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PRELIMINARY SAFETY ASSESSMENT OF THE FENNOVOIMA OY NUCLEAR POWER
PLANT PROJECT*Unofficial translation*

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1. INTRODUCTION

On January 14, 2009, Fennovoima Oy submitted an application to the Government for a Decision-in-Principle concerning the construction of a new nuclear power plant at either Simo, Pyhäjoki or Ruotsinpyhtää. On April 15, 2009, the Ministry of Employment and the Economy requested the Radiation and Nuclear Safety Authority (STUK) to conduct a preliminary safety assessment pursuant to section 12 of the Nuclear Energy Act.

Section 12 of the Nuclear Energy Act stipulates that it is the duty of STUK to draw up a preliminary safety assessment concerning the application for a Decision-in-Principle. STUK is to state therein whether any factors have arisen indicating a lack of sufficient prerequisites for constructing a nuclear facility as prescribed in section 6 of the Nuclear Energy Act. Pursuant to this section, the use of nuclear energy must be safe and must not cause injury to people, or damage to the environment or property.

The purpose of the application for a Decision-in-Principle is the construction of a new nuclear power plant in Finland. The Nuclear Power Plant will consist of one or two light water reactor nuclear power plant units, the buildings and storage facilities required for nuclear fuel management and nuclear waste management at the Nuclear Power Plant, and a repository for the final disposal of low and medium level reactor waste generated in the operations of the Nuclear Power Plant.

When submitting the application for a Decision-in-Principle, Fennovoima delivered documentation on the three alternative power plant units to STUK for the preliminary safety assessment. On June 9, 2009, STUK requested further information on these alternatives and their implementation. Fennovoima responded to this request for additional information on June 17, 2009 and July 31, 2009 and later provided additional material.

The preliminary safety assessment consists of an assessment of the safety of the power plant unit alternatives and the alternative sites at Karsikonniemi in Simo, at Hanhikivi in Pyhäjoki and at Gäddbergsö in Ruotsinpyhtää, and an assessment of the applicant's organization and quality management. The preliminary safety assessment also addresses the question of the provision of district heating by the Nuclear Power Plant, security and emergency response arrangements, nuclear fuel and nuclear waste management, nuclear liability and nuclear safeguards arrangements.

2. POWER PLANT UNIT ALTERNATIVES

General

The following is a summary by STUK of how well the design objectives and principles of each of the nuclear power plant unit alternatives presented in the application for a Decision-in-Principle conform with the requirements of the Government Decree on the Safety of Nuclear Power Plants (733/2008). The detailed assessments on which this summary is based are given in Supplement 1.

The preliminary safety assessment concerns two nuclear power plant units with a boiling water reactor, ABWR and KERENA (formerly SWR1000) and one nuclear power plant unit with a pressurized water reactor, EPR. The principal data on these alternatives are given in Table 1.

Table 1. Power plant unit alternatives.

Unit	Supplier	Type	Thermal output [MWt]	Electrical output [MWe]
ABWR	Toshiba-Westinghouse	Boiling Water Reactor (BWR)	4 300	c. 1 600
KERENA (formerly SWR1000)	AREVA	Boiling Water Reactor (BWR)	3 370	c. 1 250
EPR	AREVA	Pressurized Water Reactor (PWR)	4 590	c. 1 700

The preliminary safety assessment is based on the following key requirements provided for in the Government Decree on the Safety of Nuclear Power Plants (733/2008):

- assessment and verification of safety (section 3),
- limitation of radiation exposure and releases of radioactive materials (sections 7 to 10),
- engineered barriers for preventing the dispersion of radioactive materials (section 13),
- safety functions and provisions for ensuring them (section 14),
- protection against external events (section 17),
- protection against internal events (section 18), and
- monitoring and control of nuclear power plants (section 19).

In addition, STUK has taken a decision on consideration of the Design Extension Condition for new plants (Y255/3, April 8, 2009).

Fulfillment of the requirements presented in the YVL Guides will be assessed in more detail at later phases in the licensing procedure.

ABWR – Advanced Boiling Water Reactor, Toshiba-Westinghouse

ABWR is a boiling water reactor with an electrical output of about 1600 MWe designed by Toshiba-Westinghouse of Japan. The first ABWR power plant unit designed and implemented by Toshiba was built in Kashiwazaki-Kariwa in Japan in the early 1990s (KK6) and the second immediately afterwards (KK7). The reference plant for the plant type being proposed for Finland is Hamaoka 5, completed at the beginning of 2005. In addition to the aforementioned plant units, there is one further ABWR plant unit in use in Japan, two under construction and several more planned.

In its feasibility study for Finland, Toshiba-Westinghouse have improved on the reference plant by adding certain safety features required in Finnish safety provisions. The design lifetime of the plant is 60 years. The basic design of the plant unit is fairly advanced. The design objectives and principles largely comply with Finnish safety requirements.

