TVO

Environmental Impact Assessment Programme

Extension of the Olkiluoto Nuclear Power Plant by a Fourth Unit

YV4

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Foreword

On the assignment of Teollisuuden Voima Oy (TVO), Pöyry Energy Oy has prepared this EIA programme for the nuclear power plant unit planned in Olkiluoto.

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. TVO. 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 Ministry of Trade and Industry will act as the coordinating authority in the project's EIA procedure. At TVO, the EIA project group has been supervising the preparation of the EIA programme. Mr. Olli-Pekka Luhta, Manager of Quality and Environment, has served as the project manager.

The EIA programme has been prepared at the Energy Consulting unit of Pöyry Energy Oy. Ms. Päivi Koski, M.A, has served as the consultation project manager. Reporting has been under the responsibility of Ms. Satu Lyyra, Ph.D., and Ms. Pirkko Seitsalo, M.Sc. (Eng.).

Espoo, 3 May 2007
Pöyry Energy Oy, Energy Consulting

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Summary

Teollisuuden Voima Oy (TVO) has initiated the environmental impact assessment procedure (EIA procedure) for investigating the environmental impacts of a new nuclear power plant unit possibly to be built at Olkiluoto.

In the EIA procedure, the construction of a nuclear power plant unit at Olkiluoto with net electrical output of 1,000 to 1,800 MW and thermal power of 2,800 to 4,600 MW will be examined as the primary option, and the non-implementation of the project as the zero-option. Two alternative sites for the power plant unit, located to the north of the existing OL1 and OL2 power plant units, will be considered in the environmental impact assessment. In addition, the EIA procedure will also examine two alternative locations for the power plant unit's cooling water intake as well as two alternative locations for cooling water discharge.

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

Based on the EIA programme and the opinions and statements given about it, an EIA report will be prepared. The report will present information about the project and its options 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 dispersion calculations, opinions of the nearby residents, 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 unit 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. In addition to the above, the assessment of the impacts on people and society will also be a central part of the assessment of the project's environmental impacts.

During the EIA procedure, briefings and discussion meetings will be arranged for the general public, the audit group and small groups. In these meetings, the citizens 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 transboundary 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 are likely to affect the state in question. The Ministry of the Environment is responsible for the practical arrangements relating to the international hearing concerning the assessment of transboundary environmental impacts. The Ministry of the Environment will notify the environmental authorities of certain neighbouring states about the commencement of an EIA procedure, inquiring about their willingness to participate in it.

The EIA procedure is to be completed during summer 2008. The construction of a nuclear power plant unit is subject to a decision-in-principle issued by the Council of State 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.

Glossary

Activity
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), equates to one disintegration per second.

bar
A unit of pressure. 1 bar = 100,000 pascal (Pa). Atmospheric pressure is approximately 1 bar.

Bq, becquerel
The unit expressing the activity of a quantity of radioactive material. The activity of the material equals one becquerel if it undergoes one nuclear disintegration per second.

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

Carbon-14
In addition to radon, the Carbon-14 isotope is the most significant source of radiation exposure in a uranium fuel cycle.

Efficiency
The ratio of the amount of electric energy produced by a power plant to the amount of energy contained in the consumed fuel.

EIA
Environmental impact assessment.

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

Fission
The splitting of a heavy atomic nucleus into two parts, accompanied by the release of fast neutrons.

GWh, gigawatt hour
A unit of energy (1 GWh = 1,000,000 kWh).

Ion
An electrically charged atom or molecule.

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

Isotope
Atoms of the same element differing from each other in the number of neutrons in their nucleus. Almost all natural elements occur as more than one isotope.

KAJ Store
Interim storage facility for intermediate-level operating waste.

KPA Store
Interim storage facility for spent fuel.

Landscape province division
Prepared as a result of a report concerning Finland's nature and culture characteristics and their variation, the landscape province division was used as a tool for evaluating the value and representativeness of landscape areas.

MAJ Store
Interim storage facility for low-level operating waste.

MW, megawatt
A unit of power (1 MW = 1,000 kW).

MW_f
Fuel power in megawatts (f=fuel).

Noble gas
The noble gases are helium (He), neon (Ne) argon (Ar), krypton (Kr), xenon (Xe) and radon (Rn).

Nuclear fuel
Nuclear material that has been 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 at a nuclear power plant.

ONKALO
Underground rock characterisation facility for the final disposal of spent nuclear fuel.

PWR, pressurized water reactor
A light-water reactor in which the water used as coolant and moderator is kept under such a 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. It boils into steam that is used for driving a turbine.

Radiation
Electromagnetic waves or particle radiation consisting of the smallest particles of matter.

Radioactivity
Transformation of an atomic nucleus into other nuclei. A radioactive nucleus emits radiation characteristic to the transformation (alpha, beta or gamma radiation).

Sv, sievert
A radiation dose unit indicating the biological effects of radiation. As it is a very large unit, millisieverts (1 mSv = 0.001 Sv) and microsieverts (1 µSv = 0.001 mSv) are more commonly used.

Thermal power
Capacity by which a plant generates thermal energy.

Tritium
A hydrogen isotope (^{3}H).

TWh, terawatt-hour
A unit of energy. One terawatt-hour equals one billion kilowatt hours or one thousand gigawatt hours.

UNECE, United Nations Economic Commission for Europe
Founded in 1947, UNECE, the United Nations Economic Commission for Europe, is one of the five regional commissions of the United Nations. Its aim is to strengthen the economic cooperation between its member countries.

Uranium
An element with the chemical symbol U. Uranium comprises 0.0004% of the earth's crust (four grammes in a ton). 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 0.72% of natural uranium is in the form of isotope U-235, which can be used as a nuclear fuel.

VLJ Repository
A final repository for low- and intermediate-level operating waste.

1 Project

Teollisuuden Voima Oy (TVO) is examining the construction of a nuclear power plant unit with approximate net electrical output of 1,000 to 1,800 MW and thermal power of 2,800 to 4,600 MW at Olkiluoto, which is the location of two existing nuclear power plant units (OL1 and OL2) and a third one (OL3) under construction. In order to improve its facilities for constructing additional production capacity, the company has initiated the environmental impact assessment procedure concerning a new nuclear power plant unit that would possibly be located at Olkiluoto.

According to Section 4 of the EIA Act (468/1994), projects subject to the environmental impact assessment procedure are specified in more detail by Council of State Decree. According to point 7 b) in the list of projects within Chapter 2, Section 6 of the EIA Decree (713/2006), nuclear power plants are included in projects subject to the assessment procedure.

The construction of a new nuclear power plant unit is subject to a decision-in-principle issued by the Council of State and ratified by the Parliament. If the decision-in-principle is ratified and, in addition to environmental issues, the technical and economic prerequisites for construction are fulfilled, construction of the plant could start in the early 2010s. Construction is estimated to take 4 to 6 years.

TVO wants to ensure on its part that if necessary, a new plant unit can be implemented in the latter half of the next decade. The EIA process must be completed before submitting any application for a decision-in-principle concerning a new plant unit, and for this reason, a decision has been made to initiate the EIA procedure. TVO has not made any decisions concerning action to be taken subsequent to the EIA procedure.

1.1 Organisation responsible for the project

The organisation responsible for the project is TVO, a private power production company owned by Finnish industrial and power companies. TVO was established on 23 January 1969. The founders were 16 Finnish industrial and power companies. TVO's shareholders in 2007 comprise Etelä-Pohjanmaan Voima Oy, Fortum Power and Heat Oy, Karhu Voima Oy, Kemira Oyj, Oy Mankala Ab and Pohjolan Voima Oy. The company produces electric power at the Olkiluoto nuclear power plant for its shareholders. In addition to the Olkiluoto nuclear power plant, TVO procures electricity from the Meri-Pori coal-fired power plant.

TVO's Olkiluoto power plant has environmental management systems compliant with the ISO 14001:2004 standard and the EMAS Regulation (EC No 761/2001).

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. It is estimated to exceed 100 TWh in 6 to 8 years. *(Finnish Energy Industries ET 2007)*

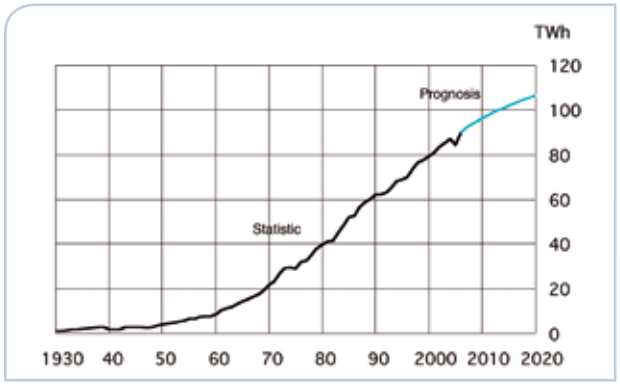


Figure 1-1 Total consumption of electricity in Finland and a forecast of the consumption trend up to 2020 (Finnish Energy Industries 2007).

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 industry.

The purpose of the new nuclear power plant unit is to increase the production capacity for base-load power. The construction of a nuclear power plant unit will also improve Finland's independence of electricity import and increase supply in the electricity market. A nuclear power plant is characterised by the stability of production costs, which means that the project will improve the predictability of the electricity market.

The construction of a nuclear power plant unit will contribute to achieving the Kyoto Protocol obligations for the reduction of greenhouse gas emissions. Preparation for the construction of a new nuclear power plant unit is also in harmony with the National Climate and Energy Strategy adopted by Parliament in 2006.

Approximately one-quarter of Finland's total electricity consumption is produced by nuclear power. There are two nuclear power plants in operation in Finland, with a total of four plant units. These are the Olkiluoto nuclear power plant owned by TVO and the Loviisa nuclear power plant owned by Fortum Power and Heat Oy.

1.3 Location and need for land

The planned location for the nuclear power plant unit is on the west coast of Finland, on Olkiluoto island in the municipality of Eurajoki. The road distance from Olkiluoto to the nearest town, Rauma, is approximately 25 kilometres. The distance from highway 8 to the power plant is approximately 14 kilometres.

Figure 1-2 The location of Eurajoki and Olkiluoto. Eurajoki is located along highway 8. The distance from highway 8 to the Olkiluoto power plant is approximately 14 kilometres.

The area required for the buildings and auxiliary buildings of the new power plant unit is approximately 4 to 6 hectares.

The TVO nuclear power plant units OL1 and OL2 located at Olkiluoto were constructed between 1973 and 1980. The net electrical output of each plant unit is 860 MW. Furthermore, the OL3 plant unit is under construction and its net electrical output will be approximately 1,600 MW. It is scheduled to start operation at the turn of 2010-2011.

In addition to the plant units, the site contains administrative buildings, a training centre and a Visitor Centre, warehouses, repair shops, a backup heating plant, a raw water treatment plant, a demineralization plant, a sanitary water treatment plant, a landfill, intermediate storage facility for spent fuel (KPA Store), intermediate storage facilities for low-level and intermediate-level operating waste (MAJ and KAJ Store), a final repository for operating waste (VLJ Repository), Posiva's ONKALO construction site, a contractors' area, accommodation villages, a wind power plant and a gas turbine plant under construction. The OL3 unit under construction is being built on a site of approximately 19 hectares located to the west of the existing units.

1.4 Project schedule

If the project will be implemented, the aim is to start construction of the new nuclear power plant unit in or around 2013. Thus the plant can be commissioned around 2018.

1.5 Links to other projects, plans and programmes

Power transmission

The national grid operator Fingrid Oyj is responsible for the operation of the electric power system at the national level under an obligation prescribed in the Electricity Market Act.

The project involves the construction of power transmission line from the power plant to the national grid. The environmental impacts of these changes will be assessed in a separate EIA procedure.

Disposal of spent nuclear fuel

Posiva Oy is an expert organisation established in 1995 that is responsible for the disposal of spent nuclear fuel, research associated with disposal, and other expert tasks belonging to its scope of operations. Posiva is owned

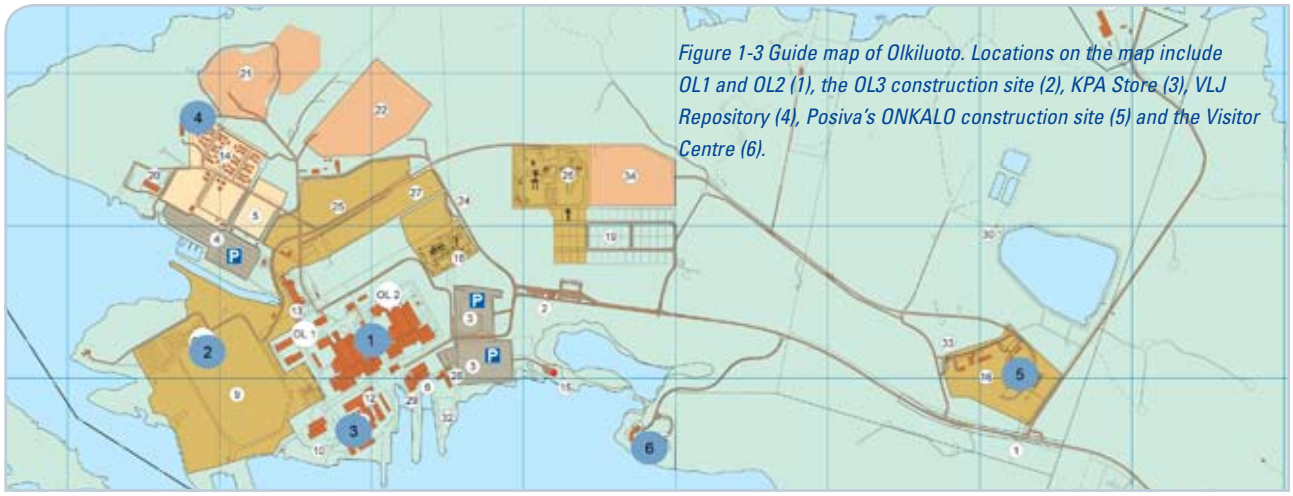


Figure 1-3 Guide map of Olkiluoto. Locations on the map include OL1 and OL2 (1), the OL3 construction site (2), KPA Store (3), VLJ Repository (4), Posiva's ONKALO construction site (5) and the Visitor Centre (6).

by TVO (60%) and Fortum Power and Heat Oy (40%), who are also 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 planned new nuclear power plant unit, this 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 plant unit.

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 eight per cent 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)*. The releases between 2008 and 2012 are estimated to exceed the assigned amount units by 60.4 million tonnes, which means an average annual excess of 12.1 million tonnes *(Decision of the Council of State 22.2.2007)*.

