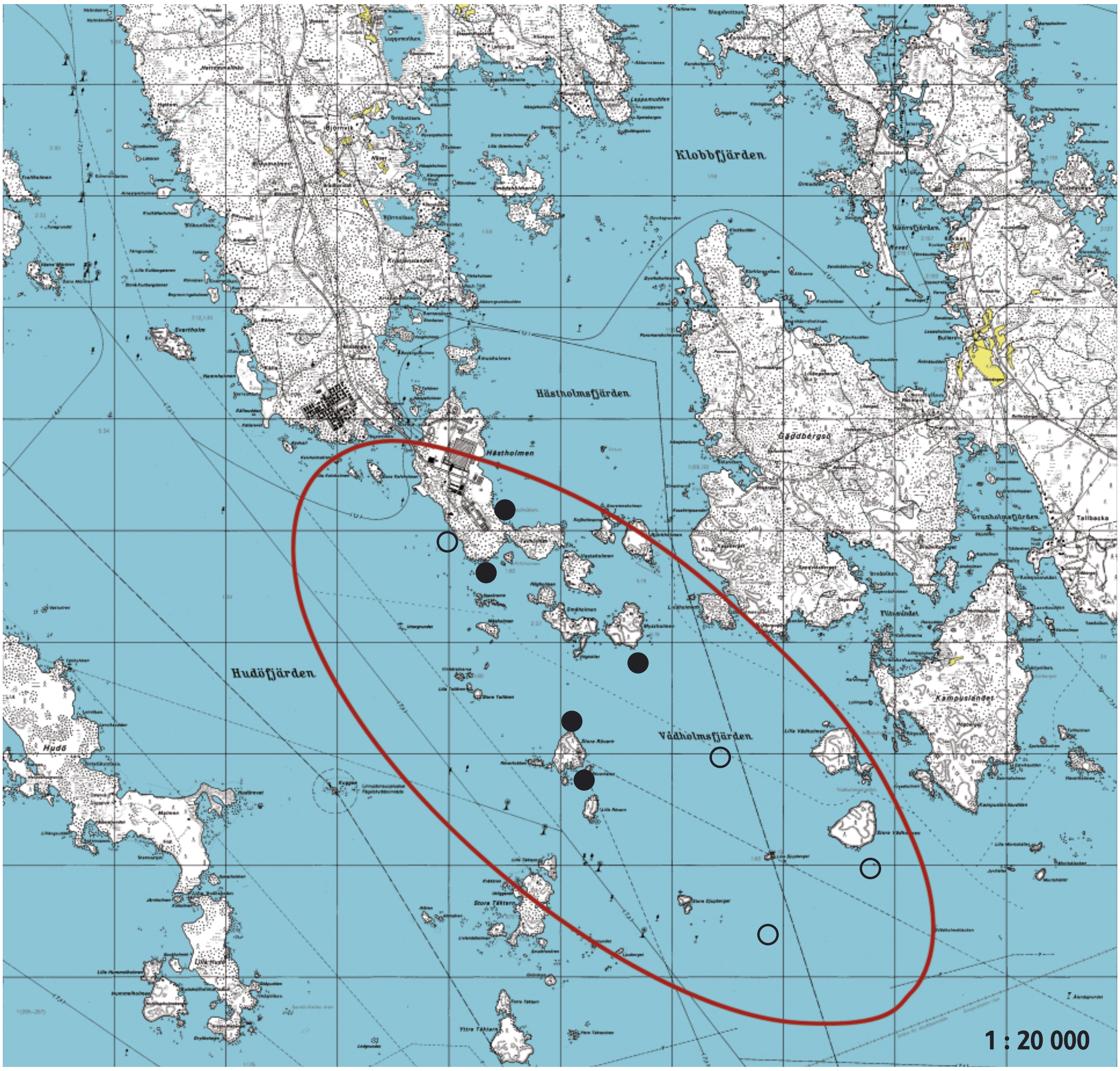


Figure 5-3. Border of cooling water intake and discharge locations and the intake and discharge locations presented in earlier surveys.

○ Cooling water intake location
● Cooling water discharge location

6 PRESENT STATE OF THE ENVIRONMENT

The present state of the environment serves as a starting point for comparing the options. The environmental impacts of nuclear power plants have been studied extensively in Finland, and the state of the immediate environment of the plants has been monitored for more than 40 years. There are a lot of reports available that describe the state of the environment at Loviisa and in nearby areas. The last comprehensive environmental impact assessment of the Loviisa nuclear power plant took place in connection with the EIA procedure for the Loviisa 3 nuclear power plant project in 1999. Fortum regularly monitors the operation of the plant and its effects on the environment (including the monitoring of cooling and waste water, the intake and discharge temperature of the cooling water, quality and biological condition of the sea water, fishing industry in the area and radiation control).

6.1 Land use and the built environment

6.1.1 Functions located in and around the area

The island of Hästholmen and its immediate surroundings are located in eastern Uusimaa within the borders of the town of Loviisa. The Loviisa town centre is located approximately 12 kilometres and the village of Valko approximately 7 kilometres away from the power plant. The power plant site borders both publicly (government, the town of Loviisa) and privately owned land. The privately owned land is mainly used for recreational purposes. The government areas are protected and the land owned by the town of Loviisa is reserved for agriculture, forestry and recreational purposes in the master plan. A causeway, approximately 200 metres long, leads to the island over the Kirmosund inlet.

Fortum owns the island of Hästholmen and the southern edge of the peninsula north of the island. Fortum owns approximately 170 hectares of land and 240 hectares of waters in the vicinity of the plant. About half of Hästholmen is used by the existing power plants. The Loviisa power plant is located in the northeastern part of the island.

Figure 6-1. The Loviisa power plant is located on Hästholmen island.

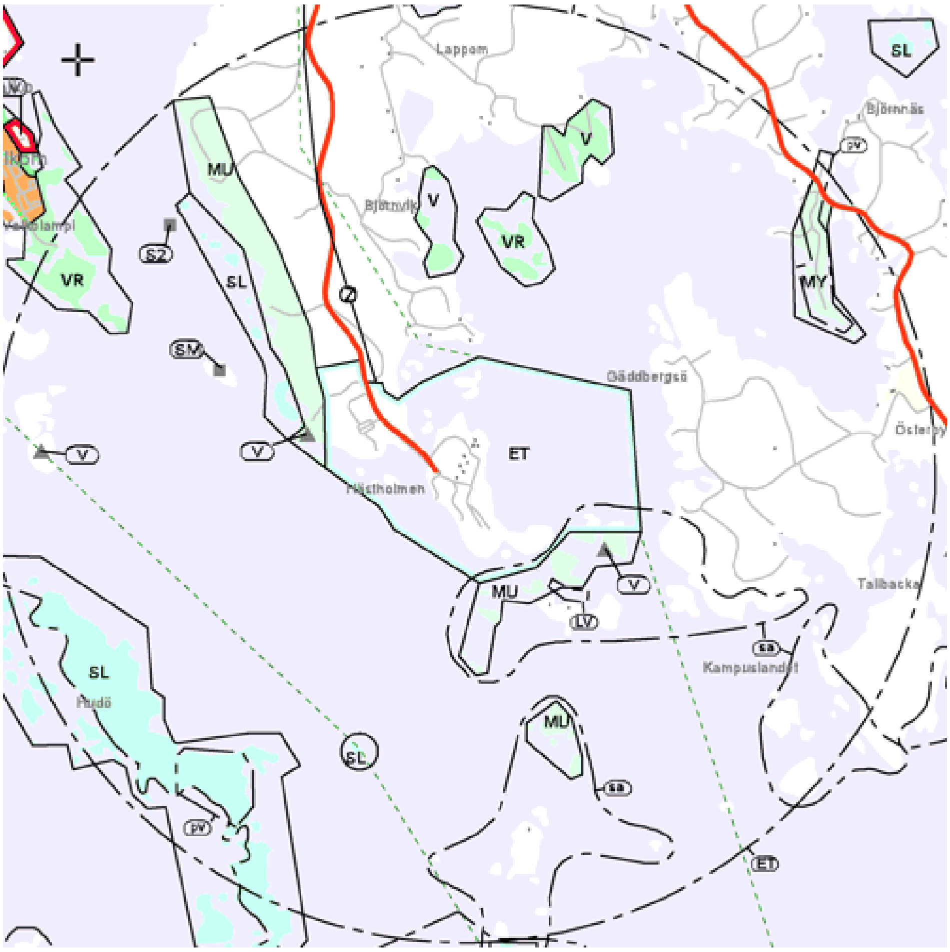
The mainland site includes various support functions, such as the buildings and structures needed for the reception and guarding functions and the accommodation of annual maintenance staff. The shore area contains structures relating to power transmission and the discharge of cooling water. There is no other industry in the vicinity of the power plant.

6.1.2 Land use planning

The land use of the Loviisa nuclear power plant area is controlled by the town plan, master plan and the regional plan.

Regional and provincial plan

The regional plan of eastern Uusimaa consists of a plan prepared in four stages. In the combined regional and provincial plan of eastern Uusimaa approved on 5 April 2002, Hästholmen and the support area on the mainland have been designated as a community management zone (ET) (Figure 6-2. An extract from the eastern Uusimaa regional plan. The new power plant will be located in the community management zone (ET).).



2000 m ©National Land Survey of Finland ©Regional Council of Itä-Uusima

Figure 6-2. An extract from the eastern Uusimaa regional plan. The new power plant will be located in the community management zone (ET).

The power plant will be surrounded by a protection zone five kilometres wide with limited land use options. The archipelago south of Hästholmen and the eastern shore area of Loviisanlahti on the mainland have been designated as agriculture and forestry-intensive areas with environmental values and a need for control of outdoor recreation. The archipelago northwest of Hästholmen is a nature conservation area (SL). The Svartholma sea fortress is a historical site (SM). The Smedsholmarna islands a couple of kilometres north of Hästholmen have been designated as a camping and recreational area (VR). Storholmen and the coastal area to the west of Smedsholmarna, plus Smedsnäs, are a recreation area (V). The islands of Hudö and Lilla-Hudö located to the southwest of Hästholmen and the small islands near them are designated as a nature conservation area (SL). The nearest population centre (A) is the Valko village located on the mainland.

The Regional Council of Itä-Uusimaa is in the process of drafting a complete provincial plan to replace the current regional and provincial plans. The preparation of the provincial plan for eastern Uusimaa was begun in September 2002. In the provincial plan suggestion for eastern Uusimaa dated 28 May 2007, the power plant area has been designated as a energy management zone (EN) (Figure 6-3). The suggestion for a provincial plan will be available to the public between 1 and 30 June 2007.

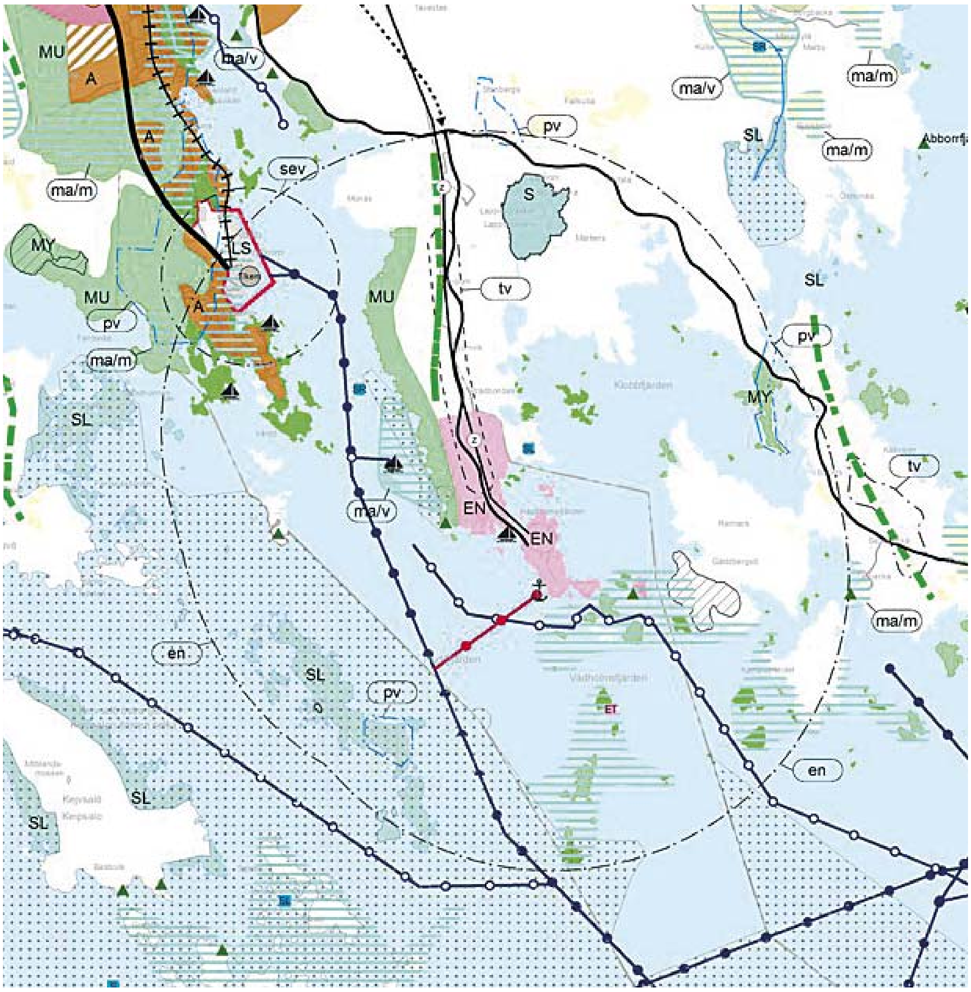


Figure 6-3. An extract from provincial plan suggestion, 28 May 2005. The location of the new power plant has been designated as a energy management zone (EN).