For the implementation of safety functions both active and passive safety systems are employed in the ABWR plant unit. There are certain technical details that need further analysis, experimental qualification and further design. It is the considered opinion of STUK that this could be done at a later phase of the licensing in a manner consistent with the fulfilling of the requirements of the Government Decree (733/2008). The technical details that STUK considers do not currently comply with the requirements of the Decree are presented in Appendix 1.

KERENA - AREVA

KERENA is a boiling water reactor with an electrical output of about 1200 MWe designed by Areva of Germany. Areva (formerly Siemens) has extensive experience in designing boiling water reactor units since the 1960s. Every boiling water reactor ever built in Germany was designed by Areva. The reference plant for the plant type being proposed for Finland, concerning the basic processes, is Gundremmingen C, completed in 1985. At Gundremmingen C, safety functions are based on safety systems that require an external power source.

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KERENA is a plant unit based on German boiling water reactor technology; its design is based on structural simplicity and a reduction in the number of components requiring maintenance. The design lifetime of the plant is 60 years. KERENA is a plant unit that is still being planned. Its design is less complete than that of the other alternatives. Construction has not yet begun on a single plant unit of this type. The design objectives and principles largely comply with Finnish safety requirements.

Safety in the KERENA unit is based not on active systems but on new kinds of natural properties and on passive safety systems. The passive safety functions of the KERENA unit are designed so that their activation and operation do not require an external power source. The purpose of the passive systems is to bring the power plant into a controlled state in case of accident situations and keep it in that state for as long as necessary. Therefore the design of the automation and electrical systems, for instance, can be much simpler.

The chosen design strategy in case of a crash by a large passenger aircraft is that principal protection is provided by the outer shell of the reactor building, which protects the containment building and the safety systems in the reactor building itself. The auxiliary building, which houses the main control room, has not been protected against a plane crash; it is accepted that in such an event this building would be damaged. STUK considers that it has so far not been proven that Finnish safety requirements can be fulfilled without protecting the main control room.

There are certain technical details that need further analysis, experimental qualification and further design. It is the considered opinion of STUK that this could be done at a later phase of the licensing in a manner consistent with the fulfilling of the requirements of the Government Decree (733/2008). The technical details that STUK considers do not currently comply with the requirements of the Decree are presented in Appendix 1.

EPR – European Pressurized Water Reactor, AREVA

EPR is a pressurized water reactor with an electrical output of about 1,700 MWe designed by the Franco-German consortium AREVA. The reference plant for this plant type is Olkiluoto 3. EPR is originally based on the German 1,300 MWe plants in the Konvoi series and the French 1,450 MWe plants in the N4 series.

Safety functions in the EPR unit are provided mainly through active systems, backed up by passive hydroaccumulators required for emergency cooling, as is typical for pressurized water reactor units. The design lifetime of the plant is 60 years.

The design objectives and principles comply with Finnish safety requirements.

Compared with Olkiluoto 3, the EPR unit proposed here has an output about 7% higher. The power uprate affects the design of the unit's safety functions and its behavior in transient and accident situations. The potential for a power uprate must be further assessed at a later phase of the licensing.

3. PRODUCING DISTRICT HEATING IN A NUCLEAR POWER PLANT UNIT

The Fennovoima application includes the technical possibility of cogeneration of heat and power at the new power plant unit. The plan is to transfer the district heating produced to communities near the site of the power plant, even to the Helsinki area in the case of Ruotsinpyhtää. The Fennovoima application contains an explanation in principle of the process design required for district heating production at a nuclear power plant.

What would be essential for radiation safety in the vicinity of the plant is that the district heating production be designed in such a way that the escape of radioactive materials into the district heating network can be reliably prevented. What would be essential for nuclear safety is that the district heating production does not increase the incidence of transient situations at the power plant.

In a pressurized water reactor unit, the steam in the secondary circuit contains no radioactive materials during normal operation. If the heat transfer pipes separating the primary and secondary coolant circuits of the reactor were to develop a leak large enough for radioactive materials to be detected in the steam, the plant would be shut down and the leaking steam generator isolated from the rest of the secondary circuit. The extraction steam from the secondary circuit required for district heating production will be conveyed from the turbine to the district heating heat exchanger, which will form a second and independent engineered barrier for preventing the dispersion of radioactive materials. Also, the intention is that the pressure in the district heating transfer network will be greater than the extraction steam pressure, meaning that in case of any damage to the district heating heat exchanger, leakage would occur from the district heating network to the plant, not vice versa. Therefore the separation of radioactive materials from the environment will be as reliable as at existing nuclear power plants.