EU Energy Policy

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 Climate and Energy Strategy

On 24 November 2005 the Council of State approved a report to Parliament concerning its planned near-term actions in energy and climate policy *(Council of State report VNS 5/2005)*. In this report, the Council of State 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 mitigate global greenhouse gas emissions after the Kyoto period. The Parliamentary Finance Committee approved the report on 2 June 2006 *(Statement of the Finance Committee TaVM 8/2006)*. Parliament approved the report according to Finance Committees Statement on 6 June 2006 (Plenum Protocol PTK 66/2006 vp).

National land use objectives

The Council of State decided on national land use objectives in accordance with Section 22 of the Land Use and Building Act on 30 November 2000 and the decision gained legal validity on 26 November 2001. The decision divides the objectives into six categories: 1) a functioning regional structure, 2) an integrating community structure and quality of the living environment, 3) cultural and natural heritage, recreational use and natural resources, 4) functioning networks of connections and energy, 5) special issues in Greater Helsinki, and 6) special regions with regard to natural and cultural environments.

Objectives aimed at securing the national energy supply are of particular importance in the preparation of a partial master plan for Olkiluoto. According to these, land use must secure the national needs for energy supply, prepare for the disposal of nuclear waste and ensure the protective zones required for nuclear power plants.

2 EIA Procedure

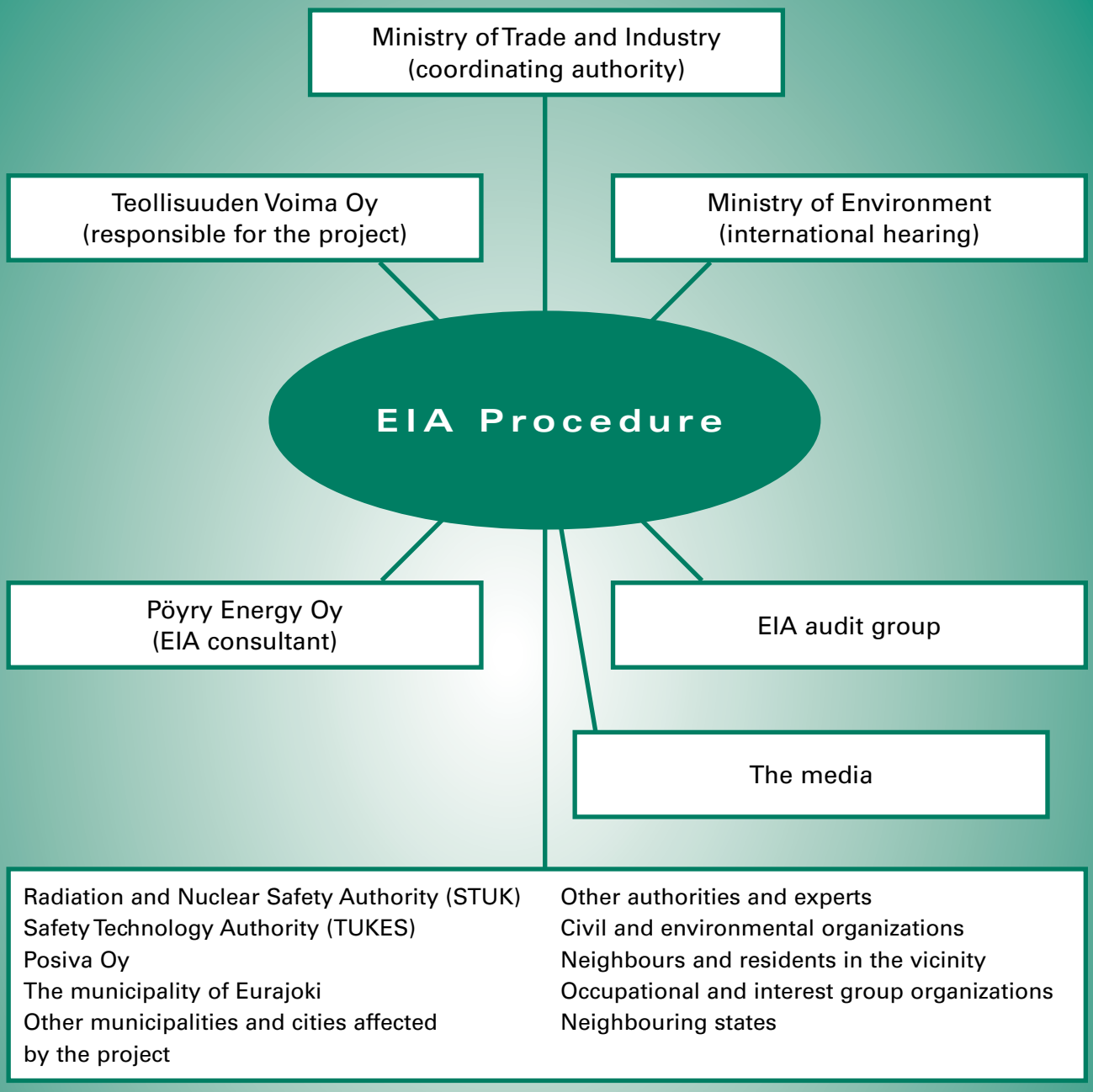


Figure 2-1 Parties involved in the EIA Procedure.

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, no decisions will be made in the EIA procedure concerning the project or to resolve any licensing issues; its objective is to produce information to serve as a basis for decision-making.

The parties involved in TVO's EIA procedure are in the figure 2-1.

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 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 *EIA report* will present information about the project and a coherent assessment of its environmental impacts resulting from the assessment procedure. The EIA programme 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'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. Authorities will provide statements on the EIA report.

The EIA procedure is completed when the Ministry of Trade and Industry submits its statement on the EIA report to TVO. The licensing authorities and the organisation responsible for the project 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 coordinating authority's statement have been taken into account.

The crucial stages and planned schedule for the EIA procedure are presented in the figure 2-2.

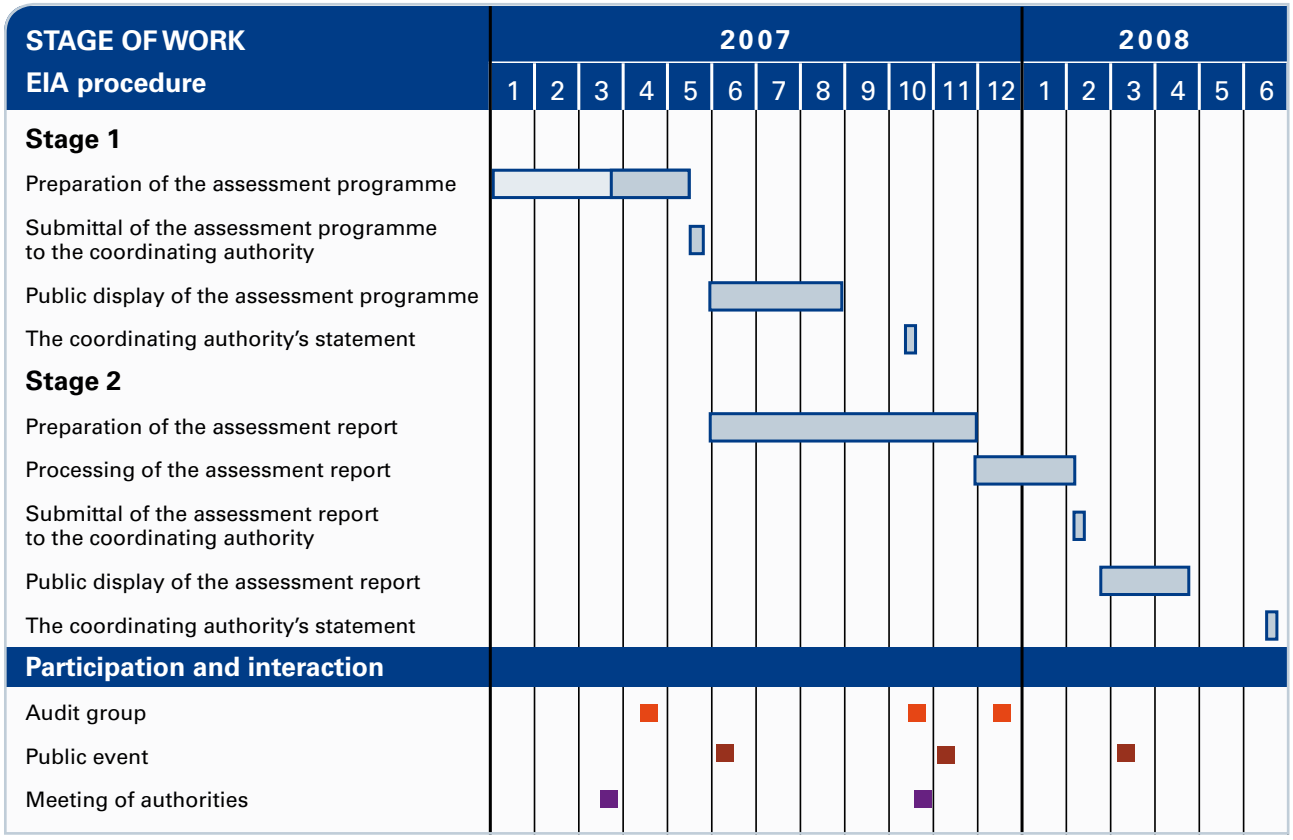


Figure 2-2 Planned schedule for the EIA procedure.

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 following is a presentation of the communications and interaction in the EIA procedure in accordance with the stages of the EIA procedure.

3.1 Audit group work

An audit group consisting of different interest groups was established 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:

- Ministry of Trade and Industry
- Provincial State Office of Western Finland
- Southwest Finland Regional Environment Centre
- Western Finland Environmental Permit Authority
- Town of Rauma
- Municipality of Eurajoki
- Municipality of Eura
- Municipality of Kiukainen
- Municipality of Lappi
- Municipality of Luvia
- Municipality of Nakkila
- Satakunta Regional Council
- Radiation and Nuclear Safety Authority (STUK)
- Safety Technology Authority (TUKES)
- Posiva Oy
- Satakunta Regional District of the Finnish Association for Nature Conservation
- Satakunta Employment and Economic Development Centre (TE Centre).

At its meetings the audit group will discuss 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 24 April 2007 and presented the project, the EIA procedure 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 a second and a third time to discuss the EIA report in the draft stage.

3.2 Small group meetings

TVO will arrange small group meetings for representatives of interest groups for the purpose of presenting the upcoming stages of the EIA procedure and the EIA programme. TVO has already arranged small group meetings in the stage of preparing the EIA programme. This has allowed various interest groups to express their views on issues and impacts important to them. The small group meetings have included presentations of the stages of the EIA procedure and the contents of the EIA programme, as well as discussion on the project.

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 opinions on the EIA work and its sufficiency. The first public event will be arranged in Eurajoki on 13 June 2007. The public will have the opportunity to receive information and discuss the EIA procedure with TVO and the authors of the EIA programme. The next information and discussion events will be arranged during the EIA report phase.

3.4 Public display of the assessment programme and international hearing

Once the assessment programme is completed, the Ministry of Trade and Industry will announce its public display on the announcement boards in Eurajoki and the surrounding 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.

The Ministry of the Environment is responsible for the practical arrangements relating to the international hearing referred to in the UN Economic Commission for Europe (UNECE) Convention on Environmental Impact Assessment in a Transboundary Context *(67/1997)*. The Ministry of the Environment will notify the environmental authorities of certain neighbouring States about the commencement of an EIA procedure associated with the Olkiluoto 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 a

summary document of the EIA programme translated into the other necessary languages.

3.5 The coordinating authority's statement on the EIA programme

The Ministry of Trade and Industry will compile the statements and opinions provided on the EIA programme by different parties. The coordinating authority will also provide its own statement on the EIA programme 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 coordinating authority.

3.6 Public display of the assessment report

The Ministry of Trade and Industry will announce the public display of the assessment report once TVO has submitted the report. 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 coordinating authority 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 Other communications

TVO will provide information on the project through press releases and on the TVO internet sites. TVO will also provide information through its publication TVO Uutiset issued four times annually and distributed to all households in Eurajoki, Rauma, Eura, Kiukainen, Lappi, Luvia and Nakkila. An additional issue of TVO Uutiset focusing on the EIA has been published during the EIA programme stage.

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.

For the duration of the EIA procedure, an information point will be open at the Visitor Centre on the Olkiluoto power plant site, displaying and distributing material concerning the EIA procedure and the outcome of the environmental impact assessment.

If necessary, a survey will be conducted among local residents in connection with the EIA procedure for the purpose of increasing interaction by providing the organisation responsible for the project with information on public attitudes towards the project and providing local residents with information on the project and its impacts on their living environment.

The EIA programme, as well as the EIA report, will be available for viewing on the Internet sites of TVO (www.tvo.fi) and the Ministry of Trade and Industry (www.ktm.fi).

4 The Options Under Assessment

Figure 4-1 Alternative locations for the power plant unit and alternative locations for cooling water intake and discharge. A and B are locations for the cooling water discharge channel for plant unit 4, while C and D are locations for the cooling water intake channel for plant unit 4. P refers to a potential extension to the northern bank of discharge channel B in order to reduce the effect of water recirculation.

The primary option for the project is a new nuclear power plant unit at Olkiluoto. TVO does not have any other realistic options for the location because it is essential for the project to utilise existing land use planning and infrastructure.

According to completed investigations, the sub-options for the new nuclear power plant unit are the following:

- two alternative sites at Olkiluoto, Alternative 1 and Alternative 2
- two alternative locations for cooling water discharge A and B
- two alternative locations for cooling water intake C and D.

The alternative locations for the power plant unit on the site and the alternative locations for cooling water intake and discharge are presented in the figure 4-1. In the figure, the alternative locations for cooling water intake and discharge are presented as arrows representing the direction of water flow.

4.1 Zero-option

The zero-option is that no nuclear power plant unit will be constructed at Olkiluoto. The zero-option assesses the environmental impacts caused by generating the electricity corresponding to the plant unit's production using the average Nordic power production structure.

4.2 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 at the alternative sites. TVO's present operations (production, emissions, impacts, etc.) are described on the basis of information for the last few years.

4.3 Limits of environmental impact assessment

The EIA procedure will primarily assess 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. The impacts of these operations will also be assessed to the required extent. The environmental impacts of the construction of a power transmission line will be assessed in a separate EIA procedure.

