



When assessing the significance of environmental impacts, the views obtained from the monitoring groups in the alternative locations during the draft stage of the report were taken into account. Boat sheds in Simo, 2008.

As a result of the assessment, none of the project's alternative implementations have been found to have any adverse environmental impacts that were unacceptable, or could not be mitigated to an acceptable level. Thus, the project is feasible from the environmental impact perspective.



9 Comparison between alternatives and assessment of the significance of the impacts

9.1 Comparison between alternatives

For environmental impact assessment purposes, the current environmental status and impact factors have been surveyed on each alternative location based on current knowledge and surveys carried out for the EIA procedure.

Characteristics of the project to be assessed, and the factors that are essential in terms of environmental impacts have been identified on the basis of preliminary design data. Surveys and interviews on the environmental impacts have been carried out in the vicinity of the project's alternative locations. In addition, model calcu-

lations, photomon-tages and expert assessments of the impacts of future operations, based on the experience and research data from similar projects and operations, have been prepared to support the assessment.

The environmental impacts of the project have been examined by comparing the zero alternative and the changes to the current situation brought about by the implementation of the project in the four alternative locations. Moreover, differences in the implementation of the two power plant alternatives and in alternative cooling water intake and discharge locations have been assessed. To obtain an overview of the project, the de-



Energy supply is an important element in ensuring the welfare of Finnish people. Urban view of Helsinki in 2008.

scription also includes parts of the project lifecycle that will take place outside the boundaries of Finland, or that will be covered by EIA procedures of their own. Also the impacts of an extremely unlikely serious accident have been considered. Special emphasis has been placed, based on the feedback given by the various audit groups during the EIA procedure, on investigating and describing the key impacts.

The significance of environmental impacts has been assessed based on the magnitude of the change, and by comparing the impacts of future operations on guidelines and limit values of environmental load, on environment and quality standards, and on the current environmental load in the area. Comments received from the audit groups from the alternative locations during the drafting of the assessment report have also been considered in the assessment of the significance of environmental impacts.

Key factors for the significance of impacts include:

- Extent of the impact area

- Impact target and susceptibility to changes
- Significance of the impact target
- Recovery or non-recovery from the impact
- Intensity of the impact and magnitude of the resulting change
- Fears and insecurities associated with the impact
- Different views on the significance of the impacts.

Impacts of the different implementation alternatives are presented in a comparison table (Table 9-1). The table gives a consistent view of the major environmental impacts of the different alternatives. At the same time, the ease of implementation of the different alternatives with respect to the environment has been evaluated. The differences between the different alternatives have also been discussed in the sections on the alternative locations, plant options and cooling water intake and discharge options following the table. A more detailed evaluation of the impacts of the different alternatives is presented in Chapter 8

Table 9-1. Major impacts of the project in the alternative site locations (Pyhäjoki, Ruotsinpyhtää ja Simo).