In the case of the boiling water reactor units, the plan is to add a separate intermediate circuit for district heating because of radioactivity in the turbine process during normal use. Extraction steam from the turbine will

be conveyed to the primary side of the heat exchanger of the intermediate circuit and from the secondary side to the district heating transfer network. The operating pressure of the intermediate circuit will be greater than that of the extraction steam.

Current references for heat and power cogeneration at nuclear power plants in the world are on a small scale, their thermal output ranging from 20 to 240 MWth. The Fennovoima application describes a district heating output of up to 2,000 MWth and how this would affect the electrical output of the power plant. If built to these specifications, the new nuclear power plant would become the world's largest unit for the provision of district heating. At the moment, the largest single unit for the provision of district heating on stream in Finland is Vuosaari B, operated by Helsinki Energy (420 MWth). Transient situations in the provision and transfer of district heating are possible, and the impact of such transients on the safety of the nuclear power plant must be examined and taken into account in the basic design of the power plant unit.

It is the considered opinion of STUK that the provision and transfer of district heating can be implemented in such a way that environmental radiation safety and the nuclear safety of the power plant are not compromised.

4. ORGANIZATIONS

The Government Decree on the Safety of Nuclear Power Plants (733/2008) provides for duties of the licensee concerning the construction and operation of a nuclear power plant. These duties require the organization in question to have a wide range of expertise available. The Decree further sets requirements for the management system. STUK interprets the Decree according to its own Guide YVL 1.4, 'Management systems for nuclear facilities'. STUK further draws on recent experiences of nuclear power plant construction in its assessment of organizations.

At this point, the assessment focuses on the applicant for the Decision-in-Principle and the plans that the applicant has in place for controlling and monitoring other organizations contributing to the power plant delivery.

Expertise

Fennovoima Oy is a new company with no prior experience of nuclear power plant construction projects, construction or operation. As such, it is obliged to organize and find resources for its operations from scratch. In Finland, it is up to the licensee to manage safety, and for this purpose the licensee's organization must have sufficient expert resources. At the

moment, Fennovoima does not have the resources required for implementing the nuclear power plant project, operating the plant or ensuring its safety.

Fennovoima states in its application that it will have access to a sufficient number of experts during the bidding process and at the planning, construction and commissioning phases for the duties required in the Government Decree (733/2008). Fennovoima presents preliminary resourcing plans for the various phases of the project and notes that it is aware that it is competing for a limited pool of resources in the field of nuclear energy. Fennovoima intends to build up its organization gradually, relying heavily on the expert resources and know-how of its largest individual shareholder, the German energy company E.ON AG. Fennovoima intends to organize the project so that a Fennovoima employee will be in charge of each of the component projects in the implementation project.

When processing construction license and operating license applications, STUK will pay particular attention to the availability of sufficient expertise in the applicant's own organization. STUK considers it important that for the bidding process and subsequent contract negotiations Fennovoima should already have sufficient expertise available concerning safety and quality matters. It is also important with a view to the indivisible responsibility of the licensee that Fennovoima should have the resources for independently assessing key plant safety issues already when applying for the construction license.

The resources required for plant operation can be planned in more detail once the plant unit type has been selected and the construction timetable decided. Resource acquisition and the development of expertise can proceed in parallel with the construction project.

Management system during the design and construction phases

The provisions on safety culture and on safety and quality management in chapter 7 of the Government Decree on the Safety of Nuclear Power Plants (733/2008) apply not only to Fennovoima itself but to all organizations that will be involved in the design and construction of the Fennovoima Nuclear Power Plant with implications for the safety of the power plant unit.

Fennovoima states that it will be responsible for the Nuclear Power Plant being built in compliance with Finnish safety and quality requirements and, by extension, for undertaking quality management as per requirements. Fennovoima will require that Finnish nuclear energy

legislation and official instructions as well as professional standards in the sector be taken into account in the quality management of any participating actors whose work will have a bearing on nuclear and radiation safety. Fennovoima proposes that its own personnel and all its suppliers, subcontractors and other partners involved in functions relevant for safety be required to commit to systematic safety and quality management. The required procedures will be included in the management system for the design and construction project and runtime operations.

According to Fennovoima, the Nuclear Power Plant project will proceed in phases, from design to construction to commissioning and finally to operations. The quality management procedures for each phase will be planned before the phase is started.

Fennovoima proposes that the quality management system of the applicant be presented within the management system of the construction project. The management system is to be drawn up as an integrated system including not only quality management but also project policies, the project plan and organization.

According to Fennovoima, the Nuclear Power Plant construction project management system will be based on relevant professional standards and will comply with the requirements of Guide YVL 1.4. In this system, safety relevance will be taken into account in the defining of products and functions so that the quality requirements will be the strictest for the devices, systems and functions that are the most critical for safety, and the procedures employed to ensure compliance will be the most comprehensive.