The impacts of transport and intermediate storage of spent nuclear fuel and operating waste 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.

The environmental load (emissions, traffic, etc.) will also be assessed for the zero-option and compared with the other options.

In connection with the EIA procedure, it will also be assessed whether the project will have impacts extending beyond Finnish territory.

At this stage, no combined effects with other planned projects known at the time have been identified. This issue will also 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.

The *observed area* refers to the area defined for each type of impact within which the environmental impact in question is examined and assessed. The extent of the observed area depends on the environmental impact being examined. The *affected area* refers to the area within which the environmental impact is estimated to occur in accordance with the assessment. The affected areas are probably substantially smaller than the observed areas. The affected areas will be presented in the assessment report.

4.4 Option excluded from the investigation: energy conservation

The organisation responsible for the project does not have access to any energy conservation means that would allow replacement of the quantity of electricity produced by the nuclear power plant while continuing the operations of the shareholders and other electricity consumers as planned. However, according to Section 26 of the Nuclear Energy Decree *(161/1988)*, the Ministry of Trade and Industry must submit a special review of the importance of the nuclear power plant for Finland's energy supply to the Council of State for the judgement of the decision-in-principle (see Section 8.3.1). This review will probably also examine the possibilities for energy conservation on the national scale.

5 Project Description

5.1 Technical description of the power plant unit

The new nuclear power plant unit planned for Olkiluoto will be either a boiling water reactor plant or a pressurised water reactor plant.

5.1.1 Operating principles of the planned nuclear power plant unit

In a nuclear power plant, uranium fuel heats water and the resulting heat is used to produce steam at a high pressure. The steam is conducted to a turbine that drives an electric generator.

In the reactor, the fuel is in small pellets encased in gas-tight fuel rods of approximately four metres in length. The fuel rods are assembled into fuel assemblies, and there are hundreds of these in the reactor. The typical amount of uranium fuel in the reactor is approximately 100 to 150 tonnes. Approximately one-quarter of the fuel is replaced at each annual outage.

Natural uranium consists mainly of two isotopes: 99.3% of the isotope U-238 and 0.7% of the isotope U-235. For use as nuclear fuel, uranium is enriched so that the fuel to be placed in a reactor contains approximately 2% to 5% of uranium U-235 and approximately 97% of uranium U-238. During operation, the U-235 in the fuel produces energy and is transformed into fission products. A fraction of the isotope U-238 is transformed into plutonium, which also produces energy. Spent fuel contains almost 96% U-238 and approximately 3% fission products, as well as a total of more than 1% fissionable uranium and plutonium.

Table 5-1 presents some technical data on the planned power plant unit. The figures are preliminary.

The planned nuclear power plant unit will be a base-load power plant that will operate continuously with the exception of an annual maintenance outage. The technical service life of the plant unit is approximately 60 years. The following is a presentation of the main principles of the two reactor types.

Table 5-1 Preliminary technical data on the nuclear power plant unit planned for Olkiluoto. MW = megawatt = one thousand kilowatts TWh = terawatt-hour = one billion kilowatt-hours

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

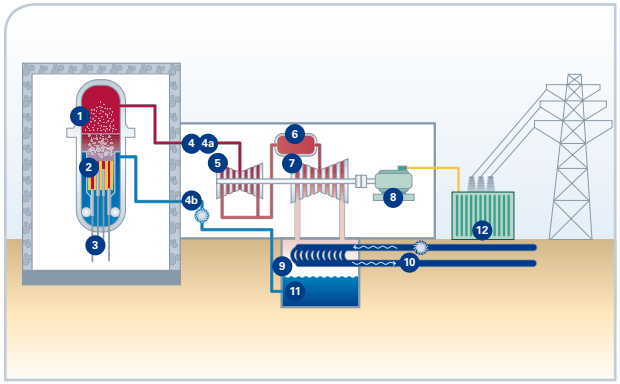


Figure 5-1 The operating principle of a boiling water reactor plant. 1. Reactor, 2. Core, 3. Control rods, 4. Primary circuit, 4a. Steam for the turbine, 4b. Water for the reactor, 5. High pressure turbine, 6. Reheater, 7. Low pressure turbine, 8. Generator, 9. Condenser, 10. Sea water circuit, 11. Condensation water, 12. Transformer

BWR (Boiling Water Reactor)

In the reactor of a BWR plant, the fuel is cooled by pure water. Within the pressure vessel, reactor coolant pumps circulate water through the fuel assemblies. This heats the water to a temperature of approximately 300 °C, which makes it boil and generate steam at a pressure of approximately 70 bar. The saturated steam is conducted through steam separators and a steam dryer located within the pressure vessel to a high-pressure turbine, an intermediate reheater and a low-pressure turbine. The turbines are linked by a shaft to a generator that produces electricity.

The steam coming from the low-pressure turbine is conducted to a condenser in which it is condensed into water using cold seawater. There is underpressure in the condenser, meaning that in the case of a leak, seawater will leak into the process, not vice versa. From the condenser, the water is pumped into pre-heaters. In the pre-heaters, steam extracted from the turbine heats the water before it is conducted back to the reactor. The existing nuclear power plant units at Olkiluoto (OL1 and OL2) are of the BWR type.

PWR (Pressurized Water Reactor)

In a PWR plant, fuel heats water but the reactor pressure vessel is maintained at such a high pressure that the water will not boil at any stage. The pressure is typically approx. 150 bar and the temperature in the reactor is approx. 300 °C. The pressurised water boils steam in separate steam generators from where it is pumped into the reactor (primary circuit). The steam circulates in the secondary circuit, operating the turbine and generator. The OL3 unit under construction and the existing nuclear power plant units at Loviisa are of the PWR type.

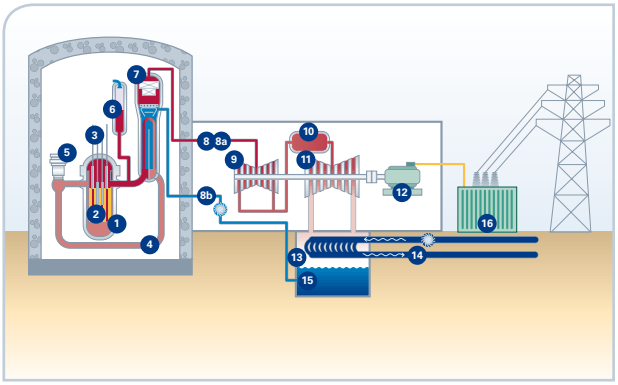


Figure 5-2 The operating principle of a pressurised water reactor plant. 1. Reactor, 2. Core, 3. Control rods, 4. Primary circuit (water circuit), 5. Main reactor coolant pump, 6. Pressurizer, 7. Steam generator, 8. Secondary circuit (steam), 8a. Steam for the turbine, 8b. Water for the steam generators, 9. High pressure turbine, 10. Reheater, 11. Low pressure turbine, 12. Generator, 13. Condenser, 14. Seawater circuit, 15. Condensation water, 16. Transformer

5.1.2 Fundamentals of nuclear safety

A nuclear power plant must be designed in accordance with nuclear energy legislation and regulatory guides on nuclear safety (YVL Guides) published by the STUK in order to ensure the safety of its operation. Nuclear power plants have been developed and are continuously being developed in many ways to improve their safety and operational reliability. The latest safety requirements will be taken into account in the potential new power plant unit. The potential plant unit will be one in which provisions have been made for severe accidents and the mitigation of their consequences.

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

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

The fundamentals of safety include three barriers for radioactive substances and the defence in depth principle of safety. The principle of three barriers means that there is a series of strong and tight physical barriers between radioactive substances and the environment, preventing the substances from entering the environment in all circumstances.

- *First barrier:* the uranium fuel within which radioactive substances are formed is encased in a fuel rod cladding made of metal.
- *Second barrier:* the reactor pressure vessel made of thick metal, containing the reactor core and the uranium fuel with cladding.
- *Third barrier:* the primary circuit is entirely contained in a gas-tight containment building with thick concrete walls (the containment has two concrete walls built on a thick base slab; the inner containment has a leak-proof metal liner).

The tightness of any single barrier is enough to ensure that no radioactive substances can enter the environment. The defence in depth principle refers to the prevention of the occurrence of transients and accidents as well as to the control of transients and accidents and mitigation of their consequences.

STUK inspects the analyses related to the plant's safety and ensures that the plant is operated in accordance with the safety requirements and that employees have sufficient qualifications.

5.1.3 Procurement of fuel

The existing plant units (OL1 and OL2) consume approximately 23 tonnes and the plant unit under construction (OL3) will consume approximately 32 tonnes of enriched uranium per year. The fuel is brought to the power plant in fuel assemblies.

The new plant unit will consume approximately 20 to 40 tonnes of enriched uranium fuel per year. This equals approximately 170 to 250 tonnes of raw uranium.

The stages of nuclear fuel procurement are quarrying of raw uranium, ore cleaning, conversion, isotopic enrichment, and manufacture into fuel assemblies.

TVO procures uranium for fuel under long-term contracts from suppliers in countries such as Canada, Australia and the EU. The uranium is enriched in Russia and the EU. The fuel assemblies currently delivered to Olkiluoto are manufactured in Germany, Spain and Sweden.

5.1.4 Spent fuel

In the reactor, nuclear fuel becomes highly radiating. Spent fuel is considered high-level waste in terms of activity.

The nuclear waste from the planned new power plant unit will be managed in accordance with the same principles applicable to OL1, OL2 and the OL3 unit under construction.

Spent fuel is initially cooled down and stored for a few years in water pools at the power plant unit. After this it is taken to intermediate storage and cooled in water pools at the spent fuel interim storage facility (KPA Store) at the Olkiluoto power plant. Intermediate storage in the KPA Store will continue for decades until the final disposal of the spent fuel. An extension to the interim storage

facility will be required once the OL3 power plant unit has been commissioned. An extension to the KPA Store is scheduled for the years 2011 to 2014. The possibility of extension has been taken into account in the original design of the KPA Store.

In Finland spent nuclear fuel is planned to be disposed of in a final repository to be excavated in bedrock. An environmental impact assessment concerning the disposal facility for spent nuclear fuel was completed in 1999. After a positive decision-in-principle (in 2001 and 2002), Posiva focused its final disposal studies at Olkiluoto and started preparations for building an underground rock characterisation facility called ONKALO. The municipality of Eurajoki granted a building permit for ONKALO in May 2003. The intention is to dispose of spent nuclear fuel in the bedrock of Olkiluoto at a depth of approximately 400 to 500 metres. The construction of ONKALO started in the autumn of 2004, and by the spring of 2007 it had progressed to a depth of approximately 200 metres. The objective of the project is to obtain detailed information concerning the bedrock for the purpose of designing a disposal facility and assessing its safety, and to test disposal technology in actual deep underground conditions. Posiva's present target is to submit an application for a construction licence for the spent fuel disposal facility by the end of 2012. The disposal of spent fuel is scheduled to start in 2020. The spent fuel from a potential new plant unit will be disposed of in the same location as spent fuel from other nuclear power plant units in Finland.

5.1.5 Operating waste and other wastes

Low and intermediate-level operating waste originates from the purification of the power plant's process water, as well as from maintenance and repair work. Low-level operating waste includes protective plastic, protective clothing and equipment, towels, tools, wood waste and scrap metal. Intermediate-level operating waste includes e.g. sludges and ion-exchange resins used in the cleaning systems for radioactive water.

A disposal facility for low and intermediate-level operating waste, known as the VLJ Repository, was introduced at Olkiluoto in 1992. The repository is used for the disposal of low and intermediate-level waste originating from the operation and maintenance of the plant units. The VLJ Repository will be extended as required, and the possibility of extension has been taken into account in its original design.

According to the decommissioning plan for the existing power plant units at Olkiluoto, dismantled components as well as all other dismantling waste will be disposed of in Olkiluoto bedrock by extending the VLJ Repository. This would also be the principle with regard to the new nuclear power plant unit.

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. The Olkiluoto power plant has a landfill of its own that will be utilised for the needs of the new power plant unit.

5.1.6 Radioactive emissions

Radioactive liquids and gases generated in a nuclear power plant are collected, delayed to reduce radioactivity, and filtered or evaporated. Even after the treatment, minor amounts of radioactive substances are released into the atmosphere and water. Emissions into the atmosphere include noble gases, iodines, aerosols, tritium and carbon-14, and discharges into the sea include fission and activation products and tritium. Emissions into the atmosphere take place through the plant unit's stack, while discharges into the sea take place after radiation control through release tanks and discharge channel of the plant unit. Water released into the sea is mixed into the cooling water flow in the discharge channel.

Radioactive emissions are also released from the KPA Store. The releases take place through the exhaust stack of the KPA Store and are very minor.

5.1.7 Other emissions

The availability of electric power at the nuclear power plant in extraordinary situations must be secured with backup diesel generators or a gas turbine. Test runs of backup power sources generate some nitrogen oxide, sulphur dioxide, carbon dioxide and particle emissions. The backup heat boiler also generates minor emissions of a similar nature.

5.1.8 Water requirements and supply

The power plant unit uses seawater for cooling the turbine condensers. The existing nuclear power plant units at Olkiluoto, OL1 and OL2, take their cooling water supply, 60 m^3/s in total, from the shoreline of the Olkiluodonvesi sea area south of the island. The consumption of cooling water will increase by some 60 m^3/s when the OL3 plant unit is in operation. Fresh water required at the power plant site is taken from the lower course of the Eurajoki river.

5.1.9 Cooling and waste water

Cooling water is conducted back to the sea at Iso Kaalonperä bay, located to the west of the island, through a discharge tunnel and discharge channel. The process increases the temperature of the cooling water by approximately 13°C.

Waste water generated at the power plant and on the site includes water from the raw water treatment and demineralization plant, water from the liquid waste treatment plant, water used for flushing the traveling band screens, sanitary waste water and laundry waste water. The waste water is processed appropriately before being conducted to the sea.

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 close environment of the plants has been monitored for more than 30 years. There are a lot of reports available that describe the state of the environment at Olkiluoto and in nearby areas. The last time the environmental impacts of the Olkiluoto nuclear power plant were assessed comprehensively was in connection with the EIA procedure for OL3 in 1999. TVO is regularly monitoring the operation and impacts of the plant (for example, monitoring of cooling, process and sanitary waters, physical, chemical and biological monitoring of the waters around Olkiluoto, fishery monitoring and noise monitoring). The bibliography lists some of the most important reports relevant to this project.