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Construction-phase impacts of a nuclear power plant				
The construction-phase impacts are of a temporary nature.				
Impacts of construction on the environment and people	Construction sites create local dust, and its impact on air quality is mostly restricted to the construction site. Other construction-phase impacts, such as impacts on noise or comfort, are discussed in separate sections below.			
Noise impacts during construction phase	The daytime guidance value will be exceeded on about 15 existing vacation properties in the vicinity of the power plant and on 10 vacation properties near the road.	The daytime guidance value will be exceeded on about 20 existing vacation properties in the vicinity of the power plant and on 20 vacation properties near the road.	The daytime guidance value will be exceeded on less than 20 existing vacation properties in the vicinity of the power plant and on about 30 vacation properties near the road.	The daytime guidance value will be exceeded on a few dozen existing vacation properties in the vicinity of the power plant.
Regional economic and social impacts of construction	During the construction phase, municipal tax revenue will be EUR 2.8 to 4.5 million in the economic areas, and property tax revenue in the location municipality will be determined by the stage of completion of the nuclear power plant. In the economic area, the employment impact will be 500 to 800 man-years annually. The project will boost business in the economic area, and demand for private and public services will grow.			
Impacts of construction-related transport and commuter traffic	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 20%.	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 40%.	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 40%.	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 20%.
	Traffic during construction will increase emissions in all of the alternatives. Traffic volumes will reach their peak in the fourth or fifth year of construction. In other construction years, traffic volumes and emissions will be considerably lower. Construction-related traffic emissions are not estimated to have any significant long-term impacts on air quality in the areas surrounding the alternative location sites.			
The Impact of building a navigation channel and harbor quay	The sea bed will have to be dredged and blasted for the quay. The length of the required new channel is about 1.5 kilometers. Dredging will cause temporary and local clouding of water.	Building the quay will not require much dredging or blasting. The existing channel is deep enough so there will be little need for dredging. Dredging will cause temporary and local minimal clouding of water.	The sea bed will have to be dredged and blasted for the quay. The existing channel requires deepening along about a 500-meter stretch. Dredging will cause temporary and local clouding of water.	The sea bed will have to be dredged and blasted for the quay. The length of the required new channel is about 500 meters. Dredging will cause temporary and local clouding of water.
The impacts of building cooling water structures	Impacts mainly depend on the chosen intake structure. The tunnel needed for bottom intake will be blasted under the seabed. Shore intake will be built by the mainland or island shoreline. When a shore intake and discharge structures are built, the shore will be excavated and/or blasted and the bottom dredged as required. Dredging will cause temporary and local clouding of water.			

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Impacts of building road connections	<p>A new road of slightly less than 5 kilometers will be built in the plant area.</p> <p>There are no significant changes in land use in the area.</p> <p>There is no housing near the planned road so the construction will not cause disturbance to inhabitants.</p>	<p>Road improvement along a 7.4-kilometer stretch, and reinforcement of a bridge located on the road.</p> <p>About 3.5 kilometers of new road will be built. A road connection to Kampuslandet will be built across a 170 meters wide strait by means of embankment and bridge structures.</p> <p>There are no significant changes in land use in the area.</p> <p>Regional landscape will be altered.</p> <p>There will be temporary disturbance to road users and housing along the road. Traffic connections to holiday homes and other villages will improve.</p>	<p>Road improvement along a 7.4-kilometer stretch, and reinforcement of a bridge located on the road.</p> <p>About 2.5 kilometers of new road will be built.</p> <p>There are no significant changes in land use in the area.</p> <p>There will be temporary disturbance to road users and housing along the road.</p> <p>Traffic connections to holiday homes and other villages will improve.</p>	<p>Road improvement along about a 5-kilometer stretch.</p> <p>About 1 kilometer of new road will be built.</p> <p>There are no significant changes in land use in the area.</p> <p>Coast landscape will be slightly affected.</p> <p>There will be temporary disturbance to road users and possibly to housing along the road.</p> <p>A road connection to the Laitakari Island will be built. Traffic connections to holiday homes will improve.</p>
The impact of building power lines	<p>About 20 kilometers of new power line route will be built to connect the plant to the national grid.</p> <p>Restricted land use in the power line clearing.</p> <p>There are no nature conservation areas along or in the immediate vicinity of the power line route.</p> <p>Construction will disturb avifauna during nesting and migration periods, especially at the Hietakarilahti Bay.</p>	<p>About 15 kilometers of new power line route will be built to connect the plant to the national grid.</p> <p>Restricted land use in the power line clearing.</p> <p>There are no nature conservation areas along or in the immediate vicinity of the power line route.</p> <p>Construction will disturb avifauna during nesting and migration periods.</p>	<p>About 15 kilometers of new power line route will be built to connect the plant to the national grid.</p> <p>Restricted land use in the power line clearing.</p> <p>There are no nature conservation areas along or in the immediate vicinity of the power line route.</p> <p>Impacts on historical stone structures should be considered when designing power lines.</p>	<p>About 20 kilometers of new power line route will be built to connect the plant to the national grid.</p> <p>Restricted land use in the power line clearing.</p> <p>Construction will disturb avifauna during nesting and migration periods.</p> <p>The relationship between the power line route and antiquities in Northern Karsikkoniemi should be assessed.</p>