Fennovoima notes that attainment of the following objectives will be particularly considered in defining quality management procedures:

- ensuring compliance with safety requirements
- fulfilling quality requirements for devices, systems and structures
- ensuring that project personnel has the required expertise in safety management, quality management and safety culture

According to the Fennovoima application, it will require its suppliers to uphold a high-quality safety culture and also require its suppliers to require the same of their own subcontractors in turn. Fennovoima states that it will evaluate the safety culture of the potential power plant unit suppliers and of subcontractors relevant for the safety of the project. STUK requires that if and when the Nuclear Power Plant project proceeds, Fennovoima must establish procedures for developing and monitoring a safety culture covering the entire project and agree on these procedures in advance with the power plant unit supplier and key subcontractors.

Under section 29 of the Government Decree 733/2008, systematic procedures shall be in place for identifying and correcting nonconformances significant in terms of safety. STUK requires that if and when the Nuclear Power Plant project proceeds, Fennovoima must require all parties participating in the project to employ efficient and uniform procedures in the reporting, classification, processing and approval of nonconformances.

According to Fennovoima, supply chain management is a key factor in the successful quality management of the Nuclear Power Plant project. Fennovoima states that it will communicate the quality requirements for each phase of the project to the power plant unit supplier and subcontractors and that it will monitor safety and quality management in the organizations participating in the construction project. The means proposed by Fennovoima for monitoring include supplier evaluations, delivery monitoring, inspections and testing. STUK requires that supplier evaluation at the implementation phase should also involve auditing.

Under section 29 of the Government Decree 733/2008, organizations participating in the design and construction of a nuclear power plant shall employ a management system for ensuring the management of safety and quality. According to the description provided by Fennovoima, the management systems of all power plant unit suppliers are based on one or more requirement documents in the nuclear energy sector (IAEA 50-C-Q, 10 CFR part 50 Appendix B, ASME NQA-1 or JEAC 4111-2003). The Guide YVL 1.4 requires that organizations participating in the design and construction of a nuclear power plant comply with IAEA standard GS-R-3 and to take its requirements into account in project-specific quality plans and guidelines.

The plans presented by Fennovoima demonstrate that the company is sufficiently familiar with the requirements concerning a nuclear power plant licensee and its management system and that it is prepared to fulfill these requirements. Fennovoima has the potential to create a management system conducive to safety and quality management and a good safety culture for the design and construction phases of the power plant.

Runtime management system

Under section 29 of the Government Decree 733/2008, organizations participating in the operation of a nuclear power plant shall employ a management system for ensuring the management of safety and quality.

Fennovoima has no experience itself of operating a runtime management system at a nuclear power plant, but Fennovoima states that it will draw on the experience of E.ON in this respect.

According to Fennovoima, the operating and decommissioning phases of the power plant will be taken into account from the beginning of the Nuclear Power Plant construction project. As an example of this approach, Fennovoima describes its proposed documentation system, document management process and archiving system.

Fennovoima has the potential to create a management system conducive to safety and quality management and a good safety culture for the operating phase of the power plant.

5. SITES

The Nuclear Energy Act stipulates that in considering a Decision-in-Principle the Government shall pay particular attention to the suitability of the intended site of the nuclear facility (Nuclear Energy Act, section 14(2)). The site of the nuclear facility must be appropriate with respect to the safety of the planned operations, and environmental protection must be taken into account appropriately when planning operations (Nuclear Energy Act, section 19, paragraph 2). Also, there must be a site reserved for the construction of a nuclear facility in a local detail plan in accordance with the Land Use and Building Act (132/1999), and the applicant must be in possession of the site required for the operation of the facility (Nuclear Energy Act, section 19, paragraph 4).

According to section 11 of the Government Decree on the Safety of Nuclear Power Plants (733/2008), the site selection must also take into account the impact of local circumstances on plant safety and security and emergency response arrangements. The site must be such that the impediments and threats arising from the plant are minimal and that heat removal into the environment can be reliably implemented.

The alternative sites for the new Nuclear Power Plant given in the Fennovoima application for a Decision-in-Principle are:

- Hanhikivi in Pyhäjoki, a headland about 20 km southwest of the town centre of Raahе,
- Gäddbergsö in Ruotsinpyhtää, a headland about 13 km southeast of the town centre of Loviisa,
- Karsikko in Simo, a headland about 12 km southeast of the town centre of Kemi.

All sites are wooded headlands with little or no housing and agriculture in their interiors. The housing that does exist is located on the shore at each site and consists mainly of holiday homes.

Implementation of the Nuclear Power Plant project requires that a land area is reserved for the plant in the regional land use plan, the local master plan and the local detail plan in connection with land use planning for the area in question.