6.1 Land use and the built environment

6.1.1 Land use planning

National land use objectives

The national land use objectives are a part of the land use planning system in accordance with the Land Use and Building Act. The Council of State decided on the objectives on 30 November 2000. The Council of State decision divides the national land use objectives into six categories:

1. a functioning regional structure
2. an integrating community structure and quality of the living environment
3. cultural and natural heritage, recreational use and natural resources
4. functioning networks of connections and energy
5. special issues in Greater Helsinki
6. special regions with regard to natural and cultural environments.

The objectives are intended to serve as a tool for proactive guidance of land use planning related to nationally significant issues. The objectives must be taken into account in master planning and also in local planning when the plans are associated with nationally significant issues. However, decisions of a principal nature that are crucial for the achievement of objectives at the municipal level are often made in master plans. *(Ministry of the Environment 2003)*

Land use must ensure the protective zones required for nuclear power plants and prepare for disposal of nuclear waste. Land use and its planning related to networks of connections and energy must pay attention to surrounding land use and the nearby environment, particularly settlements, valuable natural and cultural sites and areas, as well as special characteristics of the landscape.

Valid regional plan

In the Satakunta regional plan 5 ratified by the Ministry of the Environment on 11 January 1999, the TVO site is designated as a community management zone (ET-1). According to the special provisions concerning the zone, detailed planning and design must pay specific attention to environmental protection, and the handling and storage of radioactive waste must be arranged in a completely safe manner. Furthermore, the regional plan also allows other energy production besides the nuclear power plant units, as well as other industry based on the energy production in the zone.

There is a harbour and a dockyard (LV) in the northeastern part of Olkiluoto. The protected Liiklankari old-growth forest (SL) is located to the east of the power plant site. Kuusisenmaa (MY, area dominated by agriculture and forestry, environmental values) is located to the southwest of Olkiluoto.

The Olkiluoto nuclear power plant site is surrounded by a protection zone extending to a distance of approximately 5 kilometres. In detailed planning and design, this zone must not be used for any large residential areas or facilities with a large number of employees or patients, or any facilities whose operations would be severely hampered by the potential effects of spent nuclear fuel, such as food processing plants. Furthermore, the zone must not be used for any facilities or equipment that could be a danger to the nuclear power plant, such as explosives factories, warehouses or airports. *(Satakunta regional plan 5, 2001)*

Figure 6-1 An extract from Satakunta regional plan 5.

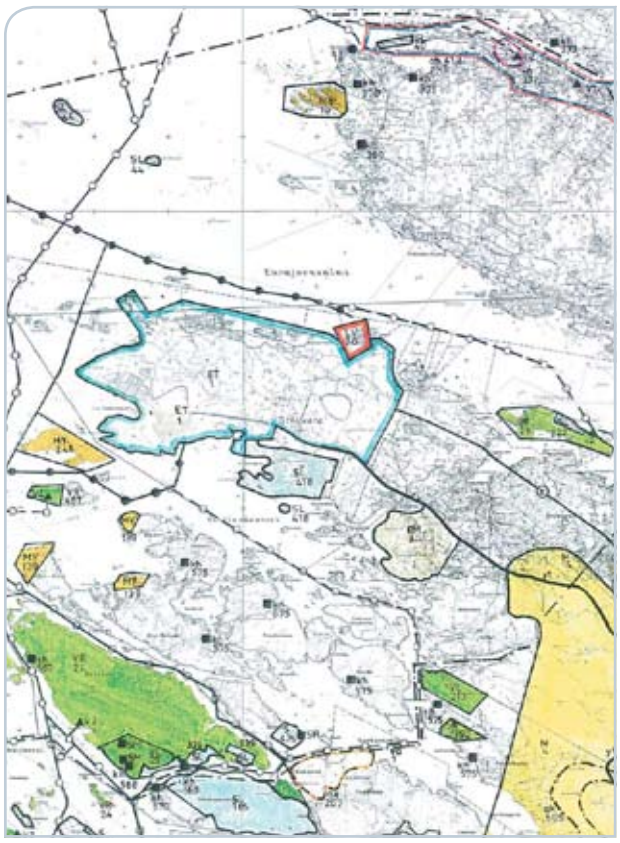
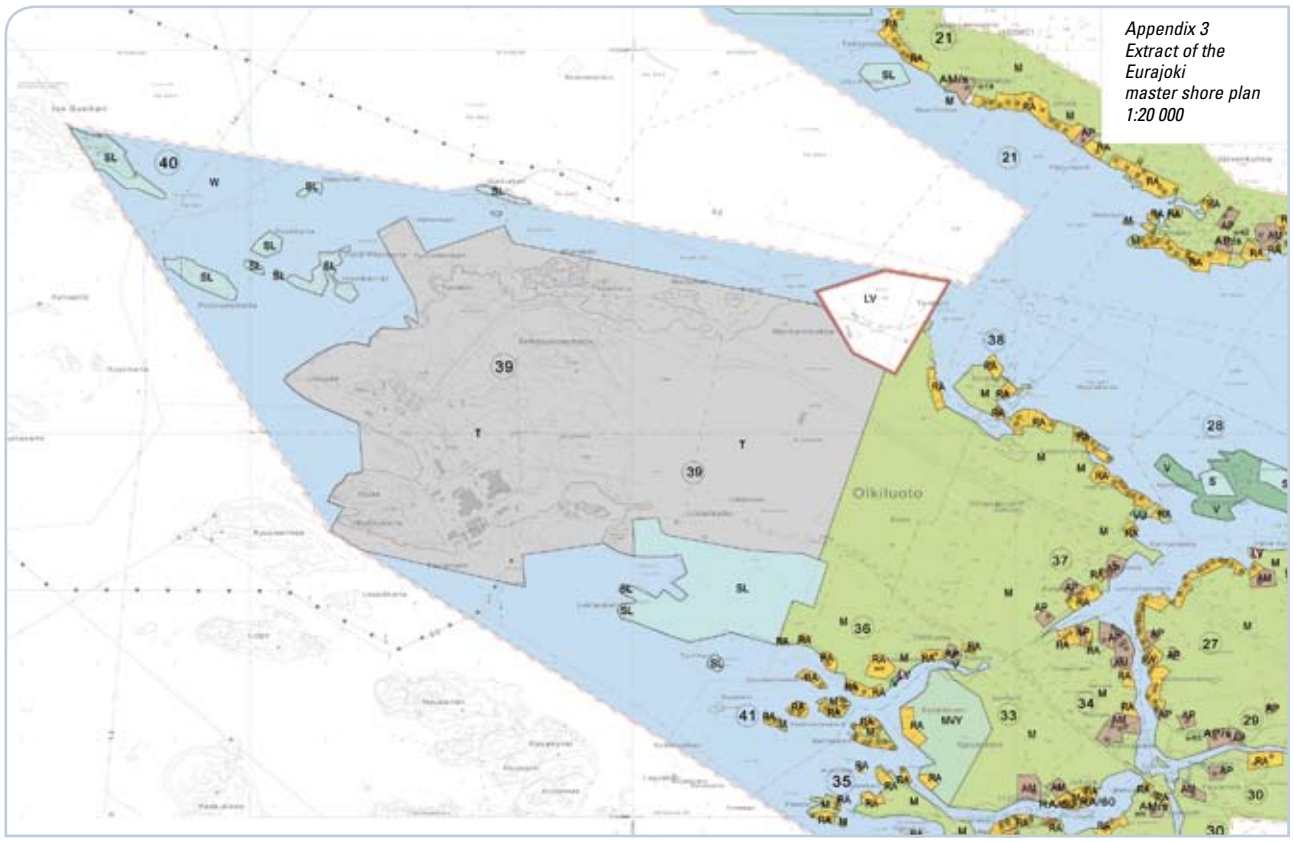


Figure 6-2 Extract from the Eurajoki master shore plan. The options for the site of a new plant unit are designated as a zone for industrial and warehouse buildings (T).



Provincial plan in preparation

The Satakunta Regional Council is preparing a provincial plan that will replace the valid regional plan. The preparation of the Satakunta provincial plan was initiated in February 2003. The provincial plan is currently at the draft preparation stage. The valid regional plan from 2001 will be revised and updated to comply with the requirements of the Land Use and Building Act. The provincial plan will include a general provision for an energy supply zone (EN) and designate power lines, a regional road, navigable passages for ships and boats, and conservation areas. The intention is to make a proposal for the provincial plan available for public viewing during 2007.

Master plans

The Eurajoki master shore plan ratified by the Southwest Finland Regional Environment Centre on 25 October 2000 is valid in the Olkiluoto area. The power plant site and the surrounding areas are designated as a zone for industrial and warehouse buildings (T). Most of the area east of the power plant site is designated as a zone dominated by agriculture and forestry (M). The master shore plan also includes zones for holiday homes (RA), farmsteads (AM) and detached residential houses (AP). The Liiklankari area located on the southern shore of the Olkiluoto peninsula is designated as a nature conservation area (SL).

Eurajoki municipal council approved an amendment to the master shore plan on 12 December 2005, assigning an accommodation village and other functions serving energy production in the southeastern part of Olkiluoto.

Figure 6-3 Amendment to the master shore plan assigning an accommodation village and other functions serving energy production in the southeastern part of Olkiluoto.

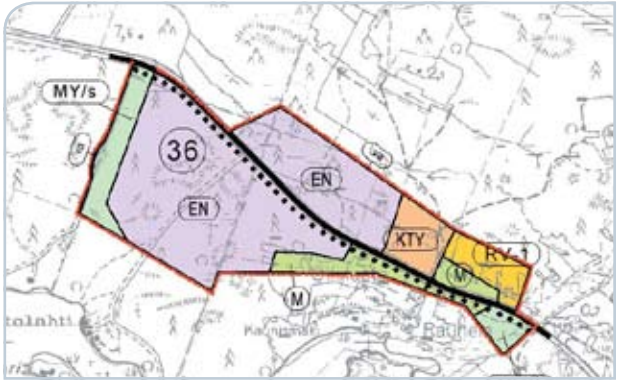


Figure 6-4 An extract from the partial master plan for the northern shores of Rauma.

The partial master plan for the northern shores of Rauma ratified on 23 December 1999 is valid in the coastal areas of Rauma. With regard to the islands to the southwest and south of Olkiluoto, this plan designates Kuusisenmaa as an agricultural and forestry zone (M-1), while the southern bay is a boat harbour (LV-1). Leppäkarta is designated as a zone for holiday homes (RA). Lippo includes recreational zones (V), agricultural and forestry zones (M) and zones for holiday homes (RA).

Amendment to the partial master plan

The Olkiluoto partial master plan and an amendment to the partial master plan for the northern shores of Rauma are under preparation in the Olkiluoto area.

Area belonging to the municipality of Eurajoki

Within the municipality of Eurajoki, the partial master plan covers Olkiluoto, minor islands to its north and northwest (Kornamaa, Mäntykari, Munakari and approximately 20 smaller islands), and the waters surrounding them. The partial master plan will amend the Eurajoki master shore plan ratified on 25 October 2000 and the amendment to the master shore plan approved on 12 December 2005 (the area known as the accommodation village with its surroundings).

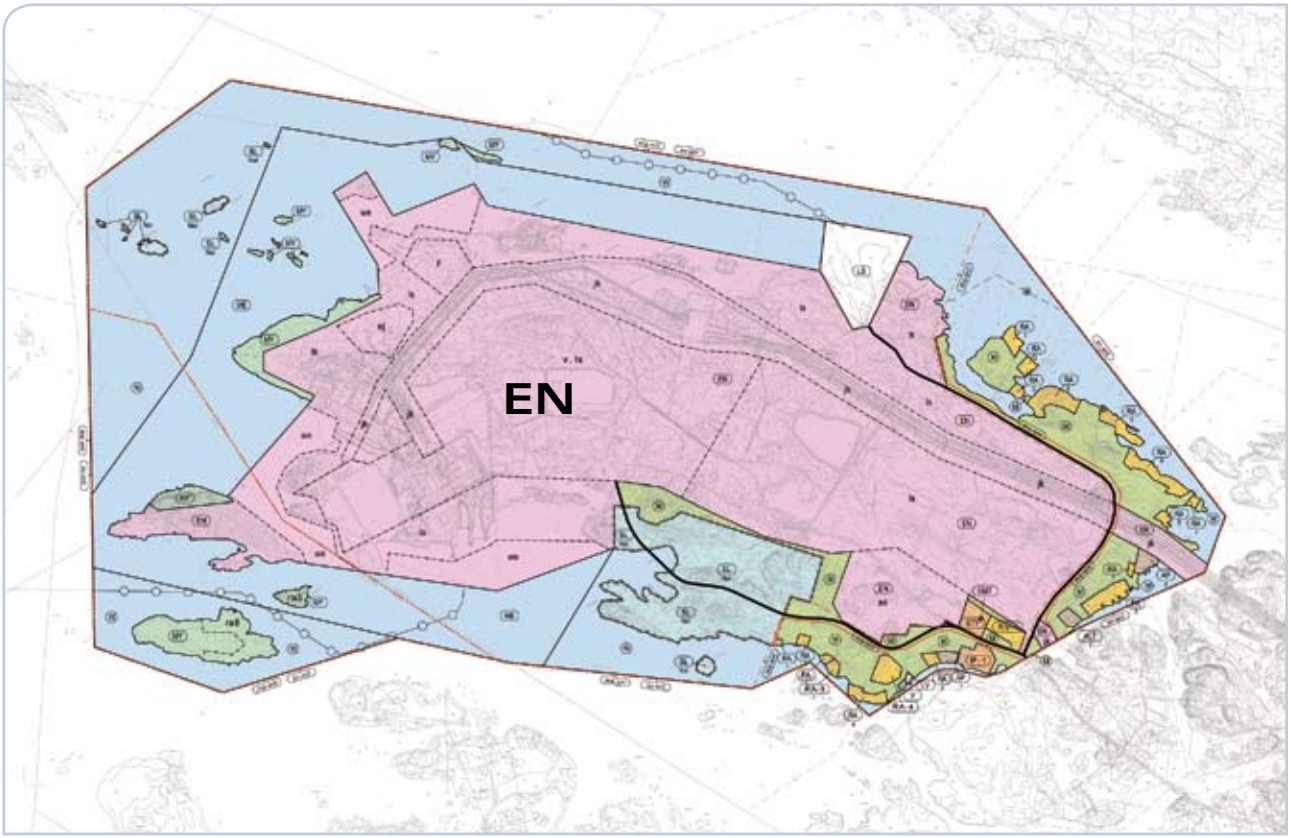
Area belonging to the town of Rauma

Simultaneously with the Olkiluoto partial master plan, an amendment to the partial master plan for the shores north of Rauma has been in preparation. Within the town of Rauma, the area covered by the plan include the islands of Kuusisenmaa, Leppäkarta, Lippo and Vähä-Kaalonperä off Olkiluoto, as well as the waters surrounding these islands. The partial master plan is an amendment to the partial master plan for the northern shores of Rauma ratified on 23 December 1999.