Master plans

The Loviisa town council approved a master shore plan for the power plant area on 13 November 1985, and the master plan for the entire town on 9 December 1987. The master plans of Loviisa have no legal effect.

In the master plan, the Hästholmen area has been designated as the nuclear power plant area (E-1) and the southernmost point of the mainland opposite Hästholmen as a nuclear power plant support area (E-2). Of the island to the south of Hästholmen, Stora Rövaren, Rövarhället and Stora Djupberget and parts of Högholmen and Småholmen have been designated as nature conservation areas (SL) in the master plan due to the special beauty and vulnerability of the outer archipelago of the Loviisa region. The rest of Högholmen and Småholmen has been designated as cottage area (RA).

In the master shore plan of the town of Loviisa, the waters south of the power plant have been designated as a protected outer archipelago landscape area (SL-1). A few holiday cottage areas have been added on the southern islands.

The town of Loviisa launched preparations for a Loviisa component master plan for shore areas in 2005. The area to be planned is located on the eastern shore of the Loviisanlahti bay and the islands in the southern part of the bay within the borders of the town of Loviisa. The purpose of the component master plan for shores is the general control of the community structure and land use of the eastern shore of Loviisanlahti and the islands, as well as the placement and coordination of various operations. The component master plan presents the main points of the desired development and shows the necessary areas to be used in detailed land use planning and other planning procedures to enable construction work and other land use. The purpose of the work is to control construction projects and to develop land use practices that support future needs, as well as to guide land use in a direction that supports the natural characteristics and identity of the region. At the moment, a draft for a component master plan for shores is under preparation with the objective of making it public in the autumn of 2007.

The component master plan of the Vahterpää-Gäddbergsö area near the plant in Ruotsinpyhtää was established in 2001, and minor changes were made in 2002 and 2003 by decisions of the municipal council. The component master plan of the Kulla-Lappom area was established in 2005. For the Pyhtää shores and archipelago, the component master plan of 2000 is valid. The component master plan covering the entire Pernaja archipelago excluding the Påsalo island was established in 2004.

Town plans
A town plan established in 1972 and modified in 1974 applies to the Hästholmen island and the surrounding waters (Figure 6-4. Hästholmen town plan. In the town plan, the site of the new power plant has been designated for industrial and warehouse buildings.). A modification to the master plan was established in 1993, enabling underground construction in the area. The construction area of the current plant units is designated as a zone for industrial and warehouse buildings (T).

When preparing the Hästholmen town plan, the construction of a new nuclear power plant was taken into account. The site of the Loviisa 3 plant unit is in a section suitable for the construction of a power plant in the area designated for industrial and warehouse buildings (TTV). Part of the shore area has been designated for special structures of the power plant, such as the cooling water intake structures and recreational buildings. Part of the shore is designated as an area to be kept in a natural state (ELL area). This part is also intended for the use of the plant, with permission to build structures necessary for guarding the plant site. In the town plan, the eastern shore has been designated as an area for planting trees and bushes, with permission to build only structures necessary for guarding the area.

Figure 6-4. Hästholmen town plan. In the town plan, the site of the new power plant has been designated for industrial and warehouse buildings.

Master plan designations in figure 6-4:
T and **TTV** A zone for industrial and warehouse buildings.
ET-1 Power transmission area.
ER-1 Recreational area for the power plant personnel.
ER-2 Combined training and short-term accommodation area related to the operation of the power plant.
EK Power plant cooling water intake place with permission to build the structures necessary for the power plant.
ELL Area to be preserved in natural state, intended for the use of the plant and with permission to build structures necessary to the guarding of the power plant.
EIL Area for planting trees and bushes. The area can be levelled out to a maximum height of +10,00. Structures necessary for the guarding of the power plant are allowed, as well as temporary warehouse and service buildings serving the construction site.
W-1 Waters allowed to be used for the purposes of the power plant. By the areas designated as industrial and special areas, the construction of piers and other structures necessary for the power plant is permissible to the extent allowed by the Water Act.
VE Waters allowed to be used for the purposes of the power plant. By the areas designated as industrial or special areas, the construction of piers and other structures necessary for the power plant is permissible to the extent allowed by the Water Act.

The Uusimaa County Administrative Board established the town plan prepared for the so-called power plant support area on the mainland in 1989. The support area will contain many functions, especially during the construction of the new plant. Temporary accommodation buildings can be located in the support area in the accommodation buildings zone (A4). The town plan also includes a personnel parking zone (LPA) with a capacity for 1,000 personal vehicles, as well as a public parking zone (LP). Along the Atomitie road, several zones have been designated to be kept in natural state (E-1).

Shore plan and local shore plan
Within approximately five kilometres of the plant, the following shore plans apply:

- The Hudö shore plan established in Pernaja in 1988. The government has purchased the area for nature conservation purposes, excluding some built areas on the island. The Hummelholmen shore plan established in 1987 concerns areas within the municipality of Pernaja.
- The Långstrand shore plan from 1986 and the Gäddbergsö shore plan from 1989 have been established in the municipality of Ruotsinpyhtää.

6.2 Landscape and cultural environment

The Hästholmen island is approximately 1.5 km long and 0.6 km wide. Hästholmen and the small islands south of it have a flat profile. The highest point of Hästholmen is +16.00. The area surrounding the power plant consists of a fairly natural coast and archipelago landscape, with numerous red granite boulders and cobbly areas as a special characteristic.

The eastern shoreline of Hästholmen has undergone drastic changes as a result of the land filling in connection with the construction of the Loviisa power plant. There is no protective green zone on the eastern shore nor on part of the northern shore. Thus the plant and its structures are clearly visible from the Hästholmsfjärden sea area east of the island.

The unbuilt south and west shores of Hästholmen are for the most part in their natural state. These areas are covered by a thin layer of moraine, and the bedrock is bare in many places. The forest of the area is mainly old pine forest. On the narrow neck of land between Hästholmen and Fallholmen there is an alder grove with a representative variety of tree species, as well as a seashore forest. Even though the plant structures are visible from a wide part of the Hudöfjärden sea area west of the plant, the forest zone of the southern and western shoreline softens the landscape considerably.

Figure 6-5. An aerial photo of the plant and its surroundings.

There are no nationally or regionally valuable buildings or other objects of cultural history on Hästholmen. The nearest location with nationally significant cultural history value is the sea fortress of Svartholma approximately 2.5 kilometres from the power plant site. (*National Board of Antiquities 2007*)

6.3 People and communities

There is a permanent population of approximately 40 people living in the immediate vicinity of the power plant (less than 5 kilometres from the plant). The population has concentrated mainly on the areas to the north and west of the power plant. There are no settlements within one kilometre of the plant.

A population of approximately 12,600 people live within 20 kilometres of the Loviisa power plant. The largest population centre within 20 kilometres of the plant is Loviisa with its 7,500 inhabitants. Tesjoki, Ruotsinpyhtää municipal centre and the Pyhtää municipal centre have less than 1,000 inhabitants each. Kuggom, Pernaja municipal centre, Isnäs village in Pernaja and Purola village in Pyhtää are smaller population centres. The share of children (0–17 years) in the population is evenly distributed within the radius of 20 kilometres. In the immediate vicinity of the coastline the share of children is slightly lower than elsewhere in the area. The working population (18–64 years) is evenly distributed. The share of population over 64 years old is largest near the shoreline. (*Fortum Power and Heat Oy 2006*)

A population of approximately 1.6 million people live within 100 kilometres of the Loviisa power plant. Most of this population is concentrated in towns, municipal centres and other population centres. The largest population centres are located along the railway between Helsinki and Hämeenlinna, in the Salpausselkä sand ridge area (Lahti, Kouvola, Kuusankoski, etc.) and the coast (Kotka, Porvoo, Hamina). There are also regions belonging to Estonia and Russia within a hundred kilometres of the plant. (*Fortum Power and Heat Oy 2006*)

There are plenty of recreational settlements in the vicinity of Hästholmen. The number of holiday cottages within five kilometres of the power plant is estimated at 400. The number of temporary population in this area during the holiday season is estimated at a little over 1,000. The largest holiday cottage zone within 20 kilometres of the power plant begins east of Loviisanlahti and reaches all the way to Vahterpää, Munapirtti and Koukkusaari in Pyhtää. There are also holiday cottage concentrations in the southern archipelago of Pernaja and within six kilometres of Pernaja. Even though the number of holiday cottages in the area continues to increase, new separate cottage areas have not formed within 20 kilometres of the plant. Practically the entire shoreline is a holiday cottage area.

There are no schools or day-care centres within 5 kilometres of the power plant. The nearest school and day-care centre are located in the village of Valko. The nearest targets that will be disturbed are presented in a map in the assessment report.

6.4 Traffic

Highway 7 (Helsinki-Vaalimaa), part of the major east-west route E18, goes past Loviisa. The highway has exits to the east and west of Loviisa. From highway 7, the Saaristotie and Atomitie roads (1583) lead to Hästholmen. The share of the traffic coming to Loviisa power plant through the western highway exit comes through the Loviisa town centre. A causeway about 200 metres long with a bridge over the Kirmosund inlet leads to Hästholmen.

The operational traffic of the existing plants consists of commuting and maintenance traffic, transportation of new fuel and chemicals, fuel oil and gases, as well as waste management traffic.

The average daily traffic from Määrlahti to the crossroads of Saaristotie and the Hästholmen road in the south is approximately 1,260 vehicles, approximately 40 of which are heavy vehicles. The average daily traffic from the crossroads mentioned above to the south to Hästholmen is approximately 725 vehicles, approximately 20 of which are heavy vehicles. Due to commuting, the traffic is slightly concentrated on weekdays. (*Road Administration 2007*)

The nearest railway runs from the Loviisa harbour at Valko to the city of Lahti. There is only freight traffic on this railway section. Previously, the railway was used to transport spent fuel from Loviisa and to bring new fuel to the plant, but these transportations ended in 1996.

There are two harbours in the neighbouring municipalities: Valko in Loviisa and Isnäs in Pernaja. Two shipping routes pass near the Loviisa power plant. The route (9.5 m) to the Valko harbour runs near the south-western shore of Hästholmen. At its nearest, the route is a little over a kilometre from the shore of the island. The outer shipping route is the coastal route of the Gulf of Finland from Hamina and Kotka, passing Orrengrund.

To ensure safety, air traffic is not allowed within a radius of 2,000 metres from the plant up to a height of 600 metres. Hästholmen has an official heliport. The main purpose of the heliport is to ensure the efficiency of rescue operations and the management of security situations. The heliport can also be used to support rescue operations in marine accidents.