For the site at Hanhikivi in Pyhäjoki, land use planning had progressed to draft plan proposals at all three planning levels by October 2009. For the site at Karsikko in Simo, the regional land use plan proposal and the draft local master plan and local detail plan have been on public display. STUK has returned statements on these plans. As the land use planning progresses, the further information required by the Ministry of Employment and the Economy regarding environmental impact for the processing of the application for a Decision-in-Principle will be taken into account.

For the site in Ruotsinpyhtää, land use planning is under way at all three planning levels. The draft stage III regional land use plan for Itä-Uusimaa and a draft partial local master plan and draft local detail plan for Gäddbergsö are in preparation.

STUK is satisfied that the radiation safety and nuclear safety issues related to the construction of a new nuclear power plant can be taken into account in the land use planning in preparation for the sites in Pyhäjoki and Simo. As for Ruotsinpyhtää, the land use planning process has only just begun. STUK does not know of any issues that would hinder the taking into account of radiation safety and nuclear safety issues in the land use planning process in Ruotsinpyhtää.

Fennovoima has commissioned geological and ground surveys of the alternative sites from the Geological Survey of Finland and consultant companies in the field. Findings from the topographical and magnetic studies of the bedrock were presented in the application for a Decision-in-Principle. In August 2009, as the application was being processed, Fennovoima submitted to STUK findings from drill sampling and seismic surveying of the bedrock at the alternative sites.

In Finland, the buildings central to the safety of a nuclear power plant must be built on the bedrock. Ground surveys are used to ascertain that the bedrock is sufficiently near the surface that it can be used to build foundations. Geological studies are employed to study rock fracturing and water conductivity, which are relevant in assessing the suitability of the site for final disposal of low and medium level reactor waste in the bedrock.

Earthquakes are also taken into account when designing a new nuclear power plant. Ruotsinpyhtää and Pyhäjoki are located in seismically passive zones. Simo, by contrast, lies in one of the seismically most active zones in Finland. Fennovoima has commissioned studies concerning postulated earthquakes at the alternative sites from the Institute of Seismology. In Simo, the design basis earthquake is more severe than at the other alternative sites and is equivalent to the design basis earthquake at a typical central European plant site. The seismic conditions at all alternative sites can be accounted for through the design process. The seismic design properties of the new nuclear power plant will be assessed in detail in the construction license process.

STUK is satisfied that sufficient geological and seismological studies have been conducted at all alternative sites for the new nuclear power plant to enable processing of the application for a Decision-in-Principle. Each alternative site has its own geological and seismological special features, which must be taken into account in the design of the power plant. At none of the sites have there emerged any issues that would prevent the construction of the new nuclear power plant or the related repository for reactor waste in compliance with safety requirements.

Fennovoima has commissioned preliminary studies of extreme phenomena and extreme sea levels at the alternative sites from the Finnish Meteorological Institute and the Finnish Institute of Marine Research. There are no exceptional special features in the weather conditions at the alternative sites. Sea level variation is relatively great at all sites, but this variation can be taken into account when designing the new power plant unit. Packed ice forms in the winter in Simo and Pyhäjoki, and this can be taken into account when designing the water intake structures. The occurrence of extreme weather phenomena and the impact upon them of climate change is also being studied in the ongoing national nuclear safety research program, SAFIR2010. The sufficiency of design features of the new nuclear power plant as far as weather phenomena are concerned will be assessed in detail in connection with the processing of the construction permit license, based on the most recent data and in cooperation with the Finnish Institute of Meteorology. STUK is satisfied that extreme weather phenomena, sea level variation and ice conditions can be accounted for at all alternative sites taking into consideration safety aspects.

Large quantities of sea water are required for cooling the turbine condenser in a nuclear power plant. There are no known technical obstacles to implementing the alternative sea water intake and outlet arrangements in compliance with the safety requirements at any of the alternative sites. Fennovoima will commission the detailed geological surveys required for the excavation of the sea water tunnels in connection with preparing the eventual construction license application.

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The effects of the heated coolant discharged into the sea have been studied in the environmental impact assessment report. In its statement as the coordinating authority concerning the Fennovoima environmental impact assessment, the Ministry of Employment and the Economy required Fennovoima to submit further information on the environmental impact of the coolant discharge in the course of the Decision-in-Principle process. The reports in question will be completed during autumn 2009.

The processes in a nuclear power plant require substantial quantities of purified fresh water. In some plant types, large quantities of purified process water are required in cases of disturbances in the sea water cooling system and for the management of certain accident situations. A nuclear power plant must have facilities for the pumping, storage, purification and demineralization of raw fresh water. Fennovoima has explored alternative ways of obtaining raw water at each alternative site and described these in the environmental impact assessment report. The reports on raw water sourcing are sufficient for the processing of the application for a Decision-in-Principle.