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Operational impacts of a nuclear power plant				
The impact on water bodies and fishery				
The impact on sea water temperature and ice cover	<p>The extent of the warming sea area will be defined by the size of the power plant and, to some extent, by the chosen intake option.</p> <p>Bottom intake will cause warming of a smaller area than shore intake.</p> <p>Cooling waters will cause thinning of the ice cover at the Hanhikivi headland.</p>	<p>The extent of the warming sea area will be defined by the size of the power plant and, to some extent, by the chosen intake and discharge options.</p> <p>The warmed area will be most restricted if cooling water is discharged to the open sea south of Kampuslandet, and less restricted when it is discharged to a moderately shallow bay on the eastern side.</p> <p>Bottom intake will warm the smallest area, shore intake on Vådholmsfjärden the largest.</p> <p>During the winter, the uniform area of thin or nonexistent ice cover will expand. Discharge to Vådholmsfjärden would carry the largest impact.</p>	<p>The extent of the warming sea area will be defined by the size of the power plant and, to some extent, by the chosen intake and discharge options.</p> <p>The warmed area will be more restricted if cooling water is discharged to the open sea south-west of the Karsikko area. The area will be larger, if cooling water is discharged to the Veitsiluoto Bay.</p> <p>Bottom intake will warm the smallest area, and there is not much difference between the shore intake alternatives.</p> <p>Cooling waters will weaken the ice cover near Karsikko.</p>	
The impact on quality of water and ecology	<p>Proliferation of aquatic vegetation and phytoplankton will increase on the impact area of cooling waters.</p> <p>The impact will be minimal due to the open and nutrient-poor sea area.</p> <p>According to assessments, cooling water discharge will not cause anoxia in deep waters or significantly increased flowering of the blue-green algae.</p> <p>The project will not affect water quality.</p>	<p>Proliferation of aquatic vegetation and phytoplankton will increase on the impact area of cooling waters.</p> <p>Due to eutrophication, flowering of the blue-green algae may increase locally, particularly if the mostly shallow sea area east of Kampuslandet is chosen as a discharge location. The project may have local adverse impacts on the oxygen level near the bottom. The impacts will be more restricted if the alternative using open sea is chosen as a discharge location.</p> <p>In bottom intake, nutrient concentration may increase slightly at the discharge site and intensify the impact of thermal load to some extent.</p>	<p>Proliferation of aquatic vegetation and phytoplankton will increase in the impact area of cooling waters. In discharge to the open sea, eutrophication is assessed to be minimal and it is not estimated to result in anoxia in deep waters or significantly increased flowering of the blue-green algae. In discharge to the more sheltered and nutrient-rich Veitsiluoto Bay, eutrophication will probably increase relatively more. On the other hand, imprint of human activity can already be seen clearly at the Veitsiluoto Bay when compared to the sea area south of Karsikkoniemi.</p>	
Impacts on fish fauna and fishery	<p>Possible adverse impacts on fishing include the clogging of nets caused by mucilage and, in the summertime, hindered whitefish fishing especially on the fishing ground North of Hanhikivi.</p> <p>During the winter, the unfrozen body of water will hinder fishing from ice but, on the other hand, it will extend the open water fishing season and attract whitefish and trout to the area.</p>	<p>Possible adverse impacts on fishing include the clogging of nets caused by mucilage, and decreased catching efficiency of trap nets used for salmonids (whitefish, trout, salmon) on the impact area of cooling waters.</p> <p>This will hinder fishing from ice but, on the other hand, it will extend the open water fishing season and attract whitefish and trout to the area during the winter.</p>	<p>Possible adverse impacts on fishing include the clogging of nets caused by mucilage, and decreased catching efficiency of trap nets used for salmonids (whitefish, trout, salmon) on the impact area of cooling waters.</p> <p>According to assessments, cooling waters will not have an impact on fish migration.</p> <p>During the winter, the unfrozen body of water will hinder fishing from ice but, on the other hand, it will extend the open water fishing season and attract whitefish and trout to the area.</p>	