Objectives aimed at securing the national energy supply are of particular importance in the preparation of a partial master plan for Olkiluoto. According to these, land use must secure the national needs for energy supply, prepare for the disposal of nuclear waste and ensure the protective zones required for nuclear power plants.

The draft partial master plan for Olkiluoto and the draft amendment to the partial plan for the northern shores of Rauma were available for public viewing in accordance with Section 62 of the Land Use and Building Act from 21 February to 22 March 2007. The proposal

Figure 6-5 An extract from the draft plan constituting the partial master plan for Olkiluoto and an amendment to the partial master plan for the northern shores of Rauma, 27 January 2007. In the draft partial master plan for Olkiluoto, the options for the site of the new plant unit are located in a zone for energy supply (EN).



for a plan is estimated to be completed in the autumn of 2007.

In the Olkiluoto draft partial master plan (29 January 2007), the power plant site and the areas surrounding it are designated as a zone for energy supply (EN).

Local plan and local shore plan

Local plans ratified in 1974 and 1997 are valid in the area of the existing nuclear power plant units. The power plant site is designated as a zone for industrial and warehouse buildings (T) allowed for nuclear power plants, other facilities and equipment intended for the production, distribution and transmission of power, as well as buildings, structures and equipment associated with these, unless otherwise restricted. The Liiklankari area is designated as a park (P) and a special zone (EL).

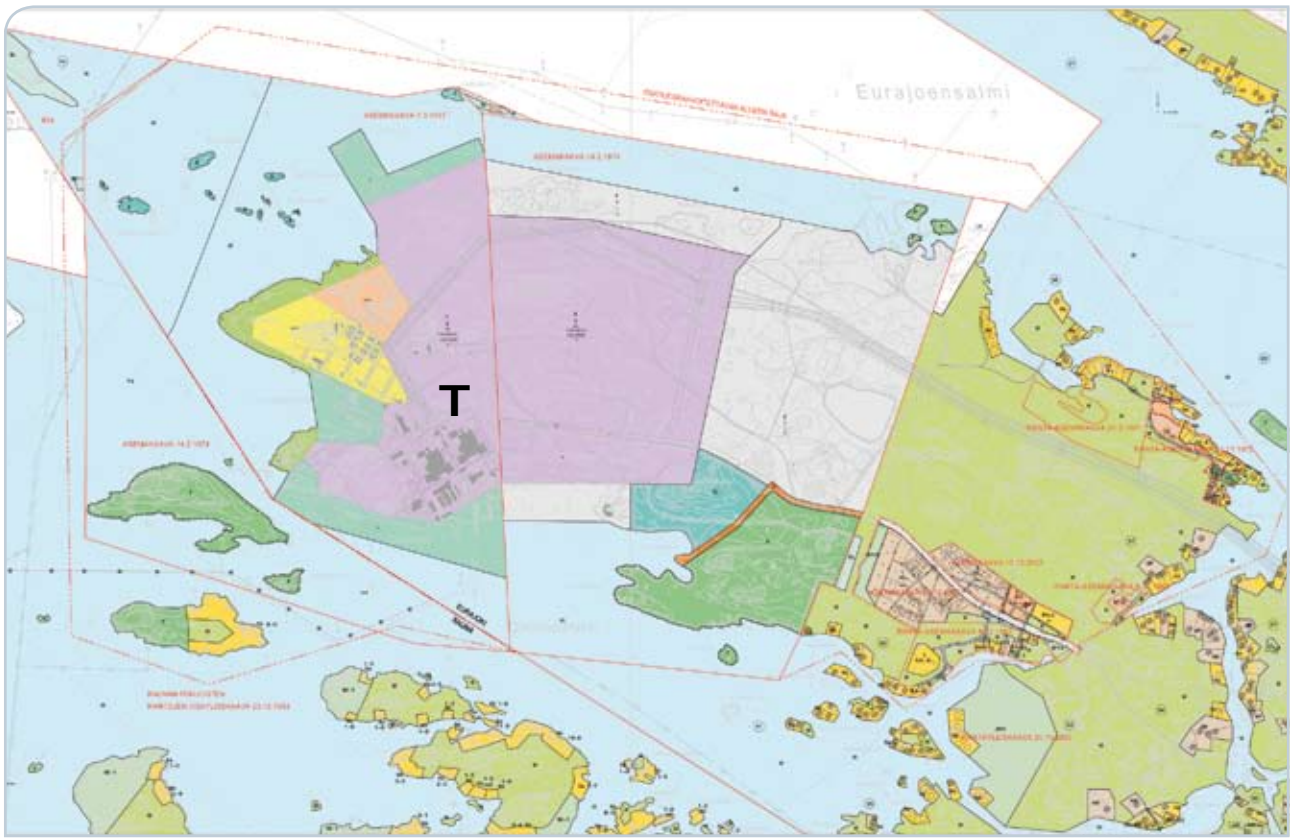
On 12 December 2005 Eurajoki municipal council approved two local plans defining a zone for accommodation buildings serving energy production (ASEN), a zone for office buildings (KTY), a zone for a caravan park serving energy production (RV-1EN), a tower zone (EMT), a protective green zone (EV), an agricultural and forestry zone (M), and an agricultural and forestry zone with special environmental values (MY/s) in the southeastern part of Olkiluoto. The plan defines an accommodation zone that must have capacity for seasonally accommodating 500 people. The area must also have connection points for temporary accommodation housing 500 people, 150 caravans and businesses serving the accommodation area (café, restaurant, grocery shop/kiosk, etc.). The project is closely linked to the construction of the third nuclear power plant unit at Olkiluoto (OL3), which started in 2005. The accommodation area and its facilities are needed for the construction workers and, in the future, for accommodating employees during annual maintenance outages of the power plant units, for example. The area partially replaces the accommodation area close to the power plant units, the use of which will become more difficult with the construction of OL3.

There are three ratified local shore plans in the eastern parts of the Olkiluoto island, ratified on 11 November 1975, 20 March 1981 and 8 December 1992. The plans assign holiday homes to the shore area.

6.1.2 Functions located in and around the area

The present Olkiluoto power plant site is located in the western half of the Olkiluoto island and has an

Figure 6-6 Extract showing the local planning situation at Olkiluoto, with the power plant site designated as a zone for industrial and warehouse buildings (T).



area of approximately 350 hectares. The construction of the power plant at the site started in 1973. The site contains TVO's existing power plant units OL1 and OL2. Furthermore, OL3 is under construction and is scheduled to start operation at the turn of 2010-2011. In addition to the plant units, the site contains administrative buildings, a training centre, a Visitor Centre, warehouses, repair shops, a backup heating plant, a raw water treatment plant, a demineralizing plant, a sanitary water treatment plant, a landfill, intermediate storage facility for spent fuel (KPA Store), intermediate storage facilities for low-level and intermediate-level operating waste (MAJ and KAJ Stores), a final disposal facility for operating waste (VLJ Repository), and accommodation villages.

Olkiluoto is also the location of Fingrid's switchyard, TVO's wind power station and, currently under construction, Posiva's underground rock characterisation facility ONKALO and Fingrid's gas turbine power plant for backup power purposes.

The power plant is connected to the national grid by three 400 kV and two 110 kV power lines. The Olkiluoto 400 kV switchyard is located on the northern shore of the island approximately two kilometres from the power plant. The 110 kV switchyard is located in the immediate vicinity on the power plant on the northern side.

To the east of the power plant site, Olkiluoto island is mainly forest. The Olkiluoto industrial harbour and dockyard are located near the middle of the island's northern shore. The eastern end of Olkiluoto island contains agricultural areas and holiday homes. The area contains a new accommodation village and caravan park providing temporary housing for nuclear power plant construction and maintenance personnel.

Figure 6-7 Olkiluoto power plant site (the power plant unit to the left is a photomontage of OL3). The new unit would be located to the right of the picture.

TVO owns most of Olkiluoto. Other owners include the State (the Liiklankari conservation area), Fingrid Oyj and private land owners. TVO owns some of the waters around Olkiluoto directly and some through joint ownership. TVO owns approximately 69% of the water rights area of Olkiluoto and Orjasaari, as well as approximately 33% of the Munakari joint area.

Eurajoki central village is located approximately 16 km east of Olkiluoto. Rauma town centre is located approximately 13 km south of Olkiluoto, Luvia central village approximately 16 km northeast and Pori approximately 32 km northeast. Figure 1-2 illustrates the locations of Eurajoki and Olkiluoto.

Hankkila, the village closest to Olkiluoto, is located approximately 8 km from the power plant site. Linnamaa, which is located approximately 10 kilometres from the power plant site, belongs to the Vuojoki cultural landscape that includes the Vuojoki mansion area and the Liinmaa castle ruins from the 1360s. The Kuivalahti village centre is located to the north of Eurajoensalmi inlet approximately 9 km from the power plant site, and Lapijoki village centre is located along highway 8 approximately 14 km from the power plant site. The nearest village centre in Rauma is called Sorkka and is located approximately 9 km to the southeast of the power plant site.

6.2 Landscape and cultural environment

Landscape

The Olkiluoto island is located in the municipality of Eurajoki on the coast of the Selkämeri sea area. Typical characteristics of the Selkämeri coast include capes pointing to the northwest, shallow bays between them and archipelago zones of small area.

In the division of landscape regions, the Olkiluoto area belongs to coastal Satakunta. The region is characterised by low-lying terrain and soil of small features: in addition to rocky land, it includes moraine areas, small areas of clay soil and ridge formations. The coast has long sheltered bays dominated by cane-grass that are turning to land due to land uplift at approximately five millimetres annually.

The Olkiluoto island is approximately 6 km long and 2.5 km wide. The Selkämeri sea area opens to the west of the island, while its southern side abuts on the Rauma archipelago. The Lapinjoki river discharges to the east of Olkiluoto island, into a narrow inlet between Olkiluoto and Orjasaari. The Eurajoki river discharges into the Eurajoensalmi inlet north of the island.

There are no nationally or regionally valuable buildings or other objects of cultural history in the area. *(National Board of Antiquities 2007)*

6.3 People and communities

The population of Olkiluoto island is very low. The nearest houses are located approximately three kilometres from the power plant site.

The Olkiluoto island and the nearby coastal areas and islands have a lot of holiday homes. There are approximately 550 holiday homes within five kilometres of the power plant site. The nearest holiday homes are located on the northern coast of Olkiluoto (Munakari), approximately one kilometre from the nuclear power plant units. Munakari and its cottages are owned by TVO and used for the recreation of TVO personnel. The nearest holiday homes in the south-southwest sector are located on Leppäkarta island approximately one kilometre from the power plant. There is a high number of holiday homes within 1.5 to 2 kilometres, for example on the islands Lippo, Nousiainen and Kovakynsi.

TVO and Posiva have approximately 750 permanent employees in Olkiluoto, while permanent subcontractors employ approximately 250 people. Olkiluoto 3 will have a maximum of about 3,000 employees during construction and 200 to 300 after completion. An additional 1,000 people work on the site during annual outages (approximately 2 months per year).

6.4 Traffic and noise

Eurajoki central village is located along highway 8 between Rauma and Pori. Road number 2176 leading to Olkiluoto separates from highway 8 at Lapijoki village. Olkiluoto can also be accessed from Rauma via the Sorkantie road to Hankkila village on road 2176. A road goes from Hankkila to Eurajoki via Linnamaa.

Average traffic on road 2176 leading to Olkiluoto in 2006 was approximately 1,230 vehicles per day, 100 of which were heavy vehicles. Traffic has been livelier than normal in 2007 due to the increased number of employees at the OL3 construction site. Average traffic in 2007 has been approximately 2,240 vehicles per day, with approximately 200 heavy vehicles (9%). The average daily traffic volumes are higher on weekdays due to commuter traffic. *(Road Administration 2007)*

Approximately half of the people commuting to Olkiluoto every day use buses, while the rest drive cars. There are 11 scheduled buses from Rauma to Olkiluoto on weekdays and 6 buses from Eurajoki. Commuter traffic mainly focuses on the hours between 7 and 9 am and between 3 and 5 pm.

The power plant's quays are located on the southern coast of Olkiluoto, beside the cooling water intake channels of OL1 and OL3. A navigable passage having a depth of five metres leads to the quays. A maximum of 1 or 2 ships per year call at the OL1 quay. The OL3 quay is expected to see the same number of ships per year. A six-metre passage leads from the west to the Olkiluoto industrial harbour on the northern side of the island, north of the Kalla island. The harbour serves both exports and imports and is only operational when the sea is open. Approximately 90 to 100 ships call at the harbour annually. Other traffic in the waters close to the power plant site mainly constitutes boating associated with recreational use and fishing.

Noise at Olkiluoto has been surveyed by measurements and calculations in 2005 and 2006. The results of noise measurements in the islands close to Olkiluoto varied between L_{Aeq} 42-46 dB. The measurements were conducted during the daytime while

the construction site was operating. Calculated noise levels at the nearest holiday homes in different situations varied between 36-38 dB at night in 2005 and 45-47 dB by day during construction. According to the results, the OL3 construction site may cause the daytime directive value for noise in holiday home areas (L_{Aeq} 45 dB) to be exceeded at the nearest holiday homes. However, the nighttime directive was not exceeded in the situation prevailing in 2005.

According to noise calculations updated in 2006, the noise level in the nearest affected location at a holiday home on Leppäkarta island will not exceed the daytime or nighttime directive value after the OL3 unit is completed. In a situation corresponding to normal operation, the noise level at the nearest holiday home on Leppäkarta island is 38-39 dB, which is lower than the nighttime directive value for holiday home areas (L_{Aeq} 40 dB). *(Insinööritoimisto Paavo Ristola Oy 2006)*

The noise caused by the power plant is a continuous stable faint humming.