There are no industrial or storage facilities, land transportation routes or gas pipes in the vicinity of any of the alternative sites such that accidents occurring to them could pose a hazard to the proposed Nuclear Power Plant.

The main shipping channel in the Gulf of Finland, along which a major portion of Russia's oil exports are transported, runs just over 30 km off the shore of Gäddbergsö in Ruotsinpyhtää. In case of a major oil spill at sea, it is possible that oil would be conveyed to the water intake area of the proposed nuclear power plant site at Gäddbergsö. There is less shipping in the vicinity of Simo and Pyhäjoki, and considerably less oil transportation, and the ships operating in these areas are typically smaller; the risk of a major oil spill is therefore substantially lower than in the Gulf of Finland.

If oil were to enter a sea water coolant system, it could decrease the efficiency of the cooling or in the worst case clog up cooling systems. The compromising of coolant intake because of oil or other chemicals in the sea water, or because of algae or ice formation, will be taken into account in the technical design of the power plant. According to current requirements, a new power plant unit must be designed so that it can survive at least a three-day interruption in the intake of sea water coolant. Because of the risk of disaster involved in oil transportations in the Gulf of Finland, it must be ensured in detailed planning if the Nuclear Power Plant is built at Gäddbergsö that an interruption of more than three days in the intake of sea water coolant will not jeopardize the safety of the plant.

Moreover, if the Nuclear Power Plant is built at Gäddbergsö, the licensee must also agree on notification procedures regarding oil spills with the Finnish Environment Institute and prepare for oil recovery action in the plant's water intake areas jointly with Itä-Uusimaa Rescue Services, just as at the Loviisa nuclear power plant.

Under section 8 of the Aviation Act (1242/2005), a no-fly zone may be defined around a nuclear power plant. The purpose of the no-fly zone is to prevent disruptions caused by light aircraft and to reduce the risk of crashes. Obviously the no-fly zone is of no effect in preventing a terrorist attack. No-fly zones are enacted on a case-by-case basis by Government decree. However, the law does not state that there must be a no-fly zone around every nuclear power plant. The law also does not stipulate how large the no-fly zone should be if there is one. The existing nuclear power plants at Loviisa and Olkiluoto have no-fly zones with a radius of 4 km and an altitude of 2,000 m, provided for in section 3 of Government Decree 929/2006.

The airports closest to Hanhikivi in Pyhäjoki are the Raahe general aviation airfield about 30 km away and the Oulunsalo commercial airport 70 km away. At Gäddbergsö in Ruotsinpyhtää, the nearest significant airport is Helsinki-Vantaa Airport, some 80 km away. If a nuclear power plant were built at either of these sites, it would not have any effect on the operations of the airport, nor would air traffic cause any safety concerns at these sites. Finavia, the body that operates Finnish airports, has returned a statement to the Ministry of Employment and the Economy concerning the Fennovoima Nuclear Power Plant project, stating that it is entirely possible to enact a no-fly zone at Hanhikivi or Gäddbergsö similar to that of the existing nuclear power plants.

At Karsikko in Simo, by contrast, the nearest airport is the Kemi-Tornio commercial airport about 16 km away. The preliminary placement of the reactor building puts it about 7 km to one side of the airport's take-off/approach path. According to information received from Finavia, aircraft taking off from or landing at Kemi-Tornio airport do not normally fly over the proposed power plant site, but occasionally do.

According to the statement received from Finavia, if the Nuclear Power Plant were built at Karsikko in Simo, its no-fly zone should be smaller than that of the existing nuclear power plants so that it would not compromise the operations of Kemi-Tornio airport.

It should be taken into account when considering the need for a no-fly zone that new nuclear power plants must in any case be designed to withstand a direct impact by a large passenger aircraft without appreciable release of radioactive materials into the environment. Compliance with this requirement in the various power plant unit alternatives is discussed in

Supplement 1 to this preliminary safety assessment. Nevertheless, a crash by a large passenger aircraft could cause substantial damage to the power plant, and the risk of such a crash should be eliminated as far as possible, meaning that passenger aircraft should not be routed to fly over the power plant if it can be avoided. Passenger aircraft take off and land at Kemi-Tornio airport under the supervision of air traffic control. It is the considered opinion of STUK that the flying of passenger aircraft over the power plant can be restricted by air traffic control, and the airport's approach methods can be modified accordingly.

A crash by a light aircraft would cause little damage to a nuclear power plant designed in compliance with current requirements. It is the considered opinion of STUK that light aircraft flying over the power plant have no safety relevance. If necessary, for instance in case of an accident situation, a temporary no-fly zone can always be imposed.