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Impacts on vegetation, animals and protected sites	<p>The construction period will disturb the fauna, and some habitats will be permanently altered.</p> <p>The Hanhikivi headland area will change, and the nature of the area will become so fragmented that the area's significance as a model of uninterrupted succession development will clearly deteriorate.</p> <p>The Hanhikivi area is rich in bird species. The plant unit of the planned power plant would be in an area where the avifauna mainly consists of ordinary forest species.</p> <p>The Hanhikivi headland is on the route of migrating birds and acts as a staging area for many species. Power lines will increase the risk of migratory bird collisions.</p> <p>There are a few occurrences of endangered and otherwise noteworthy plant species at the Hanhikivi headland. If there is no construction on the habitats, the occurrence of the species in the area will probably not deteriorate.</p> <p>The thermal load of cooling water may have indirect detrimental impacts on the shore meadows in the Takaranta area and thus on the Siberian primrose, for example, should the overgrowing of meadows accelerate.</p> <p>The project area includes the nature conservation area of Ankkurinnokka and several habitat types defined in the Nature Conservation Act. The overgrowing of protected shore meadows may intensify.</p> <p>The closest Natura area is located about 2 kilometers away, south of the area. The project is not deemed to cause any major adverse impacts on the conservation criteria of the Natura 2000 area, and a Natura assessment is not deemed necessary.</p>	<p>The construction period will disturb the fauna, and some habitats will be permanently altered.</p> <p>The observed bird species can mostly be deemed regular species for coastal and inland archipelago areas. The area does not include any avifauna sites of major significance to regional bird species. The project is not deemed to cause any major adverse impacts on the avifauna. Power lines will increase the risk of migratory bird collisions.</p> <p>Most of the natural characteristics of the area are common for the area, and the forests are highly managed. In the Kampuslandet alternative, the power line route will alter the entity formed by seashore groves and meadows on the eastern shore of Gäddbergsö.</p> <p>The most significant ecological values are located on the shores and on the Kasaberget area. There are no significant impacts on these areas as a whole.</p> <p>The total impacts of the project on the diversity of nature will be local and the regional impacts minimal.</p> <p>There are no nature conservation areas or habitat types in accordance with the Nature Conservation Act in this area. The closest nature conservation areas are approximately three kilometers to the northwest and southwest. According to assessments, the project will not have an impact on the nature conservation areas.</p> <p>The closest Natura area is at its closest approximately 1.5 kilometers south of Kampuslandet. The project is not deemed to cause any major adverse impacts on the conservation criteria of the Natura 2000 area, and a Natura assessment is not deemed necessary.</p>	<p>The construction period will disturb the fauna, and some habitats will be permanently altered.</p> <p>Karsikkoniemi is rich in bird species due to the diverse habitat structure of the area.</p> <p>The areas which will change the most are located in the inner parts of Karsikkoniemi headland where there are no significant sites considering the avifauna or other animals, except for the Lake Karsikkojärvi, and in the Laitakari and Korpikarinnokka area which are areas significant for the avifauna. Power lines will increase the risk of migratory bird collisions.</p> <p>There are plenty of occurrences of endangered and otherwise noteworthy plant species at Karsikkoniemi headland. Construction may destroy some of the occurrences from the area.</p> <p>There are no nature conservation areas in the assessment area. There are a few habitat types in accordance with the Nature Conservation Act in this area. The overgrowing of protected shore meadows may intensify on the western shore of Karsikkoniemi.</p> <p>The closest Natura area is located at Ajos headland, a little over three kilometers from the assessment area. A slight heat impact from the cooling waters may occasionally extend to the area. The project is not deemed to cause any major adverse impacts on the conservation criteria of the Natura 2000 area, and a Natura assessment is not deemed necessary.</p>	