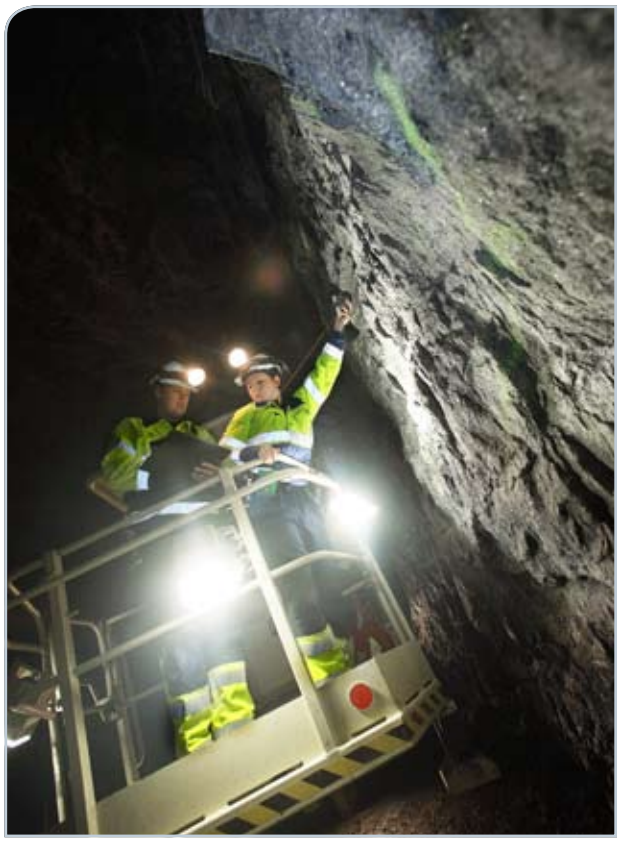
6.5 Soil, bedrock and groundwater

The main rock type in Olkiluoto bedrock is migmatite, which is a compound of mica gneiss and granite. The bedrock in the area is approximately 1,800 to 1,900 million years old. The soil on Olkiluoto is mainly rocky moraine. There are also thin layers of clay and peat at low-lying spots. The power plant site also includes filled areas.

Earthquakes are rare and weak in Finland. The Olkiluoto power plant is located on stable bedrock, and earthquakes affecting the plant's operation are nonexistent. *(EQE International Inc. 1997, ref. TVO 1997)*

The Olkiluoto island is quite flat, with no major differences in altitude. The highest point of the island is approximately 18 metres above sea level.

There are no classified groundwater areas in Olkiluoto, and the area is not significant for the procurement of water for communities. The island has 11 bored wells belonging to private owners, 5 of which are in continuous or recreational use.



6.6 Air quality and climate

6.6.1 Weather conditions

Olkiluoto is located on the coast of the Selkämeri sea area in a maritime climate. A maritime climate is characterised by the stability of the temperature conditions. In the spring, the temperature close to the coast is clearly lower than farther inland. In the autumn, the warm sea evens out the daily temperature differences and there is almost no night frost. The winter in the Satakunta region is mild because Selkämeri remains open for almost the entire winter.

6.6.2 Air quality and fallout

Emissions to the atmosphere are minor in Eurajoki. 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.

There is no air quality monitoring at Eurajoki. The nearest monitoring measurement point is in Rauma. Air quality is also monitored at the industrial locations of Harjavalta and Pori.

Measurements of fallout contained in rainwater, also known as wet fallout, have been conducted in Satakunta. The sulphate fallout has varied between 280 and 440 mg/m^2/year between 1992 and 1995. The nitrate nitrogen fallout has been 150 to 230 mg/m^2/year and the ammonium nitrogen fallout 60 to 190 mg/m^2/year *(Satakunta Regional Council 1998)*. The critical load for forest land is exceeded everywhere in Satakunta.

6.7 The state and use of waters

Olkiluoto is delimited by the Eurajoensalmi inlet of approximately 1.5 km width on the north side and the Olkiluodonvesi water area of approximately 3 km length and 0.7 to 1.0 km width on the south side. The Rauma archipelago begins on the south side of Olkiluodonvesi. The area west of Olkiluoto is a shallow coastal area with a relatively high number of small islands and islets. The Selkämeri sea area opens to the west of the islet zone.

To the west-southwest of the power plant site, there is the Kuusisenmaa island separated from Olkiluoto by a shallow inlet of approximately 0.2 to 0.3 km width. An island called Lippo is located south of Kuusisenmaa. A navigable passage to the power plant site's harbour quay goes between Kuusisenmaa and Lippo.

There are no lakes, rivers or brooks in the Olkiluoto area. The only lake on the island has dried up due to ditch drainage.

6.7.1 General description and hydrological information

The waters around Olkiluoto are shallow, with the exception of basins to the southwest and northwest of the island. The greatest depths are approximately 15 metres, and the average depth is less than 10 metres.

Selkämeri deepens fairly steadily when going off the coast. The average depth of ten metres is usually reached at the outermost islands, the depth of 20 metres at approximately 10 to 20 kilometres from the mainland and the depth of 50 metres only at approximately 30 kilometres from the mainland.

Most of the waters near Olkiluoto do not have an actual topsoil layer on the bottom; the seabed is plain rock. Areas in which the topsoil of the seabed is moraine are the second most common. The prevailing topsoil types in Olkiluodonvesi and in the basin area west of Kuusisenmaa and Lippo are muddy clay and other types of clay.

The sea around Olkiluoto is fairly open. The coast to the north of Olkiluoto only has a few islands. The conditions for seawater mixing and exchange are beneficial at the edge of the open sea. Due to the lack of archipelago, winds have a strong effect on the current conditions off Olkiluoto. *(Jumppanen 1998)*

The largest water systems in Southern Satakunta, the Lapinjoki system and the Eurajoki system, discharge into the sea area of Olkiluoto. The Lapinjoki river originates in the forest and swamp area west of Pyhäjärvi, flows through the municipalities of Lappi and Eurajoki, and discharges into Selkämeri at the bay between Olkiluoto

and Orjasaari. The catchment area of the Lapinjoki river is 462 km^2, the areal percentage of lakes is 4.2 and the mean flow is 2.4 m^3/s.

The Eurajoki river originates in the Pyhäjärvi lake within the municipality of Säkylä and flows through the municipalities of Eura, Kiukainen and Eurajoki to

Selkämeri at the Eurajoensalmi inlet. The Köyliönjoki river coming from the Köyliönjärvi river discharges into the Eurajoki river in Kiukainen, and the Juvanjoki river coming from the Turajärvi lake discharges into it in Eurajoki. There are three hydropower plants in the Eurajoki river. Water from the Eurajoki river is conducted through the Lapinjoki river to Rauma to provide a supply of water to the town of Rauma. The catchment area of the Eurajoki river is 1,336 km^2, the areal percentage of lakes is 12.9 and the mean flow is 8.4 m^3/s. *(Hyvärinen 1993, Lehtinen 1995, Turkki 2006)*

6.7.2 Water quality, ice conditions and biological condition of the sea area

The water quality and biological production in the sea around Olkiluoto is affected by the general condition of the coastal waters of Selkämeri, and nutrients and other substances carried to the area from the mainland by rivers. The discharge area for cooling water from the nuclear power plant units is locally affected by increased temperature and changes in flow conditions caused by the cooling water, as well as the nutrient load of waste water conducted with the cooling water. *(Sarvala 2005)*

Physical, chemical and biological monitoring studies of the waters around Olkiluoto have been conducted since 1979. The purpose of the studies is to survey the impacts of cooling water from TVO's Olkiluoto power plant on the quality and usability of the water in the surrounding sea area, as well as biological production. *(Turkki 2007)*

Sea water warmup

The existing nuclear power plant units at Olkiluoto, OL1 and OL2, take their cooling water supply, altogether approximately 60 m^3/s, from the shoreline of the Olkiluodonvesi sea area south to the island. The consumption of cooling water will increase by some 60 m^3/s when the OL3 plant unit is in operation. The cooling water is conducted back to the sea at the Iso Kaalonperä bay located at the western end of the island. The process increases the temperature of the cooling water by approximately 13 °C.

The increase in water temperature caused by cooling water varies by weather, season and the utilisation rate of the power plant. The cooling water mixes into the surface layer. The increase in seawater temperature due to cooling water is clear in the discharge area, and a slight increase in temperature can be perceived within a radius of 2 to 3 kilometres from the cooling water discharge point. *(Turkki 2007)*

Ice conditions

Typical of open coast, the ice conditions on the Selkämeri coast are naturally quite unstable. Variation in winds and temperatures heavily affects freeze-up, breakup and the strength of ice. On average, permanent ice cover near the coast is created at the turn of December-January and breaks up in early April. The open sea around and off Olkiluoto remains unfrozen longer than more inward areas.

The discharge of cooling water to the west of Olkiluoto in winter creates an unfrozen area, the size and shape of which depends on the flow and weather conditions in the sea area, mainly the air temperature, wind direction and the ice conditions in Selkämeri. River waters flowing into the area may occasionally also have impacts on the behaviour of cooling water and thus the ice conditions.

The area of unfrozen sea and thin ice off Olkiluoto varies from a few square kilometres to approximately 20 square kilometres. When the average temperature is five degrees below zero, the area is in the order of 10 to 14 km^2, and when it is 15 degrees below zero, the area is 3 to 6 km^2. In very cold winters the unfrozen area is approximately 2 to 3 km^2. The unfrozen area in 2006 was at its smallest 4.5 km^2 *(Taivainen 2007)*.

Oxygen situation and nutrient concentrations

The oxygen situation in Olkiluoto waters is good. The solids contents are low, both in winter and in the open water season. With the exception of the Eurajoensalmi inlet, nitrogen concentrations correspond to the background concentration in Selkämeri coastal waters.

The Eurajoki river discharging into the Eurajoensalmi inlet and the Lapinjoki river discharging into the bay between Olkiluoto and Orjasaari bring muddy nutrient-containing river water to the sea, and this affects the nutrient economy and basic production in nearby waters. The quality of water and biological production in the sea around Olkiluoto are also affected by the general condition of the Selkämeri coastal waters and the local nutrient load from waste water conducted to the cooling water discharge area, as well as the local changes in water temperature and flow conditions caused by cooling water from the nuclear power plant units. The nutrient concentrations of water off Olkiluoto and

in the Eurajoensalmi inlet have been characteristic of Selkämeri coastal waters. The local variation in nitrogen and phosphorus concentrations in seawater is relatively low. *(Sarvala 2005)*

TVO's sanitary waters contained approximately 29 kg of phosphorus and 2,555 kg of nitrogen in 2006. The load from the nuclear power plant was higher than normal due to the increased number of personnel at the OL3 construction site.

Plankton production

Abundant production of diatom in the spring normally starts at least a month earlier than elsewhere in coastal waters, and the vegetation period is clearly longer. In accordance with the general usability classification of the environmental administration, the quality of the Olkiluoto sea area at the outermost observation points was classified as excellent in terms of chlorophyll limits, which is typical of infertile coastal waters. Observation points closer to the mainland were classified as good quality or slightly eutrophic in terms of chlorophyll limits *(Turkki 2006, Turkki 2007)*.

There has been slightly more blue-green algae in the cooling water intake and discharge areas compared to the other sea areas for a number of years, but the areas have not otherwise been distinguished from other observation points in terms of plankton algae. The total amount of blue-green algae has mostly been small, however. *(Sarvala 2005)*

Aquatic vegetation

Aquatic vegetation was most recently surveyed in 2004. There were a total of 24 species of aquatic vegetation in the research area, of which 16 were algae, seven vascular plants and one aquatic moss. The discharge of cooling water from the Olkiluoto nuclear power plant to the Iso Kaalonperä bay has prevented the formation of ice cover in winter over an area of approximately 5 to 20 km^2 near the outlet. The lack of ice cover has extended the vegetation period of plant plankton and, particularly, aquatic vegetation in the area and caused changes in the quality of the sea bed and the range of species. Vascular plants have benefited from the extended vegetation period and macro-algae have suffered, with the exception of annual green and brown algae *(Ekengren 1985, Keskitalo 1987, Keskitalo & Ilus 1987, Mäkinen et al. 1992, Jumppanen 1999, Vahteri and Jokinen 1999, Kinnunen and Oulasvirta 2005)*.

Sea bed fauna

The dominant species of sea bed fauna is Baltic tellin. Other species include midge larvae, oligochaetes and occasional benthic amphipods. A new species found in the area is a certain species of polychaetes that has become more common elsewhere in the southwestern coastal waters. The composition and biomass (weight per area) of the sea bed fauna in the cooling water intake and discharge areas demonstrate slight eutrophication. The variations in sea bed fauna within the areas affected by cooling water have been cyclic, with no clear identifiable trend.

There is annual variation in the sea bed fauna around Olkiluoto, just like in other sea areas. The variation in the sea bed fauna is natural and is caused by variations in the populations of individual species and selective catching of fish, as well as annual variations in the conditions prevailing in the water layers close to the bottom, such as oxygen content and the amount of dead algal mass used for nutrition by sea bed fauna, particularly in basins. *(Jumppanen 1992, Jumppanen 1998)*. In recent years, the sea bed fauna has recovered from the situation of the early 2000s, when the Baltic clam (Macoma baltica) suffered from oxygen depletion in some locations *(Turkki 2006)*.

6.7.3 Fish and fishing

TVO monitors the effects of cooling and waste water on fishing and fish populations in a manner approved by the Turku Rural Economy District (now the Southwestern Finland Employment and Economic Development Centre, Fish Industry unit). The waters near Olkiluoto belong to the Raumanmeri fishing area with four fishery corporations. There is a public water area belonging to the State off Olkiluoto.

There were five families engaged in professional fishing in the sea area off Olkiluoto in 2005. Professional fishing is mostly net fishing, with some fyke net fishing of scaled fish and hook fishing of pike and burbot. The significance of other forms of fishing is relatively low. Fishing is carried out in the entire sea area off Olkiluoto, and the financially most important species in 2005 were perch, pike-perch, salmon and trout. The total catch consisted mainly of perch (almost one-half), pike, roach and Baltic herring. *(Ramboll 2006)*

6.7.4 Use of the water area

Boating is common in the waters near Olkiluoto. Due to shallow and rocky waters, most boats are fairly small ones with outboard motors. There are moorings for small boats in the Iso Kaalonperä bay where the cooling water from the existing units are discharged. There is a boat dock on the Olkiluodonvesi side of the power plant.

The number of actual marked passages or boat routes around Olkiluoto is small. A navigable passage of five metres draught comes to the power plant from the west between the islands of Kuusinen and Lippo. It is mainly used for transporting large equipment and components to the power plant. A six-metre passage, north of the Kalla island, leads from the west to the Olkiluoto industrial harbour on the northern side of the island. Products transported via the industrial harbour include raw timber, woodchips, peat, sawn timber, limestone, coal, coke, steel products and their additives, soil conditioners, raw materials for feedstuffs, unhewn stone, rubber granules and various types of project freight. The harbour does not handle liquid products or hazardous products. Approximately 90 to 100 ships call at the harbour each year.