STUK is satisfied that air traffic does not constitute an obstacle to the construction of the Nuclear Power Plant at any of the alternative sites examined. In the case of Karsikko in Simo, restricting commercial aircraft from flying over the power plant site will require cooperation with the Finnish Civil Aviation Authority and Finavia, and possibly modification of the approach methods of Kemi-Tornio airport.

Reliable connections from the Nuclear Power Plant to the national grid are necessary to ensure uninterrupted electricity production and transfer and, if necessary, the feeding of electricity from the national grid to the power plant. In order to ensure that the power plant's safety systems have power in case of a transient or accident situation, the nuclear power plant units have their own emergency power supply.

A new 400 kV power line connection will be needed from the new power plant unit to the national grid, and 100 kV power lines at the chosen site will have to be strengthened. Under the Electricity Market Act, responsibility for developing the national grid and maintaining its systems rests with Fingrid Oyj, which is thereby obliged to strengthen the national grid as required and to ensure sufficient transient capacity. Fingrid Oyj is also responsible for conducting any environmental impact assessments needed for strengthening the national grid. On 15 June 2009, Fingrid returned a statement to the Ministry of Employment and the Economy concerning the Fennovoima application for a Decision-in-Principle. According to this statement, a nuclear power plant with one or two plant units can be linked to the national grid at any of the proposed alternative sites. Fingrid further presented preliminary plans for how the Fennovoima Nuclear Power Plant could be connected to the national grid and how the national grid should be strengthened depending on the site and output chosen for the power plant.

The alternative sites for the new Nuclear Power Plant proposed by Fennovoima have been studied sufficiently for the processing of the application for a Decision-in-Principle as far as STUK is concerned. It is the considered opinion of STUK that there are no features at any of the proposed alternative sites that would constitute an obstacle to the construction of a new nuclear power plant and related facilities, as referred to in the application for a Decision-in-Principle, in compliance with the safety requirements.

Regarding nuclear waste management, the alternative sites are discussed in chapter 9 Nuclear waste management. A detailed assessment of the proposed alternative sites is given in Supplement 2.

6. SECURITY AND EMERGENCY RESPONSE ARRANGEMENTS

Purpose and aims of emergency response arrangements

In accordance with Section 7 of the Nuclear Energy Act, sufficient physical protection and emergency planning as well as other arrangements for limiting nuclear damage and for protecting nuclear energy against illegal activities are a prerequisite for the use of nuclear energy.

‘Emergency response arrangements’ refer to any action taken to prepare for accidents or other events compromising safety at or around the nuclear facility (Nuclear Energy Act, section 3). Emergency response arrangements must be planned so as to allow for the escape of significant quantities of radioactive material from the plant, even if the likelihood of such an event is extremely low. Requirements for emergency response arrangements are given in section 7 p of the Nuclear Energy Act and in the Government Decree on Emergency Response Arrangements at Nuclear Power Plants (735/2008). Emergency response arrangements to be implemented by the licensee include the emergency response plan, a trained emergency response organization, and facilities, equipment and communication systems commensurate with the duties involved.

It will be assessed in the processing of the application for a Decision-in-Principle how well the requirements of the provisions regarding emergency response arrangements and rescue operations in the vicinity can be fulfilled at and around the proposed site.

Under the Government Decree on Emergency Response Arrangements at Nuclear Power Plants (735/2008), there must be a protective zone and an

emergency planning zone around a nuclear power plant. Determining these zones is intended to make it easier to plan and execute emergency response arrangements, but they do not designate safe perimeters, i.e. they do not indicate that the effects of an eventual accident would necessarily be less outside them than inside them. It is the expectation of STUK that it be possible to evacuate almost all persons in the protective zone within about four hours of the decision to evacuate being taken, and that within the same time limit people in the emergency planning zone could make the necessary preparations for staying indoors for more than 24 hours.

The protective zone is an area which extends about 5 km from the power plant and where land use restrictions are in force.

The emergency planning zone extends about 20 km from the power plant, and the authorities must draw up a rescue plan for this zone as per section 9(2) of the Rescue Act (468/2003). The rescue plan concerns how to warn the population in the zone and what rescue measures to undertake. In case of a serious nuclear power plant accident, potential protective measures include taking cover indoors, ingesting iodine tablets and, as an extreme measure, evacuating the danger area. The construction of a nuclear power plant thus imposes obligations on the authorities too. Fennovoima has engaged in negotiations concerning rescue planning for the local population with the local authorities.

A protective zone will be defined for the alternative power plant sites at Hanhikivenniemi in Pyhäjoki, at Gäddbergsö in Ruotsinpyhtää and at Karsikkoniemi in Simo in connection with the land use planning. The protective zone and its land use restrictions will be shown in whole in the relevant regional land use plan. The emergency planning zone will be defined in more detail (according to municipal boundaries or local communities) in the regional rescue plan, drawn up jointly by the licensee and local rescue services while the Nuclear Power Plant is under construction.