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Impact of radioactive emissions	Fennovoima's nuclear power plant will be designed so that its radioactive emissions fall below the set limit values. The plant's radioactive emissions will be so low that they will not have any detectable impact on the people or the environment.			
Impact of other emissions				
Traffic emissions	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 3%.	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 5%.	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 5%.	Traffic to and from the nuclear power plant will increase regional traffic emissions by approximately 3%.
	<p>In all of the options, traffic to the plant runs mostly along highways or motorways. The traffic volumes on these roads are fairly high, and the nuclear power plant's traffic will not cause a significant change in the volumes and, as a result, in traffic emissions and air quality.</p> <p>The nuclear power plant's traffic emissions can be assessed as having an impact on air quality mostly along smaller, less operated roads leading to the nuclear power plant. Because air quality in all of the site options is assessed as being good, traffic emissions will not degrade air quality to the extent that it will have adverse effects on people or the nature.</p>			
Emissions from emergency power and heat generation	The emission volumes are very small and will not affect the air quality of the alternative sites.			
Impacts on the ground, bedrock and ground-water	The most significant impacts will occur during the construction of the nuclear power plant. Construction work produces large amounts of excavation, rock blasting and dredging masses. The foundation waters and rain water drained from the construction site will contain more solids and possibly oil and nitrogen compounds than waters normally drained from tarmac-covered yards. The project will not have any detrimental impacts on usable ground-waters.			
Impacts on traffic and safety	<p>Overall traffic volumes on the trunk road near the intersection leading to the nuclear power plant will increase by approximately 7-10% and heavy traffic volumes by about 2-4%.</p> <p>The new road to be built from the trunk road to the nuclear power plant will be designed to be suitable for the use of traffic required by the power plant. The intersection from the trunk road will be designed to be safe and smooth by means of preselection lanes and speed limits, for example.</p>	<p>The maximum increase in total traffic volumes on the trunk road or motorway will be approximately 5% and about 1% for heavy traffic.</p> <p>If the Atomitie road extension is completed, traffic volumes at the beginning of the Saaristotie road and on the Helsingintie and Mannerheiminkatu roads will increase slightly, because only the personnel living in downtown Loviisa will use that route to reach the plant. In this case, the traffic volume at the end of Saaristotie road from Atomitie road to Reimars will increase significantly by about 2.5 times.</p> <p>The traffic conditions on Saaristotie road from Atomitie road will change and traffic safety may decrease. However, the Saaristotie road will be improved to be suitable for the nuclear power plant traffic, in which case safety and traffic flow will be taken into consideration.</p>	<p>The total volume of traffic on the trunk road will increase by approximately 3-6% and heavy traffic by about 2-4%.</p> <p>The volumes of traffic on Karsikontie road will change significantly and traffic safety may decrease. However, the road will be improved to be suitable for the nuclear power plant traffic, in which case safety and traffic flow will be taken into consideration.</p>	
	Nuclear power plant traffic will only have a minor effect on traffic volumes on the main routes. The planned improvement projects for routes leading to the alternative nuclear power plant sites will improve traffic safety, and according to assessments, nuclear power plant traffic will not lead to degradation of traffic flow and safety.			