6.5 Noise

The noise caused by the power plant is a continuous faint humming. During the normal operation of the Loviisa power plant the sources of environmental noise include the air conditioning equipment on the roof of the turbine hall. The background noise levels of the plant site have been estimated using measurements in June 1998 (Ruishalme 1998). The measuring points were located within 200–800 metres of the plant. The results indicated noise levels between 37.9–56.8 dB(LAeq). The noise level only exceeded 50 dB(LAeq) at two measuring points. At the most distant measuring point along the road leading to Hästholmen (distance from the plant units 700–800 m), the average background noise level was 43 dB (LAeq) during the measuring period. The highest average level of the background noise, 56.8 dB (LAeq), was measured at the corner of the 400 kV switchyard.

6.6 Soil, bedrock and groundwater

The Loviisa coastal area is characterised by the numerous islands, bays reaching deep into the mainland and long peninsulas with a distinct tendency to lead from northwest to southeast. The bays reflect the weaker zones of the bedrock, the shape of which have been emphasized by the wear caused by the ice sheet during the ice age. The bedrock is mostly covered by layers of soil. Bare bedrock is concentrated on the highest parts of the mainland and the islands. The height of the area is 0–20 metres, and its profile is fairly flat and low.

The highest parts of Hästholmen are +16 metres above the sea level. The seabed surrounding the island is generally -5...-10 metres below the sea level, but there are local basins with the seabed -15 metres below the sea level. The bedrock on the island is mostly bare or covered by only a thin layer of soil. Thus the topography of the surface reflects the height of the bedrock. To the south and the east of the island the bedrock has been noted to sink even to the level of -60...-70 metres below the sea level (*Anttila 1988*). Except for these basins, the bedrock can be typically found within 20 metres below the sea level in the waters near Hästholmen.

The soil of Hästholmen and the peninsula to the north of it consists of moraine with stone and boulders. The depth of the moraine layer on the island is a few metres at most. There are only a few graded soil types, such as gravel and sand, or organic soil, such as peat. Plenty of earth work has been necessary at the construction of the power plant. Therefore, the original ground surface is covered by various land masses (rock waste, etc.) in many places, especially in the central, eastern and northern parts of the island.

The layers of soil on the seabed also consist mainly of moraine or rough soil types, gravel and sand, with clay and silt sand layered on top in places. These layers are at their thickest in the bedrock basin east of the island, where the layers are approximately 60 metres thick in total.

The Hästholmen bedrock is rapakivi granite, typical of the Loviisa region. It has been found in several variations, the most common of which are pyterlite, wiborgite and even-grained rapakivi granite. The rock is mostly unweathered and massive, and its strength properties are good. The typical disintegration of rapakivi into small rocks has been found mainly deeper in the zones containing loose rock. The main cleavage directions are northwest to southeast and northeast to southwest, with nearly horizontal cleavages forming the third main cracking direction. The method of cleavage is cubic cleavage, typical of granites (*Anttila 1988*).

Hästholmen has its own groundwater storage originating from rain water over a long period of time. The surface of the groundwater gently follows the shape of the ground surface. It is usually only a few metres below the ground surface, andthe surfaces of the sea and the groundwater meet at the shoreline. Typical of an island in the sea, the groundwater is sweet at the top and salty deeper down. In the central parts of the island the sweet groundwater turns salty more than 100 metres below ground (*Snellman and Helenius 1992; Hatanpää 1997*). There are no groundwaters suitable for or with any importance for water management at the power plant site (*Uusimaa Regional Environment Centre 2005*).

6.7 Air quality and climate

6.7.1 Weather conditions

At Loviisa, the most common direction of the wind is from the southwest, and the most uncommon from the northeast. The most probable transport direction of emissions is thus northeast. In the archipelago, winds tend to follow the shoreline more than inland, especially in the summer. Due to the location near the sea, the winds are an average of few dozen per cent stronger than on the mainland (*Heino and Hellsten 1983; Tammelin 1991*). Wind velocities are at their highest in autumn and winter, and at their lowest in summer.

6.7.2 Air quality and fallout

The emissions from the point sources in the Loviisa region are minor since there is no large-scale industry in the area. The amount of emissions from smaller industrial plants, also known as point sources, as well as so-called area sources (detached houses, saunas, etc.), has not been assessed.

The air quality in Loviisa is strongly affected by emissions from the Helsinki metropolitan area and the Kilpilahti industrial area in Porvoo, as well as traffic and transboundary pollution concentrated on the southern coast of Finland. The air of the Porvoo-Loviisa region is most heavily polluted in Finland, and for example in Loviisa a decrease in the number of lichen species found on pine trunks has been observed caused by air pollution. In the direction of Valko, the sulphur and nitrogen contents of conifer needles have been high, apparently due to emissions from the harbour. (*Pihlström and Myllyvirta 1996*)

6.8 The state and use of waters

6.8.1 General description and hydrological information

The island of Hästholmen belongs to the outer part of the inner archipelago of the Gulf of Finland. The open sea begins about 12 kilometres south from Hästholmen, on the level of Orrengrund. Consecutive pools separated by shallow underwater thresholds and inlets are typical of the sea in front of Loviisa. The water only mixes a little between these pools.

Hästholmen and the peninsula north of it are surrounded by Hästholmsfjärden and Kobbfjärden in the east and Hudöfjärden in the south and southwest.

The cooling water of the existing power plant (average of 44 m^3/s) is taken from Hudöfjärden west of Hästholmen, from the depth of 8–11 metres. The cooling water is discharged east of the island, into Hästholmsfjärden. Hästholmsfjärden is a basin between the mainland and the archipelago, connected to the outer sea by the fairly narrow and shallow inlets in the south. The square area of Hästholmsfjärden is 9 km^2 and the average depth 7.6 metres. The deepest point is 17.5 metres below the surface.

The shallower Klobbfjärden is connected to Hästholmsfjärden in the northeast. The combined surface area of Hästholmsfjärden and Klobbfjärden is 15 km^2, the average depth 6.8 metres and the water volume 0.1 km^3. In the east, Klobbfjärden is connected to the delta of Taasianjoki and the western branch of Kymijoki through the narrow Jomalsundet inlet. Klobbfjärden is also connected to Hudöfjärden through the narrow Kirmosund. The river water flowing through Jomalsundet and also the southern inlets of Hästholmsfjärden diminishes the sea-like characteristics of Klobbfjärden and Hästholmsfjärden compared to the outer sea areas. The river water is the most significant source of environmental load in the sea area surrounding Hästholmen. The load is mostly caused by the nutrients, solids and oxygen-consuming substances carried by the river water.

The cooling water intake area, Hudöfjärden, is naturally more sea-like than Hästholmsfjärden, where the cooling water is discharged. The water volume of Hudöfjärden is higher and the connection to the open sea less obstructed. The maximum depth of Hudöfjärden is approximately 24 metres and the depth of threshold in the surrounding shallower areas approximately 10 metres.

The surveys of the sea areas surrounding the Loviisa power plant began in 1966. Due to the surveys conducted before and during the construction and operation of the power plant, the Hästholmen sea area is one of the best-known areas of the Finnish coast.

6.8.2 Ice conditions, water quality and biological condition of the sea area

Sea water warm-up

The amount of cooling water and its intake and discharge temperature are continuously measured. The temperature of the seawater is mainly affected by the prevailing weather, for example winds and the air temperature.

The cooling water once conducted back to the sea is approximately 8–11°C warmer. In the 2000s the average temperature of the discharged water has been 17.4°C. According to temperature measurements, cooling water has raised the temperature of the surface water during the growing season (from May to October) about 1–2.5°C at a distance of one to two kilometres from the discharge location. (*Mattila and Ilus 2006*)

In front of Loviisa, as in the entire north coast of the Gulf of Finland, the net flow is to the west. This also affects the movement of the cooling and wastewater, especially when the sea has an ice cover. During open water season, winds have a strong effect on the spreading of the cooling and waste waters and the width of the spreading area. A small part of the warm cooling water circulates back to the water intake opening.

In the summer, cooling water flows with the wind as a layer of a few metres. The layer normally remains close to the surface, raising the temperature of the surface layer. Due to the difference in density, the warm surface water is not easily mixed with the deeper water. The rise in the temperature of the seawater is, however, mostly limited to the front of Hästholmen and the inlets leading from Hästholmsfjärden to open sea. The cooling waters do not seem to drift eastwards to any significant degree.

Outside Hästholmsfjärden the cooling water has had no permanent effect on the average temperatures of the surface water during the growth season. However, temporary increases in the temperature have been detected, depending on wind conditions at a distance of a few kilometres from the plant, in Klobbfjärden and Vådholmsfjärden.

When the sea has an ice cover, the warm cooling water in Hästholmsfjärden becomes a layer several metres thick between the cold sweet water and the cold seawater. Thus a warm intermediate layer of water is formed, with temperatures as high as 8–10°C near the discharge location. Further away from the discharge location the temperature decreases gradually as the surrounding cold water mixes with it.

Due to this phenomenon, slightly raised temperatures have been observed late in winter at a distance of more than 10 kilometres from the Loviisa power plant. The warmer layer of water has, however, been only 1 to 2 metres in these cases. Raised temperatures may occur this far only when the winter is exceptionally cold and Hästholmsfjärden remains covered with ice for a long time. Normally, the warm layer of water can be detected only in Hästholmsfjärden and its immediate vicinity.

Ice conditions

In early winter the influence of the plant to the ice cover can be seen as an extensive area of open water. The ice cover is normally rather thin in front of the plant and in the inlets leading out of Hästholmsfjärden. In late winter ice melts quickly in the inlets as the flow brings the warm water in touch with the ice.

In an average winter most of Hästholmsfjärden freezes for a short period of time. However, the ice cover in front of the plant and in and near the inlets leading to open water is at all times thin and easily broken, and it melts quickly as the air warms again. In the northern parts of Hästholmsfjärden, the ice is normally strong.

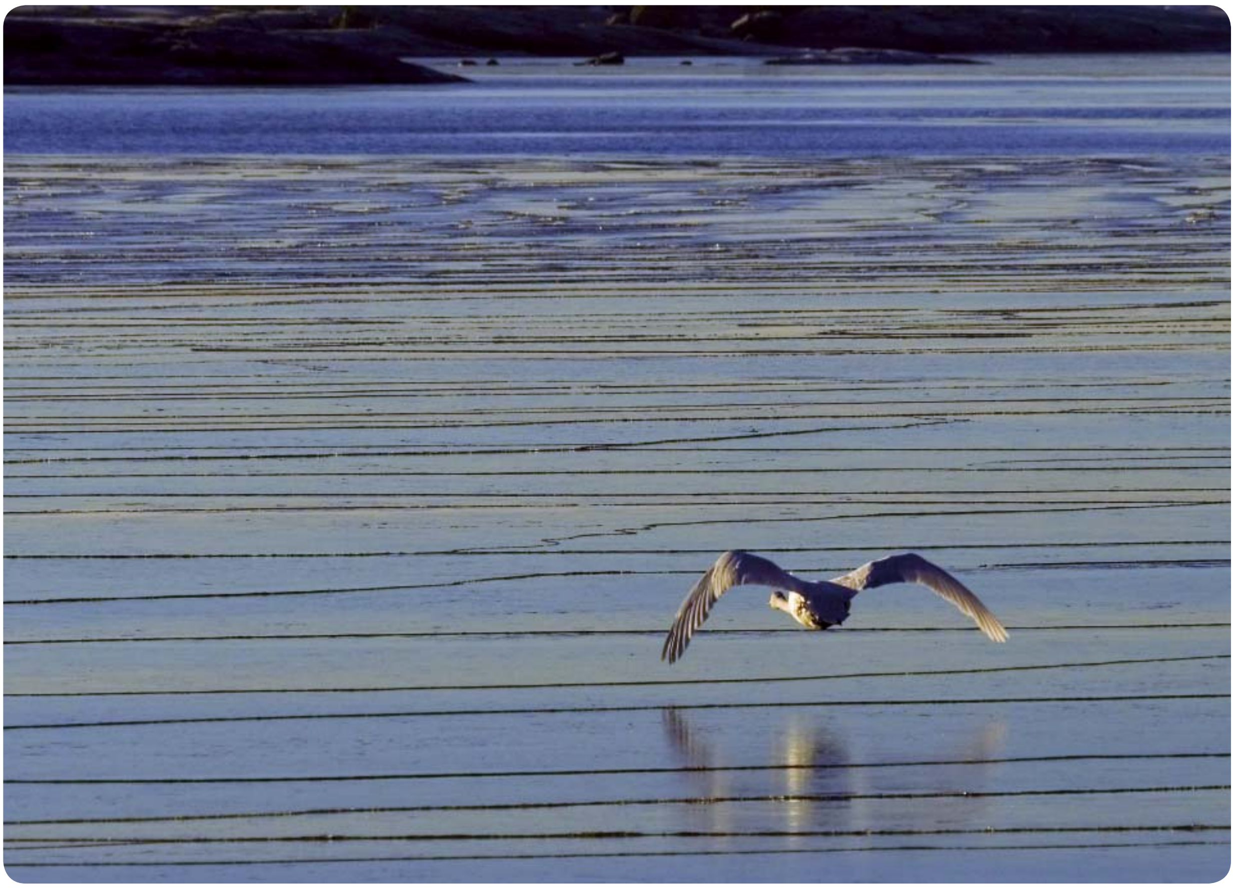
In mild or very mild winters, Hästholmsfjärden remains largely open through the winter. Since no ice cover is formed, part of the heat conducted into Hästholmsfjärden is transferred directly into the atmosphere. Due to the effect of the wind, the water masses mix in the open water and reach a fairly unified temperature and saline content.