Swimming is common at nearby holiday homes. The nearest public beaches are in Verkkokari and Sorkka.

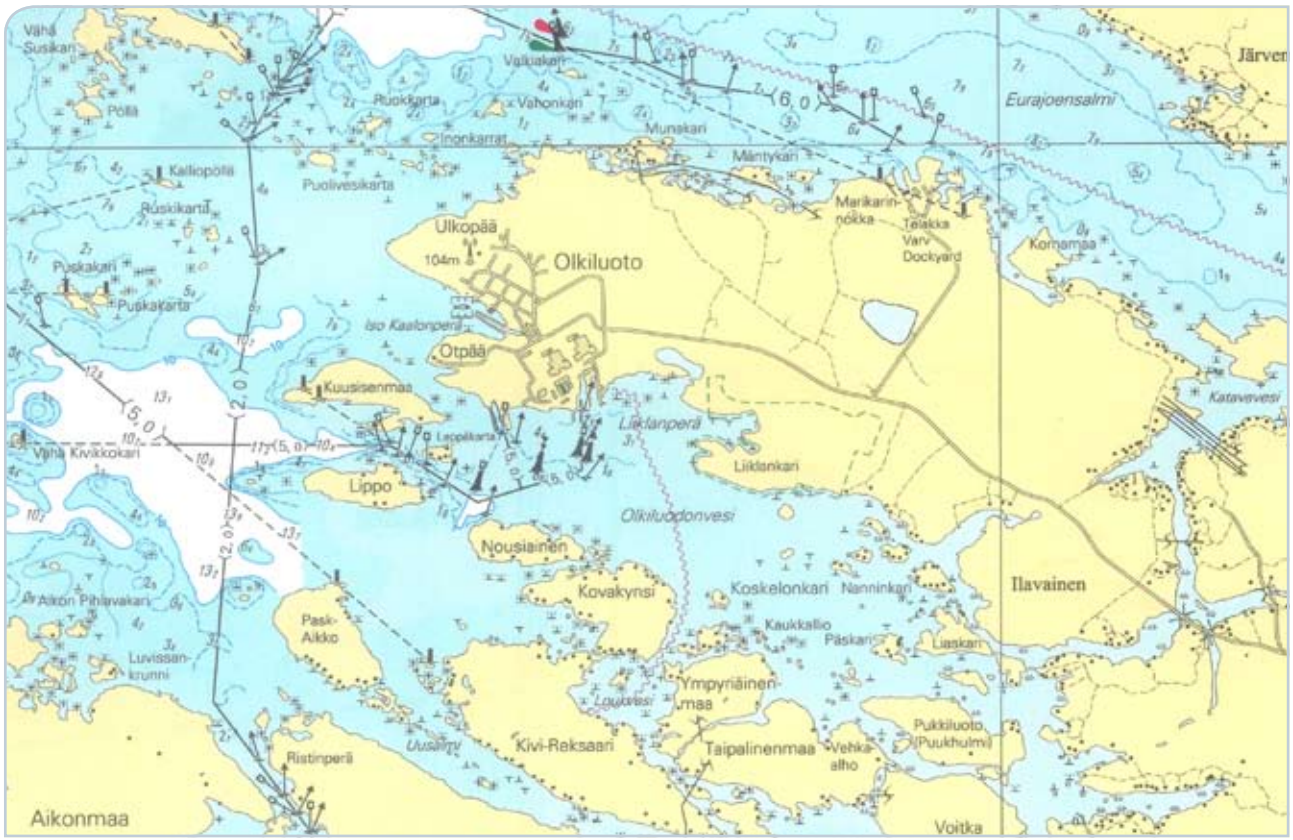


Figure 6-8 Extract from nautical chart. The chart shows the passages leading to Olkiluoto island.

6.8 Flora and fauna

The natural environment in the Olkiluoto area is heavily influenced and altered by human activities. Olkiluoto belongs to the Gulf of Bothnia coast, where land uplift is rapid, 5.35 ± 0.25 mm/year. Low-lying terrain and rapid land uplift cause a change in flora when the habitat changes. The meadowy shores of land uplift areas are becoming swampy and are bordered by a bush zone consisting mainly of willow, buckthorn and myrtle. There is an alder zone between the bush and the forest, consisting almost exclusively of black alder in the Olkiluoto area.

In the geobotanic division of regions, Olkiluoto belongs to the southern boreal zone and further to the anemone zone characterised by demanding forest plants such as hepatica and wood anemone. The coastal flora in the area is characterised by zonality that is constantly changing due to rapid land uplift. The zonality of flora is evident on the coast in that coastal forests are moister and more luxuriant than inland forests; when going inland, the forests become drier and more infertile, depending on the depth of groundwater. However, this zonality is not clear in Olkiluoto because differences in altitude within the island are minor and luxuriant habitats can be found both on the shores and inland. However, the most infertile habitats are clearly located at the highest points of the island.

In terms of natural conditions, the Olkiluoto area is a typical Southwestern Finland coastal area in which the species of flora and fauna and the soil are very similar to the surrounding areas. Unbuilt shores, particularly on the northern side, represent shore biotopes in a natural and often luxuriant state. Olkiluoto is quite abundant in species but few rare or endangered species have been observed. *(Insinööritoimisto Paavo Ristola Oy et al. 2007a)*

Forests

There are approximately 570 hectares of forests owned by TVO on Olkiluoto island outside the plant site; most of the forests (90%) are heaths of the bilberry type (MT), wood sorrel bilberry type (OMT) or lingonberry type (VT). There are 22 hectares of swamps, 19 hectares of which are wilds in productive forest use. The main species of tree in young cultivated forests is pine, and in more mature forests it is spruce. Broadleaf trees (grey and black alder, silver and white birch, rowan and willows) grow mainly in a zone surrounding the island at the sea shore, and as undergrowth. The inland forests are dominated by pine, spruce copses are mainly located on the shores inside the black alder zone.

Forests ready for felling represent 18% of the total area. The small amount of private land, as well as forests administered by the Metsähallitus outside the Natura zone, are in intensive forestry use and the area no longer has any mixed forests in a natural or near-natural state. The soil in the south of the island is clearly moister than in the north, which is evident as mild swamp formation and a higher number of vascular plants that tolerate or favour dampness. There are not many bushes in the forest, and most of the bush layer constitutes seedlings of the local

tree species and juniper. The forests in productive use in the area are primarily free of rotten wood as well.

The rocky forests are characterised by their natural state. All rocky forests have open rock areas where lichen and low twigs grow. There are also peat-covered rocks, but their area is very small. Black alder grows as narrow strips on the shore, and, together with meadowsweet growing in the field layer, it forms a zone surrounding the entire island. On the shores, common reed forms an unbroken belt around the island. Low-lying meadows are rare within the island; the reasons are eutrophication of the Baltic Sea, spreading of human settlement and ditch drainage. *(Insinööritoimisto Paavo Ristola Oy et al. 2007a)*

Swamps

The majority of swamps and peat-covered areas on Olkiluoto island have been drained, and the total area of swamps in a natural state is no more than 3.2 hectares. Some of these swamps in a natural state have disappeared following the completion of the forestry plan *(Latvajärvi et al. 2004)* due to the construction of the new accommodation village. Some of the swampy patterns are located on the sea shore and are excluded from forestry operations without any special measures because the forestry plan proposes that an untreated zone 20 to 50 metres wide shall be left on the sea shore.

The locally most valuable swamp locations on Olkiluoto island are the paludified ponds in the northwestern corner of the island and a black alder swamp on the eastern shore of Flutanperä that has partially lost its natural state. Through the black alder stand, there is a road leading to the Olkiluoto Visitor Centre. There is also an old ditch in the area and very little rotten wood; otherwise the area is in natural state. The dominant species of the field layer are meadowsweet, yellow loosestrife, marsh marigold, tufted hair grass and purple loosestrife.

The paludified ponds in the northwestern corner are infertile, so far almost treeless bogs. There are isthmuses of mineral soil between the ponds with spruce, black alder and birch. The ponds are paludified with moss of the species Sphagnum riparium; other common species include yellow loosestrife, marsh cinquefoil, bog arum, common reed, smallreed, reed mace, purple loosestrife, milk parsley, meadowsweet, bottle sedge and cotton grass. *(Insinööritoimisto Paavo Ristola Oy et al. 2007a)*

Birdlife

The most common aquatic bird species is eider, and the rarest species observed at Olkiluoto is greater scaup. Common shelduck, which is rare in Finland, and velvet scoter also nest in the Olkiluoto area. These observations have been described as valuable but not extraordinary. The most valuable part of Olkiluoto island in terms of aquatic birdlife is the northern shore. The island is neighboured by the Eurajoki river delta FINIBA area (Finnish Important Bird Areas 120075) at its northeastern corner.

Olkiluoto does not differ from surrounding areas with regard to ground birdlife; there are a lot of species but not many rarities. Like in the rest of the country, the most common species in the area are chaffinch and willow warbler. In addition to the observations referred to in the above, a grey-headed woodpecker (Picus canus, NT, a species listed in Annex I to the bird directive) was seen eating in an aspen tree in 2006 in connection with other surveys; however, the area is not suitable as a nesting biotope for the species as there are very few aspen trees of a small diameter in the Olkiluoto area and trees suitable for hole nesting are almost nonexistent. *(Insinööritoimisto Paavo Ristola Oy et al. 2007a)*

Mammals

The data concerning occurrence of mammals in the Olkiluoto area are based on active observation of animal tracks in winter, information received from hunting clubs and airborne survey data. The elk stock in Olkiluoto is estimated at 15 animals before the hunting season and 10 animals after the season. The white-tailed deer stock is estimated at 15 to 20 animals, and the roe deer stock at 10 animals. Other mammals common in the area include raccoon dog, fox, pine marten, mink, ermine, polecat, badger, hare, brown hare and rodents.

6.9 Conservation areas

The conservation area nearest to the Olkiluoto power plant site is the Liiklankari nature conservation area located on the southern shore of Olkiluoto island, in the immediate vicinity of the spent fuel disposal facility, approximately one kilometre southeast of the existing power plant units. The area belongs to the conservation programme for old-growth forest. It also belongs to the Rauma archipelago area included in the Natura 2000 network (FI0200073). The site is included in the Natura 2000 network as an SCI area (Sites of Community Importance, included in the Natura 2000 network by virtue of the nature directive).

Metsähallitus conducted a biotope inventory of the area in accordance with the nature directive in the summer of 2006. With regard to biotopes listed in Annex I to the nature directive, boreal natural forests are found in the Liiklankari Natura area. The biotope belongs to the priority biotopes, the conservation of which is of primary importance. A survey of the Liiklankari area identified flood plains and swamps with trees as new biotopes in the area.

According to present information, no species listed in Annexes II and IV to the nature directive are found in the Liiklankari conservation area. Grey seal is the only species listed in Annex II to the nature directive that is found in the Rauma archipelago Natura area. No observations of flying squirrel, which is a species listed in Annex II to the nature directive, have been made in the Liiklankari area, and the area lacks habitat suitable for the species because most of the forests are young cultivated forests and aspen trees are almost nonexistent. The Rauma archipelago Natura area has no other species requiring strict protection listed in Annex IV of the nature directive.

Surveys/preliminary reviews of certain groups of species were carried out in the Liiklankari area in the autumn of 2006. The groups of species studied were bryophytes, shelf fungi, beetles and macrofungi. No species listed in Annex II to the nature directive, nationally or regionally endangered species, or species to be observed were found in the area. Among the indicator species for boreal forest, two occurrences of goblin's gold were found. One observation was made of Phellinus ferrogineofuscus, which is a species to be observed (NT). Other notable shelf fungi included Asterodon ferroginosus, Leptoporus mollis, Phellinus chrysoloma, Phellinus nigrolimitatus, Phellinus viticola and Postia leucomallella. A noteworthy species of macrofungus found in the area was Lactarius scrobiculatus. Ganoderma lucidum has also been found in the area. *(Insinööritoimisto Paavo Ristola Oy 2006)*

The outer archipelago north of Rauma, including the Susikari, Kalla and Bokreivi islands, belongs to the shore conservation programme *(Ministry of the Environment 1991)*. These areas also belong to the Natura 2000 area of the Rauma archipelago. The area has sparsely located small isolated rocks and two larger, almost treeless, islands close to the open sea. The area is a representative sea archipelago and landscape entity. It is significant

as a breeding ground for animals and a resting stop for migratory birds.

The western shore of Nurmes also belongs to the shore conservation programme and the Natura 2000 areas. The western shore of Nurmes forms a special landscape entity at the interface between the open sea and the inner archipelago and is unique because it is unbuilt. The area includes forests, sheltered bays, forested capes and islands, as well as low-lying shore affected by land uplift.

The Reksaari coastal grove area located approximately 5 kilometres south of Olkiluoto belongs to the grove conservation programme and the Natura 2000 network. The area represents groves of the inner archipelago and has the only occurrence of the nationally endangered species heath bedstraw found in mainland Finland, as well as the northernmost natural occurrence of cowslip in Finland. The flora also includes field garlic, Sherard's downy-rose, water elder, Solomon's seal and red calamint.

Other valuable natural sites near Olkiluoto that have national conservation value include the Pyrekari islets and Kaunissaari island. The Pyrekari islets are located to the north of Olkiluoto, approximately four kilometres from the power plant site. The Pyrekari islets are rocky small outer islets with endangered plant species. They also serve as an educational site. Kaunissaari island to the east of Olkiluoto island is a site of cultural history.

The Omenapuumaa nature conservation area and the Särkänhuivi cape have regional conservation value. The luxuriant grove island of Omenapuumaa is located in the Rauma archipelago, approximately 5 km south of Olkiluoto. The nature on Omenapuumaa is a very variable labyrinth of broken landscape patterns. The landscape is an alteration of luxuriant groves, rocks and meadows. The island also has some planted foreign tree species. The flora includes many rare species, such as lesser celandine, narrow-leaved spleenwort and cowslip. The abundance of water elder in the area is special. Omenapuumaa belongs to the Natura 2000 network of areas. Särkänhuivi is a geological speciality and an educational site. The low, narrow, long and curved cape of Särkänhuivi is the outermost tip of the Irjanteenharju ridge that protrudes to the sea. The ridge of the cape has a road along its entire length, and, with the exception of the end, there are holiday homes in the area.