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Noise impacts	<p>There is no activity that causes significant noise in the vicinity of the power plant.</p> <p>The location near the sea is quite favourable in terms of spreading noise.</p> <p>The nighttime guidance value will be exceeded on about 15 to 20 existing vacation properties in the vicinity of the power plant.</p> <p>Holiday residences on the west and southwest coast will be partly removed with the implementation of the project.</p>	<p>There is no activity that causes significant noise in the vicinity of the power plant.</p> <p>The location on the archipelago is favourable in terms of spreading noise.</p> <p>The nighttime guidance value will be exceeded on about 20 existing vacation properties in the vicinity of the power plant and on vacation properties close to the road.</p>	<p>There is no activity that causes significant noise in the vicinity of the power plant.</p> <p>The location on the archipelago is favourable in terms of spreading noise.</p> <p>The nighttime guidance value will be exceeded on a few existing vacation properties in the vicinity of the power plant.</p>	<p>There is no activity that causes significant noise in the vicinity of the power plant.</p> <p>There are no characteristics promoting or constraining the spreading of noise in the surrounding environment.</p> <p>The nighttime guidance value will be exceeded on a maximum of 10 existing vacation properties in the vicinity of the power plant.</p> <p>The holiday homes located on the south coast will probably be removed with the implementation of the project.</p>
Impacts on the landscape and cultural environment	<p>The power plant will alter the landscape considerably.</p> <p>The power plant will be placed on a highly visible area on the tip of a headland reaching out into the open sea. There is no industry or other heavy structures on the regional coastal zone.</p> <p>The status and character of the surroundings of the nationally valuable historical Hanhikivi antiquity will significantly change. The landscape status of Takaranta, a seashore meadow of regional importance, will change.</p> <p>The power line will alter the landscape but the impacts will be mainly local (the power line route).</p>	<p>The power plant will alter the landscape considerably.</p> <p>The power plant will be located in the vicinity of an existing power plant. It will be placed on the edge of the outer archipelago zone where, as seen from the sea, there are very few elements to cut off the views.</p> <p>Significant impacts on the surrounding environment or status in the landscape entity of regionally important areas with regard to the cultural environment or landscape.</p> <p>The power line will alter the landscape. In particular, the section across the strait between Gäddbergsö and Kampuslandet and the section between Reimars and Bullers have significant impacts on the landscape.</p>	<p>The power plant will alter the landscape considerably.</p> <p>The power plant will be located in the same landscape space, limited by islands and the continental coast, as the existing nuclear power plant. The area belongs to an inner archipelago zone where the views from the surrounding shores will change significantly. From the open sea, islands and trees cut off the view towards the plant in some places.</p> <p>There are some impacts on the surrounding environment or status in the landscape entity of regionally important areas with regard to the cultural environment or landscape.</p> <p>The power line will alter the landscape. In particular, the section between Reimars and Bullers will have significant impacts on the landscape.</p>	<p>The power plant will alter the landscape considerably.</p> <p>The power plant will be located on a highly visible area on a headland bordering on the outer archipelago and open sea zone.</p> <p>The landscape status of the nationally important Karsikko fishing village will change.</p> <p>The power plant will complement the industrial zone of the Kemi region. The landscape of the regional coastal strip is in transition (zones of industrial activity, extensive reserves for wind power, harbor traffic).</p> <p>The power line will alter the landscape but the impacts will be mainly local (the power line route).</p>

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Impacts on living conditions, comfort and health	<p>Normal operation of the nuclear power plant has no radiation-related, detectable impact on the health, living conditions or recreation of people living in the vicinity. Access to the nuclear power plant area is denied and the area cannot be used for recreational purposes. Warm cooling water will melt or weaken the ice and, as a result, restrict recreational activities on ice during the winter, such as fishing or walking. On the other hand, it will extend the open water fishing season.</p> <p>Nearby residents and operators have very different views on the nuclear power plant project, and there are local groups both opposing and supporting the project. Opposition is often based on risks and fears associated with nuclear power plants, and on the belief that nuclear power is ethically questionable. The supporters emphasize its positive economic impacts and environmental friendliness.</p>			
Impacts on regional economy	<p>During the operation, property tax revenue in the location municipality will be EUR 3.8 to 5.0 million a year and municipal tax revenue EUR 1.9 to 2.4 million a year in the economic area. In the economic area, employment impact will be 340 to 425 man-years annually. The arrival of new residents, boosted business and escalated building activity will increase tax revenue. The population base and housing stock will increase. Demand for private and public services will grow. There is no foreseeable, significant variation between the municipalities.</p>			
Impacts on land use and community structure	<p>The holiday residences on the west coast and some of the holiday homes on the southwest coast will be removed and the southwest cannot be used for recreational purposes.</p> <p>The new road connection will not cause any significant changes in land use.</p> <p>Hanhikivi remains accessible.</p> <p>The significance of Raahe as a strong industrial region will become stronger – and preconditions for development of land use may improve.</p>	<p>Most of the current holiday home areas may be preserved. The use of the areas for recreation or outdoor activities will be restricted.</p> <p><i>Gäddbergsö</i>: the new road connection will mainly follow the layout of the existing road. <i>Kampuslandet</i>: the new road route will not be in conflict with current land use.</p> <p>A large part of the safety zone is already included inside the safety zone of the Hästholmen plant, so there are no significant changes in land use restrictions.</p> <p>The plant will strengthen the position of the Loviisa region as a center for energy production – and preconditions for development of land use may improve.</p>	<p>Holiday residences on the south coast will be removed.</p> <p>The current Karsikontie road can be used as a road connection. New road connections may be necessary for current land use and possible rescue routes but they will not affect land use.</p> <p>The plant will restrict the building of new residential areas indicated in previous plans.</p> <p>The significance of Kemi-Tornio as a strong industrial region will become stronger – and preconditions for development of land use may improve.</p>	
	<p>The power line leading to the plant will restrict land use on a strip 80–120 meters wide depending on the column type.</p> <p>The construction of the power plant will restrict land use in the plant's safety zone. Building of workplace and residential areas and services may introduce new land use opportunities in villages and settlements and along roads.</p>			
Impacts of final disposal of operating waste	<p>Adequate facilities will be built at the nuclear power plant for the treatment and final disposal of operating waste. Careful planning and implementation will help to eliminate significant environmental impacts caused by the treatment and final disposal of operating waste. The facilities will contain systems, using which the safe handling and transportation of waste and the monitoring of the amount and type of radioactive substances can be performed. Once the use of the final disposal facilities is terminated, the connections will be sealed and will not require any control afterwards. Any radioactive substances contained by waste will become safe for the environment through time.</p>			
Impacts of nuclear fuel procurement chain	<p>The impacts of the nuclear fuel procurement chain will not be felt in Finland because Fennovoima procures the required uranium from the world market. The arising impacts will be assessed and regulated in each country according to local legislation.</p> <p>The environmental impacts of uranium mining operations are connected with the radiation of the uranium ore, radiation effect of the radon gas released from the ore, and wastewater. The possible environmental impacts from the production steps of conversion, enrichment and fuel assembly manufacturing are related to the handling of dangerous chemicals and, to a lesser extent, the handling of radioactive materials. The environmental impacts of the different stages of the production chain, starting from mines, are increasingly managed by international standards and audits carried out by external parties, in addition to legal regulations.</p> <p>In the nuclear fuel production chain, transported intermediate products are slightly radioactive at most. The transportation of radioactive materials will be carried out in compliance with national and international regulations on transport and storage of radioactive materials. Chemical safety will also be ensured by appropriate measures.</p>			
Impacts of management of spent nuclear fuel	<p>Careful planning and implementation will help to eliminate significant environmental impacts caused by handling and interim storage of spent nuclear fuel. The facilities will contain systems, using which the safe handling and transportation of fuel and the monitoring of the amount and type of radioactive substances can be performed. During interim storage for dozens of years, the status of spent fuel will be monitored regularly.</p>			