In very cold winters, Hästholmsfjärden freezes over almost completely. The area remains frozen approximately one month or longer. The open water in front of the discharge location is normally less than 1 km^2 when at its smallest. The warm discharge water then settles into the intermediate layer almost immediately, and no great amount of warmth gets into the atmosphere.

Water quality

The average total phosphorus content of the surface water was clearly higher during the growth season of 2006 than in 2005, and at most measuring points also slightly higher than the average contents in the 1980s and 1990s. The above-mentioned movement of the sea water toward the surface had an effect on the increased phosphorus content of the surface water. Also, the phosphorus content of the bottom water was higher in 2006 than the average contents of the 1980s and 1990s due to the poorer condition of the bottom sediments and increased internal loading. The nitrogen content of the surface water in 2006 was slightly higher than or roughly equal to 2005. However, compared to recent decades, the nitrogen content of the water has decreased (*Mattila ja Ilus 2007*).

In 2006, the underwater visibility was on the same level as in 2005. At the beginning of the 2000s, the underwater visibility has generally been close to the averages of 1980s and 1990s. Mainly due to the general eutrophication of the Gulf of Finland, the underwater visibility has clearly decreased in the monitored area during the observation period. Underwater visibility improves when moving toward the outer sea. Underwater visibility has decreased strongly in the monitored area starting from the end of the 1970s. During the recent years the average underwater visibility has been only slightly better than at the end of the 1990s. (*Fortum Power and Heat Oy 2007*)



Estimated based on the salt content of the water, the area has lost some of its marine characteristics during the recent decades. The salt content of the water is fairly low in front of Loviisa, only 3.5–5 per mil during the growing season. The low salt content and especially the great seasonal variation in the salt content of the surface water affect the normal life of both sweet and salt water organisms in the Loviisa sea area. There are fewer species than in the western parts of the Gulf of Finland for example, where the salt content of the surface water is 1–2 per mil higher. At all measuring points, the average salt content of the surface water has been slightly higher in 2003–2006 than in 2000–2002, and nearly as high as in the 1990s.

The solids content of the sea water increases in the spring due to river water flowing to the area. In other seasons, there are occasional increases in the solids content caused by large quantities of phytoplankton. The average solids content in 2006 (3.0 mg/l) was slightly lower than in 2005 and approximately the same as in 2004.

The late-summer oxygen content of the near-bottom water has been problematic in some of the basins of Hästholmsfjärden and Hudöfjärden for decades, but in 2006 the oxygen content of near-bottom water was weak at other sample points as well, both in August and in October. The oxygen problems of the near-bottom water in the monitored area are mostly caused by the underwater thresholds limiting the mixing of water and the eutrophication of the Gulf of Finland.

Plankton production

The phytoplankton of the Loviisa sea area consists of both brackish water species and sweet water species. In 2005 the majority of the phytoplankton in the monitored area were diatoms (Diatomophyceae), Dinophyceae and cyanobacteria (Nostocophyceae). The biomass of phytoplankton is at its highest from March to May. The maximum amount of biomass was measured just before the middle of May, after which the amount of biomass decreased rapidly.

The quantity of cyanobacteria increased starting from June, and remained high in July, August and September. Generally, the amount of cyanobacteria in the eastern Gulf of Finland increased during the 1990s due to a decrease in the inorganic nitrogen-phosphorus ratio and the prevailing hydrographical conditions (*Kauppila and Bäck 2001*). The biomass of cyanobacteria and its share of the total biomass have clearly increased during the observation period, also in Hästholmsfjärden. In the summer, the quantity of cyanobacteria in Hästholmsfjärden has been observed to increase earlier than in other reference locations. On the other hand, in the first half of the 1970s the share of cyanobacteria of the entire biomass was occasionally higher in Hästholmsfjärden than in Hudöfjärden, although the total biomass at the time was considerably lower. It has been observed that cyanobacteria thrive in warm and nutritious waters (*Pitkänen 2004*).

The biomass of phytoplankton has grown in the monitored area since the first half of the 1970s. The change in the amount of biomass has been similar in the entire eastern Gulf of Finland during recent decades (*Kauppila and Bäck 2001*). In surveys in the Loviisa area it has been observed that the nutrient content, salt content and temperature of the water regulate the amount of the biomass of phytoplankton (*Ilus and Keskitalo 1987*). Longer growth seasons due to the rise in water temperature and shorter period of ice cover in the winter seems to have increased the biomass of phytoplankton in Hästholmsfjärden and influenced the ratio of different species. Prior to the commissioning of the power plant, the biomass of phytoplankton was regularly larger in Hudöfjärden than in Hästholmsfjärden (*Ilus 1999*). Since the start-up of the plant, the situation has been the opposite until 2005. (*Mattila and Ilus 2006*)

In the Loviisa power plant zooplankton monitoring, which ended in 1999, no changes in the abundance or species distribution were observed that could have been connected to the discharge of cooling water.

Aquatic vegetation

Regular surveys have been carried out on the aquatic vegetation of the shores near the Loviisa power plant since 1971. The stony shoreline with large boulders is typical of the area of Hästholmen. The bottom near the shoreline is mostly sand or mixed gravel and clay with a lot of boulders. There are relatively few shores with solid rock, and even these few turn into cobble immediately below the waterline. Beaches and shores with a soft bottom are rare.

During the observation history, one of the clearest environmental effects of the power plant has been the eutrophication of the aquatic vegetation at the southern and south-western shorelines of Hästholmfjärden. Among the species benefiting from cooling waters are perennial asexually reproduced vascular plants and fast-growing filamentous algae. Filamentous algae have also benefited from the general increase in nutrients in the area. Changes in vegetation have been most evident in the water area that remains open in the winter. Through the lengthened period of open water, the heat load affects the amount of light, length of the growing season and the dormant winter period.

In the 2005 survey, vegetation in the area was still very eutrophic. The diversity of vegetation in many lines had continued to diminish, and hornweed, which prefers habitats with high nutrient availability, has proliferated in many places. Abundant loose filamentous algae were also observed at places along the Hästholmen shore zone.

Warm water discharges have also been found to have an effect on the overwintering of plants and the length of growing season. Changes in vegetation have been most significant in the water area that remains open in the winter. (*Mattila and Ilus 2006*)

Sea bed fauna

The sea bed fauna of the Loviisa area is rather scarce, both for species and quantity (*eg. Ilus 1993, 1998*). For Hudöfjärden and Hästholmsfjärden, black sulphide sludge bottom with little sea bed fauna was typical in the 1960s (*Bagge and Voipio 1967*).

The density of fauna and the biomasses has, however, continued to go down for the last 20 years. The regression of sea bed fauna is not only peculiar to the Loviisa sea area; the regressive development is much wider. A bioindicator survey carried out in the entire east Uusimaa archipelago has shown that in a large part of the southern coast of Finland, the sea bed fauna has been disturbed or strongly disturbed (*Henriksson ja Myllyvirta 1991, 1992*). The most significant factor contributing to the scarcity seems to be the low salt content of the water; it often limits the habitat of many saltwater species such as the Baltic tellin, but, on the other hand, is too high for many sweet water bottom fauna (*Ilus 1993, 1995, 1998*).

Another reason for the scarcity of bottom fauna in the Hästholmsfjärden basin seems to have been the increase of organic matter in the bottom sediment caused by eutrophication. This has led to poorer oxygen conditions in the basins and repeated hydrogen sulphide periods (*Ilus 1998*).

Distinct changes have occurred in the species of the Hästholmsfjärden bottom fauna since the beginning of the 1970s. These changes are evidence of changes in environmental factors. New species, such as the blue mussel, have spread to the cooling water discharge location. The arrival of these species seems to be connected to the increase in the salt content of the water caused by the cooling water (*Ilus 1993*). A newcomer to our coastal waters, the polychaete, has become more common in recent years, which may at least partially explain the disappearance of other bottom fauna (*Ilus 1996, 1998*).

In 2006, bottom fauna was scarce at most of the observation points. During the observation period, bottom fauna communities have regressed, become less diversified and even collapsed at most of the observation points, which is due to a significant deterioration of the quality of the sea bed. The diversity of the bottom fauna has only increased in front of the cooling water discharge opening. In addition, the warm water seems to offer suitable conditions for many invasive species, such as the polychaete and the Gammarus tigrinus. (*Mattila and Ilus 2007*)

In the annual report of 2004, the mussel species defined as zebra mussel was in 2005 shown to be another species – the dark false mussel that has not been found in the Gulf of Finland before. The mussel population is extremely dense near the cooling water discharge location, and dense colonies were found all around the Hästholmsfjärden. The mussel has also spread to Hudöfjärden and near the cooling water intake opening. In 2005 the species was also found in the Pernaja archipelago. (*Mattila and Ilus 2006*)

6.8.3 Fish and fishing

The fish population and fishing industry of the area has been monitored within a five-kilometre radius of the plant since 1971 and in the area located to the west consisting of the Kejvsalö, Käldö and Tjuvö waters since 1983. Experimental fishing has been performed in the monitored area using nets and long lines. Also nutrient and migration surveys, fishing surveys of recreational fishers and annual interviews of professional fishermen have been carried out.

The fish population of the area consists of local and migratory species. The sprat population has been traditionally weak around Hästholmen as in the entire Baltic Sea, but has recently increased. The Baltic herring population is good, but due to declining demand the fishing of Baltic herring has been reduced. Common whitefish and vendace are found near the power plant only occasionally. The common whitefish population has, however, increased due to frequent restocking. The vendace population is not strong enough for fishing.

Salmon and trout populations are relatively strong, mostly because of the restocking carried out where Kymijoki flows into the sea. During the cold season, plenty of trout can be found near the cooling water discharge area. In spring, when the ice melts, the trout move on to the open sea. Salmon are seldom found in Hästholmsfjärden; generally, salmon remain in the outer sea.

The codfish population was strong in the early years of the 1980s, significantly affecting the populations of many other species, such as the burbot. In the latter half of the 1980s, codfish started to disappear rapidly. Currently, it is not found in the area at all. However, the population of burbot has recovered after a low point in the 1980s, along with the disappearance of codfish. At present, the burbot population of the area can be considered normal. (*Vesihydro Oy 1998*)

There is a strong population of perch and pike-perch in the area. The reproduction conditions of the area are especially favourable to the pike-perch. The pike and bream populations are normal. The populations of brack clams, such as roach, silver bream and ide, have strengthened during recent years due to general eutrophication and insignificant fishing. (*Vesihydro Oy 1997; 1998*)

Other fish species in the area include flounder, eel, smelt, eelpout and foulhorned sculpin. The populations of the eelpout and the foulhorned sculpin have been strongly influenced by variations in the codfish population. The smelt population in the monitored area has varied from one year to another. Generally, the development of the fish populations in the area follows general changes happening in the coastal waters of the Gulf of Finland, the most evident of which have recently been the eutrophication and the strong variations in the codfish population due to fluctuations in the salt content of the Baltic Sea.

Fishing industry

The number of professional fishermen in the area has diminished continuously as fishermen have aged and retired. New entrepreneurs have not entered the business. In 2006, eight households practised professional fishing in the research area. For six of these, fishing was the primary or secondary occupation. Two of the households fished only for their own use. Three of these fishermen only fished during the open water season. Others fished around the year when allowed by the ice conditions.