The Kalattila grove has local conservation value. The Kalattila grove has peculiar luxuriant grove vegetation typical of the northern Rauma archipelago *(Satakunta Regional Council 1996)*.

According to the new Council of State programme (19 April 2007), the possibilities for establishing a national park in Selkämeri will be investigated. The planned core of the park would include the chain of outermost islands in the sea areas of Pyhäranta, Rauma, Eurajoki and Luvia, as well as the versatile inner Rauma archipelago and a few islands off Säppi in Luvia belonging to the territory of the city of Pori. Kaunissaari in Eurajoki is also a specialty as it is located in the inner archipelago; it is not only a valuable natural and historic site but also a backpackers' base for exploring the outer archipelago. The Selkämeri

Figure 6-9 Conservation sites and areas around Olkiluoto.

national park is one of the spearhead projects of the Satakunta Regional Council. The objective is backed not only by nature conservation but also support to the tourism industry.

6.10 Radiation

The emissions of radioactive substances from the power plant into air and water are under constant monitoring. Radioactivity is measured on and around the power plant site from objects such as seawater, fish, algae, seabed fauna, air, soil and grass, as well as garden and agricultural products and meat. Monitoring is carried out in accordance with the radiation control programme for the surroundings of the power plant, and the results are reported to STUK.

The annual radiation doses to people resident near the plant are calculated annually on the basis of the plant's radioactive emissions. The radiation dose to nearby residents due to emissions into the air and sea in 2006 was approximately 0.27 µSv/inhabitant. The allowed maximum annual dose caused by emissions from Olkiluoto is 100 µSv. It can be noted for comparison that the average dose received by each Finn from other radiation sources is approximately 3,700 µSv annually.

Radioactive substances originating from the Olkiluoto power plant are detected relatively rarely in samples taken from the ground environment. A few observations are made each year in air and fallout samples but the concentrations have only been in the order of one thousandth of natural activity at maximum.

In the immediate vicinity of the power plant small amounts of radioactive substances originating from the power plant are regularly observed in aquatic samples, such as algae, aquatic vegetation, seabed fauna and sinking matter. The concentrations have been insignificant both for humans and the nature.

Observations of radioactive substances in food samples have been rare. Radioactive substances originating from the Olkiluoto power plant have never been detected in samples of milk, crops and meat during the entire operating history of the power plant.

Annual radiation doses to the environment are calculated on the basis of radioactive emissions from the power plant. The calculating models account for the spreading of radioactive substances in the atmosphere and waters, as well as accumulation phenomena in different food chains. The calculation of radiation doses to people resident near the plant accounts for the means by which they utilise the environment surrounding the power plant for purposes such as agriculture, recreation and fishing in order to be able to determine the radiation doses caused by people through different routes of origination.

The environmental radiation caused by the nuclear power plant is very minor in comparison to natural background radiation. However, environmental monitoring measures can be used to monitor the occurrence of radioactive substances originating from the nuclear power plant in the environment because they can be distinguished from natural radioactive substances and those originating from other sources of emissions.

7 Environmental Impact Assessment and the Methods Used

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 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). All 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.

In this context, observed area refers to the area defined for each type of impact within which the environmental impact in question is examined and assessed. Affected area, on the other hand, refers to the area where, on the basis of the assessment, the environmental impact in question is expected to manifest itself. The affected area is thus expected to be substantially smaller than the observed area.

The observed area is aimed to be defined so large 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 unit will be examined separately because they differ from the impacts occurring during the operation of the power plant unit 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. The impact of construction-time traffic will be examined in the vicinity of roads leading to the power plant site. The impact on soil and bedrock, groundwater, water systems, vegetation and animals, employment, noise and people's comfort arising from construction will be assessed on the basis of the feedback received in connection with the interactions and experience gained from the OL3 project.

7.3 Assessment of environmental impacts during operation

The safety design bases of the planned power plant unit, as regards the limitation of radioactive releases and environmental impacts, will be presented. An assessment of the possibilities for fulfilling the currently valid safety requirements will also be presented.

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 unit will be presented. Their impact on the environment and people will be assessed based on the existing research findings.

In the nuclear power plant unit 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 to those arising from the production of a similar amount of electricity.

The avoided flue gas releases are estimated by postulating that the amount of electricity equal to the electricity production volume of the nuclear power plant unit be produced with the average Nordic production structure and average release coefficients.

The project's impact on greenhouse gas emissions will be also assessed for the alternative by taking into account the releases relating to the production of substituting energy in a manner similar to that described above.

7.3.2 Assessment of water system impacts

Model calculations on the dispersal and flows of cooling waters, as well as an estimate of the impacts of thermal load on the temperatures of the area in the vicinity of the discharge site and on ice condition in different discharge site location options, will be prepared. The detailed dispersal calculations, obtained as a result of the above, will be used as the basis of the impact assessments. The analysis will cover both the present cooling waters and the addition arising from the new plant unit. The possibilities for cooling water utilisation will be examined.

The waste water load and radioactive discharges to the sea occurring during the operation of the planned power plant unit 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 extensive research data

and the results of the afore mentioned dispersal model calculations.

In the modelling, the area of the most detailed observation covers an area of approximately 12 x 12 km^2 in front of Olkiluoto. The distances between observation points will be longer outside this area. The model will also be linked to a larger entity representing the Bothnian Sea for the purpose of defining the boundary conditions.

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 ordinary, hazardous and radioactive waste generated at the power plant unit, 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 studies carried out thereafter.

The EIA report will discuss the overall management of spent nuclear fuel, including the required extensions of storage facilities and their environmental impacts.

7.3.4 Assessment of soil, bedrock and groundwater impacts

The impacts of the location site on the soil and bedrock, and the interaction between them will be assessed.

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

The available modelling data will be utilised in the assessment.

7.3.5 Assessment of impacts on vegetation, animals and conservation areas

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.

In the assessment work, 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. On the basis of the review, it will be decided whether a Natura assessment pursuant to Section 65 the Nature Conservation Act will be carried out.

7.3.6 Assessment of impacts on land use, structures and landscape

The project's impacts on 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, as well as 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. In the impact assessment, the question of whether the power plant unit 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. 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 areas where the power plant buildings will be notably more visible than other landscape elements will be defined as the power plant project's observed area in terms of landscape. The vent stack will be visible from a longer distance than the actual power plant buildings.

7.3.7 Assessment of impacts on people and society

In the environmental impact assessment, the impacts of the alternatives on people's health, comfort and living standards in terms of, e.g., land use changes, landscape impacts, increased radiation dose caused by radioactive releases, water system impacts, traffic impacts, traffic safety, employment impacts, and noise will be investigated. 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 of the area. The interaction taking place 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.

If required, a resident survey and 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 purpose of the resident survey is to further interaction by providing the person in charge of the project with information about the residents' attitudes towards the project and, conversely, by providing the residents with information about the project and its impacts on their living environment. Information about the project and its environmental impacts, and on the EIA procedure in general will be sent along with the resident survey. The resident survey is targeted at the interest groups of the nearby areas. A resident survey has been carried out in connection with the land use planning of Olkiluoto, which will be utilised as applicable in the preparation of the EIA report.

The project's impact on recreational opportunities and living comfort will be assessed on, among other things, the basis of traffic volume changes and impacts on water systems (for example, ice conditions). 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 unit will be prepared.

The increase in radiation dose for residents in the surrounding area caused by radioactive releases from the power plant unit will be assessed. Health impacts and risks will be assessed using calculations based on radiation exposure.

In the assessment of social impacts, the main focus will be in the neighbouring regions of Olkiluoto – that is, Eurajoki and Rauma – although the impacts on the regional structure and regional economy will also be examined, with the broadest framework of the analysis covering the whole Satakunta area.

The area affected by noise releases from the new power plants is typically 100 to 200 metres from the power plant wall. The power plants will be so designed that within this distance, the noise level does not exceed 45 dB(A) during normal operation. In the environmental impact assessment, the observed area for noise releases will be extended to approximately 2 km from the power plant. Previous noise measurement data that can be used for comparison exists for this area.

The area covered by the current environmental radiation monitoring programme of the Olkiluoto power plant will be used as the observed area for the impact of radioactive releases. This supervised area for normal operation, approved by the authorities, has measurement and sampling points that are used for supervising and taking samples from, for example, air, soil, wild plants, grazing grass, milk, garden and agricultural products, domestic water, landfill site, seawater, water plants, sea bed fauna, fishes, sinking matter, and bottom sediment. The distance of sampling points from the power plant varies according to the supervised object. Samples from rainwater, for example, are taken within a distance of 0 to 10 km from the power plant, while grain is sampled within a maximum distance of 20 km and beef at a maximum distance of 40 km. However, the monitoring programme mainly focuses within a distance of less than 15 km from the power plant.

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.

7.3.8 Assessment of the environmental impact of traffic

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 and the experience gained from the OL3 project. The required changes to the traffic arrangements in these areas, as well as their impacts, will be assessed.

Road 2176 from Lapijoki to Olkiluoto, and the roads from Hankkila via Sorkka to Rauma and from Linnanmaa to Eurajoki are defined as the observed area for road traffic impacts. The impact on traffic volumes on highway 8 to the north of Rauma will also be examined.

7.3.9 Assessment of impacts on the energy market

The purpose of the new nuclear power plant unit is to increase the base-load power production capacity. The construction of the nuclear power plant unit will also improve Finland's independence from foreign electricity and increase supply on the electricity market. As nuclear power is characterised by the price stability of production costs, the project will also enhance the predictability of the electricity market. The share of the planned increase in electricity production capacity in the Nordic electricity market will be presented.

7.3.10 Assessment of the impacts of exceptional and accident situations

The EIA report will discuss the environmental impacts of accidents based on the safety analyses of the existing power plant units and the requirements imposed on the new unit. The ramifications of exceptional situations will be assessed based on the extensive research data on the health and environmental impacts of radiation. In addition to the above, the advancement of the safety of nuclear power plants will also be considered.

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.

To provide for the occurrence of accidents, the existing Olkiluoto power plant has been allotted a protective zone extending to 5 km from the power plant in the land use planning, as well as an emergency planning zone of rescue operations comprising the areas of Eurajoki, Luvia and Rauma. The provisions for exceptional situations at the new power plant unit, as well the environmental impacts of these situations, will be primarily examined based on this area division.

7.3.11 Assessment of the impacts related to decommissioning of the power plant unit

Different dismantling phases and their durations, the types of dismantling waste generated and the methods used for their treatment, as well as the environmental impacts relating to them, will be presented.

7.3.12 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. The environmental impacts of the production and transportation of nuclear fuel will be described based on the existing specifications. The EIA report will describe the mining operations of the uranium supplier typically used by TVO.

7.3.13 Assessment of associated projects

The project has as its associated project the construction of a new power transmission line. Fingrid Oyj will be responsible for the operations relating to power transmission lines, which will also include the implementation of an EIA procedure in due course.

The amount, as well as the storage method and time, of the spent fuel generated by the new power plant unit will be described. In the description of environmental impacts, 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 studies, will be utilised.

The new power plant unit will increase the volume of traffic to Olkiluoto during the construction phase in particular. The increase in traffic volumes may require refurbishing the road 2176 between Lapijoki and Olkiluoto. The possible detrimental effects arising from the increased traffic volumes, as well as the options for mitigating them, will be examined.

In addition to the above, the assessment report will also present the need for back-up power.

7.4 Assessment of zero-option impacts

The zero-option is the non-implementation of the project. In this case, the shareholders of TVO will purchase their electricity elsewhere and the situation in Olkiluoto will remain unchanged. The production method or location of the electricity procured elsewhere cannot be predicted because it depends on factors such as the market situation. 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 Eurajoki region. The assessment of the impacts of the zero-option is based on the analysis of the current state of the Olkiluoto environment and its estimated development.

The discussion of the zero-option assesses the environmental impacts that would arise if the amount of electricity equal to the electricity production volume of the nuclear power plant unit were produced with the average Nordic electricity production structure.

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 interaction taking place 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 significance of the project's impact. The opinions of residents, audit group and operating agencies will be recorded in the EIA report.

8 Licences, Permits, Plans, Notifications and Decisions Required for the Project

8.1 Land use planning

The construction of the planned power plant unit does not require any changes to land use planning.

8.2 Environmental impact assessment and international hearing

According to the Act on Environmental Impact Assessment Procedure *(468/1994)* and the Decree on Environmental Impact Assessment Procedure *(713/2006)*, the construction of a nuclear power plant requires that an environmental impact assessment procedure be arranged. According to the Nuclear Energy Act, the environmental impact assessment report shall be included in the application for a decision-in-principle concerning the construction of a nuclear power plant.

The assessment of transboundary environmental impacts has been agreed upon in the so-called Espoo Convention (Convention on Environmental Impact Assessment in a Transboundary Context). Finland ratified this UNECE Convention 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 are likely to affect the State in question. Correspondingly, Finland is entitled to participate in an environmental impact assessment procedure concerning a project located in the area of another State if the impacts of the project are likely to affect Finland.

8.3 Licences pursuant to the Nuclear Energy Act

8.3.1 Decision-in-principle

According to the Nuclear Energy Act *(990/1987)*, the construction of a nuclear facility of considerable general significance shall require a Council of State 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 Council of State, on which the Ministry of Trade and Industry must obtain a preliminary safety assessment from STUK 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 a general description of the facility, the environmental effects it is expected to have and its safety, and make it generally available to the public after being checked by the Ministry. 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 Council of State.

The Council of State's 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. The investment decision for the project shall not be made prior to the decision-in-principle.

8.3.2 Construction licence

The Council of State grants the licence to construct 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.

8.3.3 Operating licence

The operation of a nuclear power plant requires an operating licence issued by the Council of State. 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 power plant 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 power plant 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 power plant shall not be started on the basis of a licence granted until STUK has ascertained that the nuclear power plant 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.

8.3.4 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).

8.3.5 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 Eurajoki municipality.

8.4 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 Eurajoki municipality (Environmental Committee), 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 30 metres above 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)*.

8.5 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 treatment relating to the operation of the power plant. The permit authority for the project is the Western Finland Environmental Permit Authority.

8.6 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, permits concerning flammable liquids, pressure equipment permits, and permits pursuant to the Chemicals Act.

9 Mitigation of Adverse Impacts

10 Uncertainty Factors

11 Project Impact Monitoring

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.

During the assessment work, the potential uncertainty factors will be identified as comprehensively as possible 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.

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