	Pyhäjoki	Ruotsinpyhtää, Kampuslandet	Ruotsinpyhtää, Gäddbergsö	Simo
Impacts of final disposal of spent nuclear fuel	The final disposal of spent nuclear fuel will not take place at plant location but the spent fuel is transported, by sea or land, to a Finnish disposal site plant. The environmental impacts of final disposal will be addressed through a separate EIA procedure.			
Joint impacts	<p>Laivakangas mining project No joint impacts.</p>	<p>The planned third unit of the Loviisa nuclear power plant When Loviisa 3 and the Fennovoima plant are both in operation, according to the modeling results, the areas heating by more than one degree are larger than in a situation where the Fennovoima plant and the existing Loviisa plants alone are in operation. This is because the areas heating by less than one degree under the impact of the two plants overlap. Even though the warming areas are located distant from each other, the impacts will be targeted at the same sea area. The basic production, sedimentation and the consumption of oxygen in layers near the bottom will increase in this sea area compared to the situation where only cooling water from Fennovoima's power plant will be discharged in the area. Because of the openness of the sea area, the impact on the coastal zone's vegetation and fish stocks will not differ greatly from the impacts of Fennovoima's power plant. There will not be any adverse impacts outside Orregrundsfjärden and Vådholmsfjärden. The extent of the impacts depends on the location of the discharges as well. The smallest sea area to warm up by more than one degree centigrade will occur when cooling water is discharged to the open and deep sea area.</p>		<p>WPD Finland Oy's wind power plant project The power lines of the wind power plant will be placed in the same corridor with the nuclear power plant's power lines, whenever possible.</p>
Impact of decommissioning the power plant				
<p>The most significant environmental impacts of decommissioning will arise from the handling and transport of radioactive decommissioning waste generated during dismantling of the controlled area of the plant. The most radioactive portion of such waste, such as power plant waste, will be treated and disposed of. As many dismantled contaminated plant parts and equipment as possible will be cleaned so that they can be released from the radiation authority's control and either recycled or disposed of at a general landfill site. The plant's systems will be sealed so that radioactive substances cannot spread into the environment. The majority of waste generated during the nuclear power plant's dismantling operations is not radioactive, however, and can be treated similarly to ordinary waste. Environmental impacts in the plant area and nearby roads caused by the dismantling, treatment and transportation of the nuclear power plant's non-radioactive structures and systems include dust, noise and vibration. Furthermore, in road sections with only a little other traffic, the emissions of increasing traffic will have an impact on air quality. The plant can be decommissioned in such a way that the plant area can be used for other future purposes. It is also possible to leave some of the buildings in the area to be utilized for other purposes or to continue to use the area for energy production or other industrial activity.</p>				
Impacts of irregular and accident situations				
<p>The likelihood of a serious nuclear accident is extremely low. In the event of such an accident, the impacts of a radioactive release on the environment will strongly depend on the prevailing weather conditions. The season also has an impact on the contamination of food products. Following a serious accident (INES 6), it is not likely that the use of agricultural products will be restricted in the long term. Short-term restrictions on the use of agricultural products may apply to areas within a 1,000 km radius of the plant without any protective measures aimed at livestock or food production. In case of an accident during unfavorable weather, it is also probable that restrictions on the use of various kinds of natural produce will have to be issued in areas affected by the greatest fallout. Long-term restrictions on the consumption of some mushrooms, for example, may be required in areas at a distance of 200–300 km. Under the threat of a serious accident, the population will be evacuated, as a protective measure, from an approximately five kilometer wide safety zone surrounding the facility. In unfavorable weather conditions, protection may be necessary indoors within a maximum of 10 kilometers. The use of iodine tablets may also be necessary according to guidelines issued by the authorities. Serious accidents will have no direct health impacts. In the event of a less severe accident, belonging to the INES Category 4, no protective measures are needed in the vicinity of the nuclear power plant. Accidents when storing or handling chemicals are unlikely, and their impacts are minimal.</p>				