In the area of Kejvsalö, Käldö and Tjuvö, professional fishing is practised fairly evenly around the year. In a radius of five kilometres from the power plant, fishing mainly occurs during the open water season. The professional fishermen mainly use sink gill nets, but also fyke net fishing is fairly common. For fishermen who fish only for their own use or for recreational purposes, simple hook and line and spinning rods are the most common equipment, in addition to nets.

The total catch by professional fishermen within a radius of five kilometres of the power plant was approximately 11,090 kg in 2006. The most common species for professional fishermen were pike-perch and pike, but also salmon, perch, bream and burbot were important species. The share of Baltic herring, earlier an important species, was only about one per cent. At the beginning of the 1990s the share of Baltic herring was 20%. The most common species for home use and recreational fishing are pike and perch. (*Fortum Power and Heat Oy 2006, Raunio and Mäntynen 2007*)

6.8.4 Use of the water area

In addition to professional and recreational fishing, the waters are used for the Loviisa power plant cooling water intake. There are no other water intakes in the power plant's cooling and waste water discharge area.

On the Hästholmen island, Oy Loviisan Smoltti Ab produces fry for restocking the waters. The fry are raised in tanks built on the land, utilising the warm cooling water from the Loviisa power plant. The Radiation and Nuclear Safety Authority (STUK) monitors the radioactivity of the fish through regular samples.

There are no common beaches or recreational areas within a kilometre of the power plant, but approximately two kilometres to the northwest of the plant on the shore of Hudöfjärden there is the Källan camping centre and its beach. There are also three other beaches closer to the Loviisa town centre. Along the Klobbfjärden, approximately three kilometres from the power plant, there are shore areas that are designated for recreational use in the regional plan of eastern Uusimaa.

Next to the gate of the plant site there is a concrete pier of the Road Office and a small boat harbour with room for about 30 boats, to be used by both Fortum personnel and the public. In addition, there is a wooden pier owned by Fortum to the north of the gate, with room for approximately 25 boats of Fortum personnel.

6.9 Flora and fauna

The Loviisa region represents a typical forest, coast and archipelago landscape of eastern Uusimaa. There are only minor differences in altitude in the area and most of the land remains below the altitude of 20 metres. Small patches of bare rock are common, but there are no extensive areas of rocky soil. No nationally or regionally endangered plant species are found in the area (*Siitonen et al. 1997*).

Forest covers more than half of the ground of Uusimaa and Loviisa. The shares of different tree species vary greatly in different parts of the area, but as a result of extensive felling the area is currently rather open. On Hästholmen, the trees are old and the species distribution is natural. (*Siitonen et al. 1997*)

Due to the broken shoreline, varying soil types and numerous islands, the shore vegetation of the area is diversified. On Hästholmen, the original vegetation has made room for the buildings within the plant site. From the botanic geography point of view, the Loviisa region belongs to the southern part of the taiga zone and, more specifically, the southwestern part of it. This part of the southern taiga has the most favourable climate and rich vegetation. The rich grass-herb vegetation and groves differentiate the area from the rest of Southern Finland. The demanding vegetation of the area includes the hepatica, yellow anemone and wood anemone, lung-wort, pilewort, white satin flower, fumitories, wall lettuce, alternate-leaved golden saxifrage and tor-grass. Also ash, European hazel and European white elm have spread to the area.

Excluding the nuclear power plant and its structures, most of the Hästholmen and Tallholmen terrain is in its natural state. There are old pine forests and small woods of tall aspen. Special worth should be given to the unbuilt shoreline in an area that has been built almost to capacity. The area has local significance mainly for the natural shoreline and old forest. There is an extensive common alder grove and shore forest with a very representative variety of wood species on the neck of land between Hästholmen and Tallholmen, mostly on the side of Hästholmen. The neck of land has local significance as a habitat and for its vegetation. (*Siitonen et al. 1997*)

The southwestern part of the southern taiga also stands out from other areas in fauna maps; for example, the population of birds nesting on the ground is larger than in other parts of the Southern Finland. Even though there is a great variety of species, there are hardly any rare species. The fauna is a combination of the species of Central European broad-leaved forests and Siberian coniferous forests. There are no endangered species on Hästholmen.

6.10 Conservation areas

There are several nature conservation areas in the archipelago of eastern Uusimaa. The Källauden - Virstholmen area located approximately 1.5 kilometres from the power plant, the sea conservation area about two kilometres away in the bays and archipelago of Pernaja and the Kullafjärden bird waters and the bays slowly separating themselves from the sea at Vahterpää, seven kilometres away from the plant, are parts of the Natura 2000 network.

The Källaudden - Virstholmen area (FI0100080) is located on the coast and the sea in the eastern part of Loviisa two kilometres from the plant to the northwest. The area has been added to the Natura network based on the Habitats Directive. Within the ridge conservation programme, the ridge formation in the area has been found to have national value. The entire area is a part of the national ridge conservation programme. It has representative vegetation, landscape and geomorphology and has value based on the development caused by land uplift.

The sea conservation area of the Pernaja bays and archipelago (FI0100078) is a wide sea area starting from the Pikkupernajanlahti in the west and ending at the border of the territory of the Uusimaa regional centre in the east. In the outer sea, the area reaches the outer border of the inner territorial waters of Finland for the most part. The sea conservation area of the bays and archipelago of Pernaja is, among other things, a landscape of national value, forming an internationally valuable ecological system. Many parts of the area have been found to have national value, and they belong to various conservation programmes. Several nature types included in the Habitat Directive are well represented in the area, and the value of the variety of species is increased by several species included in the Birds Directive. The area has been added to the Natura network based on both the Habitats Directive and the Birds Directive.

To the west of the power plant support area on the mainland there is the old Svartholma sea fortress, which is also relevant to the history of the islands in the Källauden - Virstholmen Natura area. The graveyard of the fortress is located on Begravningsholmen, and Krutkällarholmen has the foundation of the old gunpowder warehouse. The Svartholma sea fortress is a historical site of national importance. It also has importance for the national cultural history (*Museovirasto 2007*). There is a camping site at Källarevet, and the nearby beach is public.

The Kullafjärden bird waters (FI0100081) and Vahterpää bays slowly separating from the sea (FI0100083) are included in the Natura areas in the municipality of Ruotsinpyhtää. Kullafjärden (Kullalahti) is a bird nesting area of national value in the Taasianjoki delta. The Vahterpää area consists of shores and waters located at the end of the long Vahterpää peninsula in the southeastern part of Ruotsinpyhtää. The area consists of two bays separating from the sea (Hamnfladan and Furufladan), a bay already completely detached from the sea (Lillfladan) and the shores of Hamnfladan and Lillfladan.

Approximately three kilometres from the Loviisa power plant there is the Kuggen bird conservation area. The small Hudö and Lilla-Hudö islands and other minor islands near them, about four kilometres of Hästholmen to the southwest, are a nature conservation area. North of Hästholmen, on the mainland, the nearest areas protected by the Nature Conservation Act are located in Kristianslandet.

Källa and Hamnholmen, both included in the national ridge protection programme, are located about two kilometres from Hästholmen, west of the accommodation area of the power plant. The ridge area has representative vegetation, landscape and geomorphology plus value based on the development caused by land uplift.

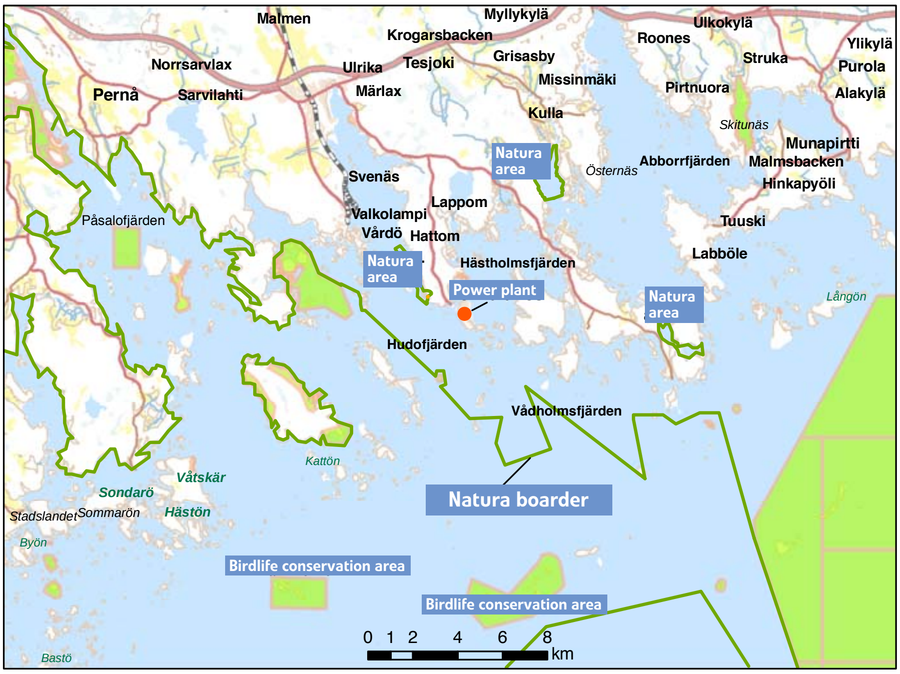


Figure 6-6. The areas included in the Natura programme and nature conservation areas.

6.11 Radiation

The Loviisa power plant has a programme for monitoring the radiation in the plant environment, referred to in Government Decision 395/1991, section 26 and described in the Guide YVL 7.7 of STUK, used to monitor radioactive emissions and concentrations in the environment. The monitoring programme includes measurements of external radiation and determination of radioactive substances in the air and in samples representing the various parts of the food chains of man, as well as determinations of the internal radioactivity in man. In addition, samples of so-called indicator organisms that collect or enrich radionuclides from the emissions are included in the programme. Approximately 500 analyses are carried out every year within the programme, taken from different locations and at different times of the year.

External radiation is measured continuously. These measurements yield real-time information on changes in the radiation level in the environment. The equipment is a part of a national radiation measurement network, thus serving regional monitoring. The results of the measurements are available to the Ministry of the Interior and the Radiation and Nuclear Safety Authority in real time.

Detecting radioactive substances in the nature is technically easy, and even very small concentrations of substances can be identified. Therefore, man-made radioactive substances can be distinguished from natural radioactive substances, such as uranium in the earth, and the radioactive products such as radon generated when uranium disintegrates. In addition to radiation originating in the soil and the human body, the radiation coming in from space also increases the radiation dose.

Plenty of natural radioactive substances are found around the Loviisa power plant, just as anywhere else in nature. Man-made radioactive substances are much rarer. These are released from the Loviisa power plant or caused by other reasons, such as testing of nuclear bombs or the Chernobyl accident. Compared to the natural concentrations of radioactive substances in the Loviisa region, these concentrations are of an insignificant size.

Radioactive substances originating from the operation of a nuclear power plant are effectively filtered, and any releases into the natural environment are low. Radioactive substances originating from the Loviisa power plant have been mainly detected in the aquatic environment, for example in the sediment of the sea bed and organisms that effectively collect radioactivity (for instance Saduria entomon) and are not used as human food. Radioactive substances originating from the power plant have been detected in the seawater only in exceptional circumstances, and never in fish. Air and fallout samples show very minor amounts of radioactive substances a few times per year, originating from airborne releases from the Loviisa power plant. Radioactive substances originating from the power plant have never been detected in soil, grazing grass, milk, garden products, crops, meat or drinking water.

The radiation caused by emissions from the Loviisa nuclear power plant is very minor in comparison to the average radiation dose received by Finns from other sources of radiation, which amounts to approximately 3700 microsievert (µSv) annually. Annual radiation doses to the people living in the vicinity of the power plant are calculated based on radioactive releases from the power plant. The maximum allowable radiation dose is 100 microsievert (μSv) per year. The radiation dose of the nearby residents with the most exposure to emissions into the air and the sea in 2006 was approximately 0.1 microsievert (μSv). The radioactivity of the people living in the vicinity of the power plant is regularly measured.

7 ENVIRONMENTAL IMPACT ASSESSMENT AND THE METHODS USED THEREIN

7.1 General

The assessment of environmental impacts focuses on those impacts that are considered and felt to be significant. Information about issues felt important by citizens and various interest groups is obtained in connection with the interaction, survey among residents, and the notification and hearing procedures, among other things.