9.1.1 Location alternatives

The impacts have been assessed location-specifically, and a summary of the assessment is presented in the table (Table 9-1). The location alternatives are different in terms of some impact types but all alternatives are environmentally acceptable. Because of this, and because different stakeholders attach importance to different impacts it is not possible to rank the location alternatives by their environmental merits.

It is essential, however, to consider these differences carefully, along with other deciding factors, when deciding on the plant location.

9.1.2 Plant options

The most significant differences between the plant options of one or two plants lie in the extent of the heat impact of the cooling waters and in the duration of the construction phase. In the two plant alternative, the heat impact extends to a 30 to 40% greater area, and the estimated length of the construction phase is eight years as opposed to six years.

There are no significant differences between the environmental impacts of the different plant technologies.

9.1.3 Cooling water intake and discharge options

The differences between the cooling water intake and discharge options are minimal as demonstrated in the table above (Table 9-1).

9.2 Feasibility of the project

As a result of the assessment, none of the project's alternative implementations have been found to have any adverse environmental impacts that were unacceptable, or could not be mitigated to an acceptable level. Thus, the project is feasible from the environmental impact per-

spective. However, the alternatives are different in terms of some impact types, and it is essential to consider these differences carefully when deciding and developing the implementation option.

9.3 Contrast to non-implementation of the project

The impacts of non-implementation of the project have been discussed in the chapter on the impacts of the zero-option.

The most significant impacts include the environmental impacts of the substitute electricity production, depending on the used forms of production, and the implications of the fact that the Finnish electricity market will continue to be dominated by a few operators.

Also the impacts of the project, both positive and negative, will remain unrealized.

9.4 Uncertainties in assessment, and their implications on the reliability of the assessment

The available environmental data and the assessment of impacts always involve assumptions and generalizations. Also, the available design data is preliminary. This will cause inaccuracy of the assessment. The description of assessment methods includes an evaluation of the related insecurities. On the other hand, the insecurities related to the mentioned issues are well known, and they have been considered in the impact assessment.

In summary, the significance and magnitude of environmental impacts has been explored reliably, and the conclusions are not uncertain.