The significance of environmental impacts is assessed on the basis of, for example, the settlement and natural environment of the observed area as well as by comparing the tolerance of the environment with regard to each environmental burden. In addition to the investigations carried out, the existing specifications, such as release limits for radioactive materials, will be employed in assessing the environmental tolerance.

The results of the environmental impact assessment will be collected in the Environmental Impact Assessment Report (EIA report). Relevant existing environmental data, as well as the results of the prepared environmental impact assessments, will be presented in the EIA report. The EIA report will also present a plan for the mitigation of detrimental environmental impacts.

The delimitations of the environmental impact assessment in terms of each specific impact, the environmental impacts to be investigated and the methods to be used are presented below. The delimitation of the observed and affected areas is presented in connection with the description of each impact assessment.

The observed area is aimed to be so largely defined that significant environmental impacts cannot be expected to manifest themselves outside it. If, however, it becomes apparent during the assessment work that a specific environmental impact has a respective affected area larger than is estimated, the scope of the observed and affected areas will, in that connection, be redefined with regard to the impact in question. The actual definition of affected areas will thus be carried out in the environmental impact assessment report as a result of the assessment work.

7.2 Assessment of environmental impacts during construction

The environmental impacts occurring during the construction of the power plant will be examined separately because they differ from the impacts occurring during the operation of the power plant in terms of temporal duration and partly also with regard to other characteristics.

The EIA report will describe the construction work and traffic arrangements carried out during construction, and present the means of transport used. The routes of construction-time traffic will also be described and examined in the vicinity of roads leading to the power plant site.

The assessment report will also discuss the impacts of blasting on the accident risk of existing power plant units, and the dust and noise impacts caused by the construction activities. Other construction activity arrangements to be assessed are, for example, the utilisation or disposal of soil and rock waste, the handling of waste water and waste management during the work, the construction of loading and unloading place in the shore and the effects caused by the construction of the route leading to it.

The impacts of the construction on, for example, soil and bedrock, water systems, vegetation and animals, as well as the social environment, such as employment and comfort, are estimated to be taken into consideration in the feedback received, among other things, in connection with the interaction.

7.3 Assessment of environmental impacts during operation

The image below shows the activities causing environmental load during the use of the plant from the perspective of the nearby environment.

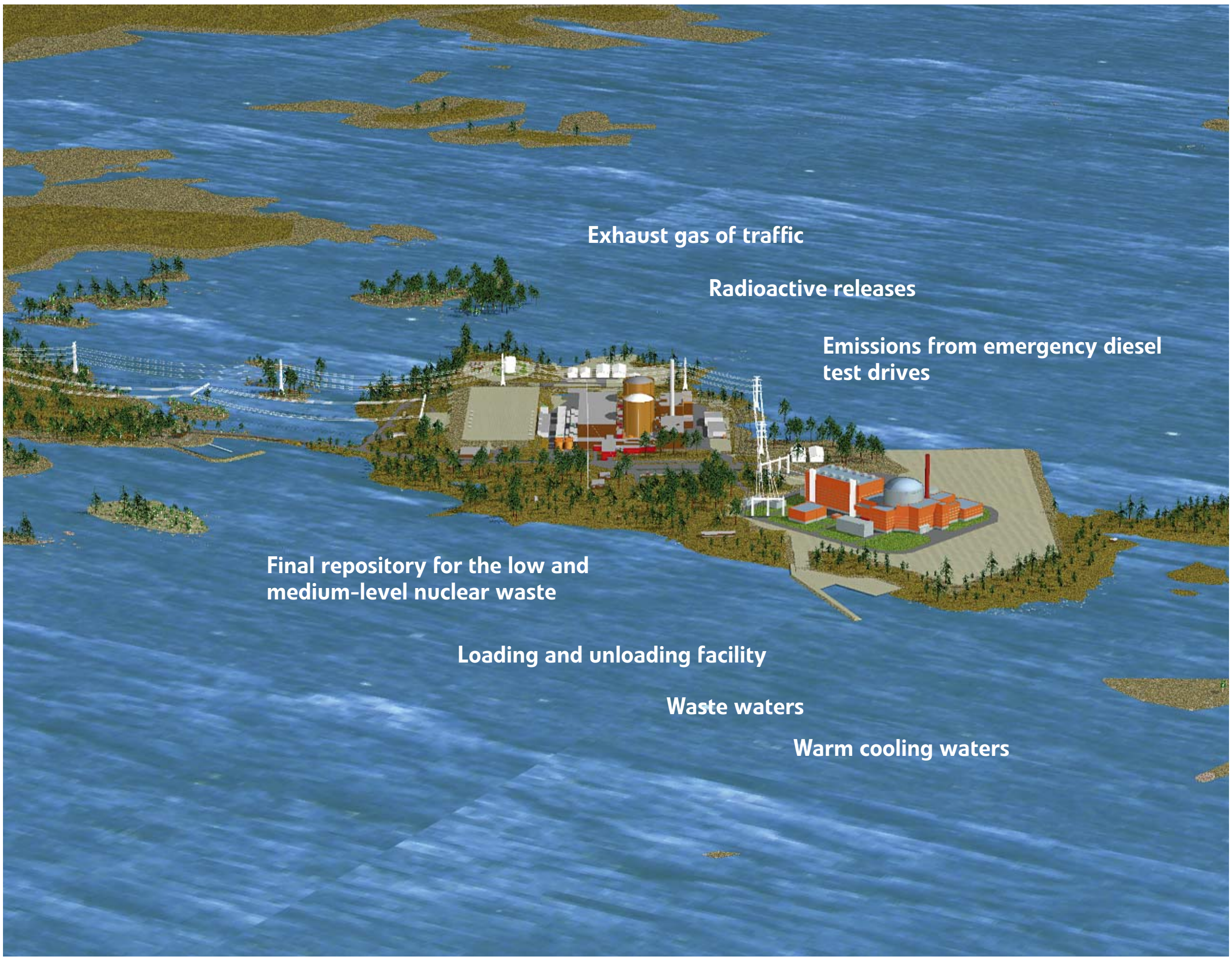


Figure 7-1. The activities causing environmental load in the nuclear power plant.

7.3.1 Assessment of air quality and climate impacts

The radioactive and other airborne releases arising from the operation of the planned power plant will be presented. Their impact on the environment and people will be assessed based on the existing research findings.

In the nuclear power plant being assessed, the electricity production will not cause any flue gas releases and the positive impact on air quality results from the avoidance of release quantities equal those arising from the production of a similar amount of electricity.

7.3.2 Assessment of water system impacts

The current water supply in the power plant is inadequate for the needs of the construction stage and the new power plant. The assessment report clarifies the options to arrange water management and the environmental impacts of the options.

The waste water load and radioactive releases to the sea occurring during the operation of the new power plant will be presented. The impacts of cooling and waste water on water quality and biology, as well as on the fish population and fishing industry, will be assessed based on the existing research data and the results of spreading model calculations.

It has been noticed that the cooling waters of the current power plants in Loviisa impact on the temperature of seawater from 3 to 5 kilometres from the power plant during the open water season. In winter, the warm cooling waters have been noticed even further out, and the ice conditions have become weaker in larger areas.

The impact of the different cooling water discharge places on the temperature of seawater in the discharge areas will be examined with a three-dimensional calculation model. The examination covers the cooling waters of both the current power plants and the new power plant. The result will be the spreading calculations for the background of the environmental impact assessment.

The model calculations for the spreading of cooling waters and the assessment on the effects on temperatures in the sea area cover an area of 150 square kilometres, the emphasis being on the sea area westwards from the power plant.

7.3.3 Assessment of the impacts of waste and by-products and their treatment

The EIA report will describe the quantity, quality and treatment of municipal waste, hazardous waste, low-level and intermediate-level power plant waste, and the decommissioning waste generated at the power plant, and assess the related environmental impacts.

The environmental impacts of the disposal of spent nuclear fuel are described utilising the results of the environmental impact assessment procedure carried out by Posiva Oy in 1999, as well as the assessments made thereafter.

7.3.4 Assessment of soil, bedrock and groundwater impacts

The impacts on the soil and bedrock of the location will be assessed according to the geography and the quality of soil.

To assess the impacts on groundwaters, the location of the power plant with respect to groundwater areas and the possible risks imposed on groundwaters due to construction and operation will be examined.

7.3.5 Assessment of impacts on vegetation, animals and objects of protection

The project's direct and possible indirect impacts on vegetation and animal populations will be assessed. On the basis of these results, the impacts of the alternatives for the project on biological diversity and interactions will be assessed.

The question of whether the project, either individually or in combination with other projects and plans, is likely to have a significant adverse effect on the ecological values that serve as the conservation basis of the nearest Natura areas will be reviewed in the assessment work. Based on the review it will be decided whether a Natura Assessment according to 65§ Nature Conservation Act will be made.

7.3.6 Assessment of impacts on land use, structures and landscape

The project's impacts on the landscape, present and planned land use, and the built environment will be assessed in terms of the land use plans and development of the area.

The landscape impacts will be assessed based on the plans prepared for the project, existing reviews and terrain visits, and map and air photo investigations. Landscape changes will be due to the power plant itself and the related activities. The characteristics of the environment in the vicinity of the location site alternatives, as well as the sites of value in the landscape and cultural environment, will be described by means of text, maps and photographs. The question of whether the new power plant will change the landscape characteristics of the sites, from which direction the view towards the location will change significantly, and whether significant impacts on the sites of value in the landscape and environment will arise will be examined in the impact assessment. Landscape impacts will be illustrated by means of photomontages, which will be prepared on photographic templates taken from viewing points that are central in terms of people's passage. The impacts on residential and recreational areas in the vicinity of the location sites will be examined in particular detail.

The observed area in terms of landscape is the one where the power plants can clearly be distinguished from the landscape.

7.3.7 Assessment of impacts on people and society

Health effects, living conditions, comfort and recreational activities

The environmental impact assessment will clarify the impacts on people's health, comfort and living standards in terms of land use changes, landscape impacts, increased radiation dosages caused by radioactive releases, water system impacts, traffic impacts, traffic safety, employment impacts and noise. In addition to the above, the assessment report will also discuss the impacts of potential accidents. The starting point is the present state of the area and the change imposed on it by the project. The focus areas of the assessment will be selected based on the feedback received from the residents and commuters in the area.

The increase in radiation dosages for residents in the surrounding area caused by radioactive releases from the new power plant will be assessed. Health impacts and risks will be assessed using calculations based on radiation exposure. The impact of radioactive releases from the Loviisa power plant is assessed for a large area according to the provisions of authorities. Radiation monitoring covers the vicinity of the power plant, to a range of approximately 10 kilometres from the power plant. The above-mentioned current radiation observation area will be used as the observed area for the impact of radioactive releases caused by the normal operation of the new power plant.

The project's impact on recreational opportunities and living comfort will be assessed, for example, on the basis of traffic volume changes and impacts on water systems. Noise impacts will be assessed based on the results of noise measurements carried out in the vicinity of the power plant area, the design data, the experience gained from other similar operations, and the data and standards concerning the level of environmental noise. A noise report on the noise impact caused by the new power plant will be prepared.

A resident survey and, if required, thematic interviews will be carried out to investigate the attitudes of nearby residents towards the project and to support the assessment of social impacts. The interaction in the audit group and the discussion meetings, as well as the information obtained from various interest groups and the media, will serve as a tool for assessing the project's impact on people.

The impacts on people's health and comfort are assessed using the human impact assessment guidelines prepared by Stakes, the National Research and Development Centre for Welfare and Health (www.stakes.fi). The guidebook on the application of the Finnish law on EIA in the assessment of health and social impacts, published by the Ministry of Social Affairs and Health (Ministry of Social Affairs and Health 1999), will also be utilised in the assessment.

Regional structure, economy and employment

The assessment report will estimate the amount of direct and indirect employment created in the Loviisa region by the construction and operation of the power plant. In addition, the impact of the project on the development of economic structure, the operational planning of society and the future plans of local enterprises. The impact of the project on the regional and municipal economy will be examined in separate surveys.

In the assessment of socioeconomic and social impact, the observed area is the economic area of Loviisa region, including Loviisa, Lapinjärvi, Liljendal, Pernaja, Pyhtää and Ruotsinpyhtää. When observing the socioeconomic impacts, the regional and provincial level observation is partly made in a wider region in the province of East Uusimaa.

7.3.8 Assessment of the environmental impact of traffic

The most remarkable traffic impacts are caused when constructing the power plant. Changes to the current traffic volumes arising from transportations, as well as the means and routes of transportation, will be presented. The noise impact and the impacts on comfort and traffic safety caused by traffic will be assessed on the basis of the traffic changes affecting residential areas. The required changes to the traffic arrangements in these areas, as well as their impacts, will be assessed.

The Loviisa power plant traffic runs from Atomitie to Saaristotie, after which the traffic merges with the traffic of the City of Loviisa and vica versa. This road section of 12 kilometres is used as the observation area for the impacts of traffic. The affected area is limited to the immediate vicinity of the road.

Ship traffic to the loading and unloading place in Hästholmen is mainly limited to the construction period. The observation area for the impacts of ship traffic is the traffic section from Valko harbour to Hästholmen.

7.3.9 Assessment of the impacts of exceptional and accident situations

The EIA report will discuss the environmental impacts of exceptional situations based on the safety analyses and accident modelling assessments prepared for the current power plant units, as well as on the requirements imposed on the new power plant. Other contemporary threats, such as the effect of climate change, will also be considered in the assessment. The consequences of exceptional situations will be assessed based on the extensive research data on the health and environmental impacts of radiation.

The safety assessments to be carried out for the purpose of applying for a construction and operating license pursuant to the Nuclear Energy Act, as well as other types of surveillance, will also be described. The assessment report will also include the current emergency arrangements for a nuclear accident.

The impacts of spreading accident release are observed to the area of neighbouring countries up to 1,000 kilometres from the power plant.

7.3.10 Assessment of the impacts of power plant decommissioning

The assessment report will present the different decommissioning phases of the new power plant, the types of decommissioning waste generated and their treatment, as well as the environmental impacts relating to them. In addition, possible land use in the plant's location after decommissioning is inspected.

7.3.11 Assessment of the impacts of nuclear fuel production and transportation

The most important potential procurement sources of uranium and its enrichment and fuel manufacture will be examined and the environmental impacts of nuclear fuel production and transportation will be described according to the existing clarifications.

7.3.12 Assessment of associated projects

The assessment observes the impacts of the 110 kV power line that may be built next to the current power lines from Hästholmen to the national grid. The assessment report presents the power line route, the need for land and an assessment of the environmental impact in the construction and usage phase of the power line.

The extent of the new power line's observation area between the power plant and the national grid connection point will be determined according to the observed impact. The largest observation area will be defined by the visual impact of the power line - that is, the extent to which the towers and their conductors are visible in the landscape.

The amount, as well as the storage method and time, of the spent fuel generated by the new power plant will be described. The material concerning the disposal of spent fuel prepared by Posiva Oy in 1999 in connection with the respective EIA procedure, as well as subsequent reviews, will be utilised in the description of environmental impacts.

The new power plant will increase the volume of traffic to Hästholmen during the construction phase in particular. The increase in traffic volumes may require refurbishing the road 1583. The possible detrimental effects arising from the increased traffic volumes, as well as the options for mitigating them, will be examined.

7.4 Assessment of zero-option impacts

The zero-option is the non-implementation of the project.

The production method or location of the electricity procured from other electricity producers cannot be predicted far into the future, and, similarly, opportunities to participate in the new projects of other players cannot be predicted. The local environmental impacts of electricity production will be imposed on the location where electricity is produced at the time and depend on the respective production method. Possible global impacts (for example, those of carbon dioxide emissions) will naturally also be imposed on the Loviisa region.

The environmental impacts of the zero-option are assessed by taking a brief look at public estimates of the emissions from different methods of electricity production.

7.5 Comparison between alternatives

The impacts of different alternatives will be compared by means of a qualitative comparison table. The major environmental impacts of different alternatives – positive, negative and neutral alike – will be recorded in this table in an illustrative and uniform manner. The environmental feasibility of the alternatives will also be assessed in this connection, based on the results of the environmental impact assessment.

The information received from several different viewpoints in connection with the resident survey will serve as a tool for assessing the significance of the project's impact. The assessment of the significance will also be handled in a steering group that will comment on and modify the preliminary significance assessment in its meeting. The opinions of residents, steering group and operating agencies will be recorded in the EIA report.

8 LICENCES, PERMITS, PLANS, NOTIFICATIONS AND DECISIONS REQUIRED FOR THE PROJECT

8.1 Licences and permissions pursuant to the Nuclear Energy Act

8.1.1 Decision-in-principle

According to the Nuclear Energy Act (990/1987), the construction of a nuclear facility of considerable general significance shall require a Government decision-in-principle in that the construction project is in line with the overall good of society. A decision-in-principle is applied for by submitting an application to the Government, on which the Ministry of Trade and Industry must obtain a preliminary safety assessment from the Radiation and Nuclear Safety Authority and a statement from the Ministry of the Environment as well as from the municipal council of the municipality intended to be the site of the facility and from its neighbouring municipalities.

Before the decision-in-principle is made, the applicant shall, according to instructions by the Ministry of Trade and Industry, compile an overall description of the facility, the environmental effects it is expected to have and its safety. The Ministry of Trade and Industry shall provide residents and municipalities in the immediate vicinity of the nuclear facility as well as the local authorities with an opportunity to present their opinions on the project before the decision-in-principle is made. Furthermore, the Ministry shall arrange a public gathering in the municipality in which the planned site of the facility is located and during this gathering the public shall have the opportunity to give their opinions. Those opinions shall be made known to the Government.

The Government decision-in-principle shall be forwarded to Parliament for perusal. Parliament may reverse the decision-in-principle as such or may decide that it remains in force as such.

8.1.2 Construction licence

The Government grants the licences to construct and operate a nuclear facility. A licence to construct a nuclear facility may be granted if the decision-in-principle ratified by Parliament has deemed the construction of a nuclear facility to be in line with the overall good of society and the construction of a nuclear facility also meets the prerequisites for granting a construction licence for a nuclear facility as provided in section 19 of the Nuclear Energy Act. These preconditions include:

- the plans concerning the nuclear facility entail sufficient safety, and the protection of workers and the safety of the population have been appropriately taken into account
- the location of the nuclear facility is appropriate with regard to safety and environmental protection has been appropriately taken into account
- the methods and plans available to the applicant for arranging nuclear fuel and nuclear waste management are sufficient and appropriate
- the applicant has available the necessary expertise, possesses sufficient financial prerequisites, and is otherwise considered to have the prerequisites to engage in operations safely and in accordance with Finland's international contractual obligations.

8.1.3 Operating licence

The licence to operate a nuclear facility may be issued as soon as a licence has been granted to construct it, providing the prerequisites listed in section 20 of the Nuclear Energy Act are met. These preconditions include:

- the operation of the nuclear facility has been arranged so that the protection of workers, the population's safety and environmental protection have been appropriately taken into account
- the methods available to the applicant for arranging nuclear waste management are sufficient and appropriate
- the applicant has sufficient expertise available and, in particular, the competence of the operating staff and the operating organisation of the nuclear facility are appropriate
- the applicant is considered to have the financial and other prerequisites to engage in operations safely and in accordance with Finland's international contractual obligations.

Operation of the nuclear facility shall not be started on the basis of a licence granted until the Radiation and Nuclear Safety Authority has ascertained that the nuclear facility meets the prerequisites prescribed by law and the Ministry of Trade and Industry has ascertained that provision for the cost of nuclear waste management has been arranged in a manner required by law.

8.1.4 Notifications pursuant to the Euratom Treaty

The European Atomic Energy Community (Euratom) Treaty requires that each Member State provides the Commission with plans relating to the disposal of radioactive waste (Article 37) and that the licensee declares to the Commission the technical characteristics of the installation for its control (Article 78) and submits an investment notification (Article 41).

8.1.5 Environmental permits during construction

A separate environmental permit is required if a rock-crushing plant with operating time exceeding 50 days per year is located in the area during construction work. The licensing authority is the environmental authority of the Loviisa municipality.

8.2 Building permit

A building permit in accordance with the Land Use and Building Act (132/1999) must be applied for in connection with all new buildings. The building permit is obtained from the building permit authorities of the Loviisa municipality (Municipal Building Board), which, when granting the permit, will ensure that the construction plan is in accordance with the local detailed plan and the building codes. The building permit is required before the construction can be started. The issuance of a building permit also requires that the environmental impact assessment procedure has been completed.

Section 159 of the Aviation Act (1242/2005), which entered into force in early 2006, requires that a flight obstacle permit is needed for the erection of equipment, a construction or a sign if the obstacle extends more than 30 metres above the ground level. The permit is an appendix to the building permit. The statement of Finavia (the provider of air traffic services) about the obstacle must be included in the permit request (*Finnish Civil Aviation Authority 2007*).

8.3 Environmental permit and water permit pursuant to the Water Act

An environmental permit must be obtained for a power plant. A permit is required for the operations based on the Environmental Protection Act (86/2000) and the Environmental Protection Decree (169/2000) enacted on the basis of the Environmental Protection Act. An environmental permit covers all matters relating to environmental impacts, such as atmospheric and aquatic releases, waste and noise matters, as well as other related environmental matters.

The permit authority for the project is the Western Finland Environmental Permit Authority. The permit authority grants the environmental permit if the operations fulfil the requirements prescribed by the Environmental Protection Act and other legislation. In addition to the above, the project must not contradict with the land use planning of the area. The environmental impact assessment procedure must also be completed before the permit can be granted.

A water permit pursuant to the Water Act (264/1961) is required for the water intake relating to the operation of the power plant. The permit authority for the project is the Western Finland Environmental Permit Authority.

8.4 Other permits

Other permits of relevance with regard to environmental matters mainly include technical permits, the primary purpose of which is to ensure occupational safety and prevent material damages. These include, among others, a permit for draining wastewaters into the sewage system, permits concerning flammable liquids, pressure equipment permits, and permits pursuant to the Chemicals Act.

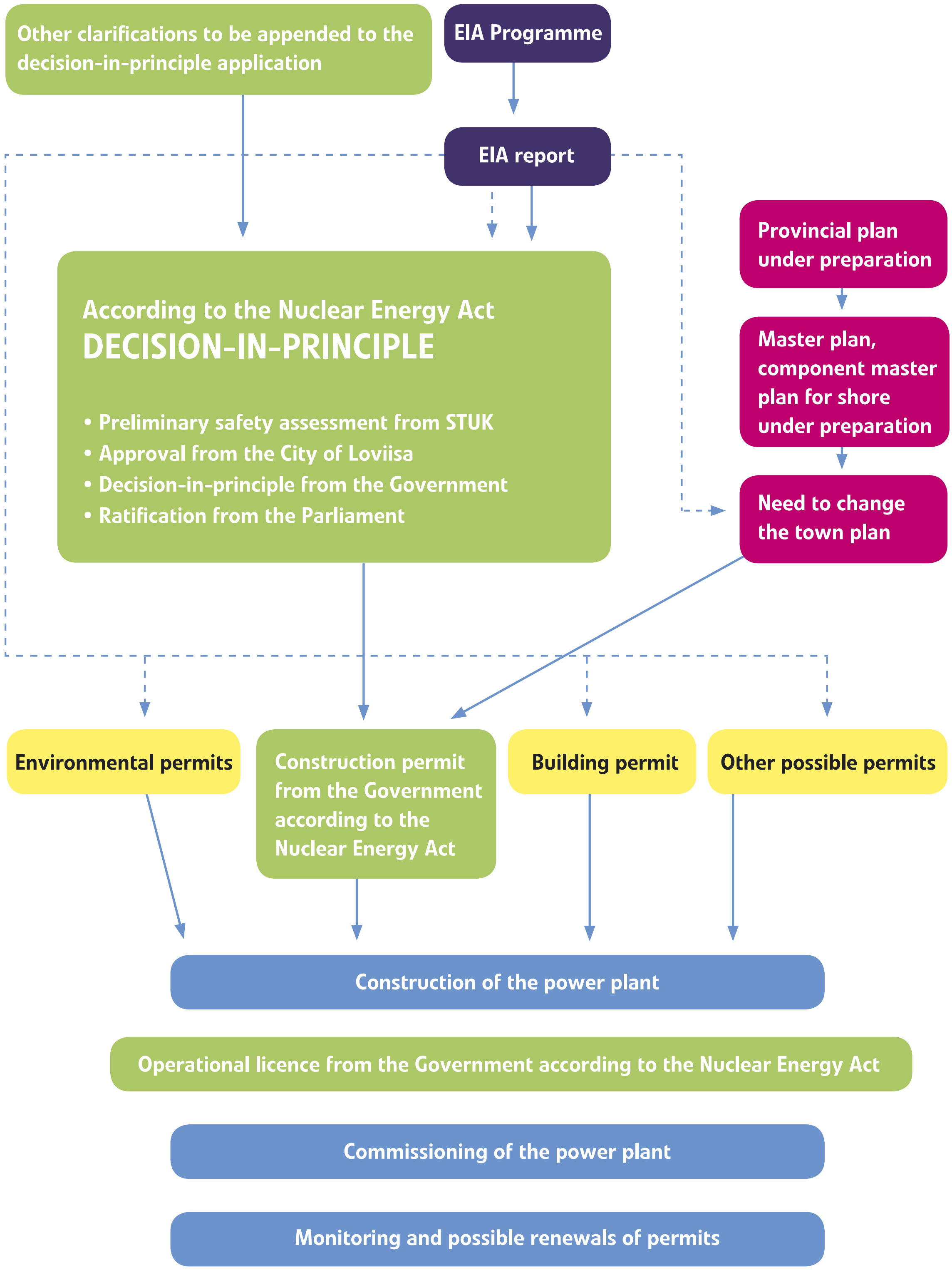


Figure 8-1. Permit phases in the construction and use of Loviisa 3 nuclear power plant. The broken line presents the connections between the permit processes in which the EIA report will be used as material for decision-making.

9 MITIGATION OF ADVERSE IMPACTS

The possibilities for preventing or mitigating the adverse impacts of the project, and its associated projects, by means of design or implementation will be investigated during the assessment work. A report on the mitigation measures and nuclear safety systems will be presented in the assessment report.

10 UNCERTAINTY FACTORS

The available environmental data and the assessment of impacts always involve assumptions and generalisations. Furthermore, the available technical data is very preliminary at this stage. Lack of sufficient data may cause uncertainty and inaccuracy in the assessment work.

The potential uncertainty factors will be identified as comprehensively as possible during the assessment work, and their impact on the reliability of impact assessments will be considered. These issues will be described in the assessment report.

11 PROJECT IMPACT MONITORING

A proposal for the content of the environmental impact monitoring programme will be prepared in connection with the impact assessment.

The monitoring aims at:

- providing information about the project's impacts
- investigating which changes have resulted from the project implementation
- investigating how the results of the impact assessment correspond with reality
- investigating how the measures for mitigating adverse impacts have succeeded
- initiating the required measures if significant unforeseen adverse impacts occur.

12 LITERATURE

Anttila P. 1988. Engineering geological conditions of the Loviisa power plant area relating to the final disposal of reactor waste. - Voimayhtiöiden ydinjätetoimikunta, Raportti YJT-88-11.

Bagge P & Niemi Å. 1971. Dynamics of phytoplankton primary production and biomass in Loviisa archipelago (Gulf of Finland). Merentutkimuslaitos, julk./ Havsforskningsinst. skr. 233:19-41.

Bagge P & Voipio A. 1967. Disturbed bottom and hydrographic conditions in some coastal areas of Finland. I. Loviisa. Merentutkimuslaitos, julk./Havsforskningsinst. skr. 223:3-12.

Energia-alan Keskusliitto ry FINERGY, 2004. Arvio Suomen sähkön tarpeesta vuoteen 2020. 29.1.2004.

Energiateollisuus ry 2007. Energiavuosi 2006 Sähkö. Lehdistötiedote 18.1.2007.

Fortum Power and Heat Oy 2007. Loviisan voimalaitos, jäähdytys- ja jätevesien tarkkailuraportti vuodelta 2006.

Fortum Power and Heat Oy. 2006. Loviisan voimalaitoksen käyttölupahakemus. 31.10.2006.

Fortum Power and Heat Oy 2006. Loviisan voimalaitoksen kalataloustarkkailu vuonna 2005. Laaja vuosiyhteenveto. Ramboll, 10.3.2006.

Fortum Power and Heat Oy 2006. Loviisan voimalaitos, jäähdytys ja jätevesien tarkkailuraportti vuodelta 2005. Raportti, Enprima 19.4.2006.

Hatanpää E. 1997. Loviisan alueen pohjavesiselvitys. Posiva Oy, Työraportti LOVIISA-96-03.

Henriksson M & Myllyvirta T. 1992. Itä-Uudenmaan saaristoalueen bioindikaattoritutkimus 1991. Itä-Uudenmaan ja Porvoonjoen vesien- ja ilmansuojeluyhdistys r.y.

Henriksson M & Myllyvirta T. 1991. Itä-Uudenmaan saaristoalueen bioindikaattoritutkimus 1990. Itä-Uudenmaan ja Porvoonjoen vesien- ja ilmansuojeluyhdistys r.y.

Heino R & Hellsten E. 1983. Tilastoja Suomen ilmastosta 1961 - 1980. Liite meteorologiseen vuosikirjaan, Nide 80 osa 1a-1980. Ilmatieteen laitos, Helsinki.

Hyvärinen, V. (toim.) 1993. Hydrologinen vuosikirja 1993. Suomen ympäristö 69/93. Helsinki 1993.

Hällfors G & Niemi Å. 1981. Vegetation and primary production. Teoksessa: Voipio, A. (toim.), The Baltic Sea, s. 220-238. Elsevier Oceanography Series, 30. Amsterdam.

Ilus, E. 1999. Loviisan ydinvoimalaitosta ympäröivän merialueen biologinen tarkkailu vuonna 1998. Säteilyturvakeskus. monistettu raportti. 36 p.

Ilus E. 1998. Loviisan ydinvoimalaitosta ympäröivän merialueen biologinen tarkkailu vuonna 1997. Loviisan voimalaitoksen jäähdytys- ja jätevesien tarkkailuraportti 1997. Imatran Voima Oy, ympäristönsuojeluyksikkö, Y1-G780-284.

Ilus, E. 1998. Laajat ympäristöohjelmat Suomen ydinvoimalaitosten vahvuus. Ytimekäs 5-6/98.

Ilus E. 1996. Loviisan ydinvoimalaitosta ympäröivän merialueen biologinen tarkkailu vuonna 1995. Loviisan voimalaitoksen jäähdytys- ja jätevesien tarkkailuraportti 1995. Imatran Voima Oy, ympäristönsuojeluyksikkö, Y1-G780-151.

Ilus E. 1995. Loviisan ydinvoimalaitosta ympäröivän merialueen biologinen tarkkailu vuonna 1994. Loviisan voimalaitoksen jäähdytys- ja jätevesien tarkkailuraportti 1994. Imatran Voima Oy, ympäristönsuojeluyksikkö, Y1-G780-88.

Ilus E. 1993. Imatran Voima Oy, Loviisan voimalaitos. Kuvaus jäähdytysveden ottovesistöstä, jäähdytysja jätevesien purkuvesistöstä sekä jäähdytys- ja jätevesien vaikutuksista purkuvesistöön. Liite Loviisan voimalaitoksen vesioikeudelliseen lupahakemukseen.

Ilus E & Keskitalo J. 1987. Phytoplankton in the sea around the Loviisa nuclear power station, south coast of Finland. Ann. Bot. Fennici 24:34-61.

Itä-Uudenmaan maakuntahallitus 2005. Itä-Uudenmaan maakuntakaava, luonnos 28.2.2005.

Itä-Uudenmaan maakunta- ja seutukaava 2002. Seutu- ja maakuntakaavayhdistelmä 5.4.2002.

Kauppila, P. ja Bäck, S. (toim.), 2001. The state of Finnish coastal waters in the 1990s. Suomen ympäristökeskus. Suomen ympäristö 472.

Mattila, J., Ilus, E. 2007. Loviisan voimalaitoksen vesistötarkkailu vuonna 2006: meriveden laatu ja biologinen tila. Säteilyturvakeskus, maaliskuu 2007.

Mattila, J., Ilus, E. 2006. Loviisan voimalaitoksen vesistötarkkailu vuonna 2005: meriveden laatu ja biologinen tila laaja yhteenvetoraportti. Säteilyturvakeskus, huhtikuu 2006.

Ministry of Environment 1991. Rantojensuojeluohjelman alueet. Selvitys 97/2001.

Ministry of Social Affairs and Health, 1999. Ympäristövaikutusten arviointi. Ihmisiin kohdistuvat terveydelliset ja sosiaaliset vaikutukset. Oppaita 1999:1. 51 p.

National Board of Antiquities 2007. Rakennettu kulttuuriympäristö. Valtakunnallisesti merkittävät kulttuurihistorialliset ympäristöt 1993 -luettelo. [http://www.nba.fi/rky1993/maakunta4.htm]

Oy Vesi-Hydro Ab. 1987-1996. Loviisan voimalaitoksen vesistö- ja kalataloustarkkailut vuosina 1986 - 1995. Liitteenä Loviisan voimalaitoksen jäähdytys- ja jätevesien tarkkailuraporteissa 1986 - 1996.

Pihlström M & Myllyvirta T. 1996. Ilman epäpuhtauksien leviämis- ja vaikutustutkimus Itä-Uudellamaalla, Lahden seudulla, Mikkelin läänissä ja Jousassa 1994 - 1995. Kuntakohtaiset raportit: Hollola, Lahti, Loviisa, Nastola ja Porvoo. Itä-Uudenmaan ja Porvoonjoen vesien- ja ilmansuojeluyhdistys r.y. 105 s.

Pitkänen, H. (toim.), 2004. Rannikko- ja avomerialueiden tila vuosituhannen vaihteessa, Suomen Itämeren suojeluohjelman taustaselvitykset. Suomen ympäristökeskus. 104 p.

Raunio, J. ja Mäntynen, J. 2007. Loviisan voimalaitoksen kalataloudellinen tarkkailu vuonna 2006. Kymijoen vesi ja ympäristö ry:n julkaisu no 151/2007.

Road Administration, 2007. Tiehallinnon tierekisteri Finnranet.

Ruishalme, J. 1998. Ympäristömelumittaukset Loviisassa. Raportti 15.6.1998 melumittauksista 10.–11.6.1998. Imatran Voima.

Siitonen, M., Sipari, J. ja Ranta, P. 1997. Loviisan Hästholmenin luontoselvitys 1997. Ympäristötutkimus Oy Metsätähti 1997. Työraportti 97–64, Posiva Oy, Joulukuu 1997, 59 p.

Snellman M & Helenius J. 1992. Loviisan Hästholmenin pohjavesikemia, yhteenveto vuosien 1980-1992 tutkimuksista.
- Voimayhtiöiden ydinjätetoimikunta, Raportti YJT-92-27.

Statistics Finland, 2006. Kasvihuonekaasuinventaario. [http://www.stat.fi/tup/khkinv/khkaasut_raportointi.html]

STUK 2007. Suomalaisen keskimääräinen säteilyannos. [http://www.stuk.fi/sateilytietoa/ihmisen_radioaktiivisuus/fi_FI/keskimaarainen_sateilyannos/]

Tammelin B. 1991. Suomen tuuliatlas 1991. Ilmatieteen laitos, Helsinki.

Uusimaa Regional Environment Centre, 2005. Loviisan pohjavesialueet. [www.ymparisto.fi > Uusimaa > Vesihuolto > Pohjavesialueet > Loviisan pohjavesialueet]

Valtioneuvoston päätös kansallisesta jakosuunnitelmaesityksestä 2007. Annettu Helsingissä päästökauppalain (683/2004) 34 §:n nojalla 22 päivänä helmikuuta 2007. Direktiivin (2003/87/EY) ja sen toimeenpanemiseksi säädetyn päästökauppalain (683/2004) mukainen Suomen esitys päästöoikeuksien kansalliseksi jakosuunnitelmaksi vuosille 2008-2012.

Vesihydro Oy. 1997 - 1998. Loviisan voimalaitoksen vesistö- ja kalataloustarkkailut vuosina 1996 - 1997. Liitteenä Loviisan voimalaitoksen jäähdytys- ja jätevesien tarkkailuraporteissa 1997 - 1998.

Fortum Power and Heat Oy
P.O. Box 100
FI-00048 FORTUM, Finland
www.fortum.com