Under the Nuclear Energy Decree, the licensee must submit plans and reports on its preparedness for emergency response together with the application for a construction license, to which must be appended a preliminary emergency response plan as per section 36(1) paragraph 5 of the Nuclear Energy Decree. When applying for the operating license, the licensee must submit the final emergency response plan and demonstrate that all the other requirements for emergency response arrangements have been fulfilled (emergency response organization, facilities, equipment, training, etc.). STUK will approve the emergency response plan in connection with the processing of the applications for the construction and operating licenses. In the case of Gäddbergsö, Fennovoima must take into account the proximity of the Loviisa nuclear power plant in its emergency response arrangements for the construction phase. Training, early warning

and rapid evacuation of worksite personnel must be ensured in case of an accident situation arising at the Loviisa nuclear power plant during construction.

In emergency situations, the licensee shall be prepared to carry out radiation monitoring at the power plant site and protective zone, alongside meteorological measurements, on the basis of which the dispersion of radioactive materials in the emergency planning zone will be assessed (Government Decree 735/2008, section 5). Fixed measuring points for this purpose will be designed, instructed and built at the construction phase of the Nuclear Power Plant project.

Emergency response exercises must be held regularly at the nuclear power plant to test emergency response jointly with local rescue services and with regional and national authorities, and also always before a new power plant unit is commissioned. Preparedness training for the personnel of the Nuclear Power Plant will be provided during the construction phase.

The licensee shall, in cooperation with the local rescue services, supply the population with advance instructions on preparing for a nuclear accident situation occurring in the emergency planning zone, and distribute iodine tablets in advance to the population within the protection zone, before the nuclear power plant is commissioned. In an emergency, the licensee shall participate in warning any members of the population who are under imminent threat (Government Decree 735/2008, section 12).

Sites

It is advantageous for emergency response arrangements if the power plant is located in a sparsely populated area, well away from major conurbations. Preparedness measures will then affect a smaller population.

Hanhikivi in Pyhäjoki

Hanhikivi headland in Pyhäjoki is in a sparsely populated area. There are no permanent residents on the headland, and there are relatively fewer leisure homes here than elsewhere on the waterfront in Pyhäjoki. Two access routes are planned for the Hanhikivi site. The nearest community, Parhalahti village (population c. 400), is about 4 km from the proposed site of the power plant. The village is wholly included in the proposed protective zone as outlined in the draft regional land use plan. This protective zone would include a permanent population of about 450, and also some 40 leisure homes. The emergency planning zone, within a radius of about 20 km from the proposed nuclear power plant site, has a permanent population of about 11,300, and within a radius of 100 km the

population is about 370,000. The nearest major industrial facilities and harbor are 15 to 16 km from Hanhikivi.

It is the considered opinion of STUK that the emergency response arrangements required in the Guide YVL 1.10 can be implemented in the protective zone and the emergency planning zone, provided that the village of Parhalahti is included in the protective zone and that efficient warning and protection measures are planned and in place in case of an accident situation.

Gäddbergsö in Ruotsinpyhtää

Gäddbergsö headland in Ruotsinpyhtää is in a sparsely populated area. The protective zone, planned to extend in a radius of about 5 km from the proposed power plant site, has a permanent population of about 70 and hundreds of leisure homes. The nearest large community to the site is Loviisa (population about 7,400), whose town centre is about 13 km away. The village of Valko, which is part of the town of Loviisa (population about 1,000) is about 9 km away. The emergency planning zone would have a population of about 11,900, and within a radius of 100 km the population is about 1.7 million. There are territories belonging to Estonia and Russia less than 100 km from the proposed power plant site.

There are no industrial facilities, warehouses or other facilities near Gäddbergsö that might cause a hazard at the proposed power plant, except for the existing Loviisa nuclear power plant (which is about 3 km away). It is the considered opinion of STUK that the proximity of the Loviisa nuclear power plant would not prevent the construction project from going ahead, but that Fennovoima must take this into account in its emergency response arrangements at the construction license phase. The harbor of Valko is about 9 km away from the proposed power plant site.

In the archipelago and along the fragmented shoreline, warning and possibly evacuating the population is a considerable challenge and must be given particular attention. There is one access route to Gäddbergsö headland. Developing emergency response and rescue arrangements forms part of the licensee's cooperation with the authorities, and in the future emergency communication systems can be further developed through the potential of modern communications technology. STUK is satisfied that the emergency response arrangements required in the Guide YVL 1.10 can be implemented in the protective zone.

The authorities have drawn up a detailed civil defense rescue plan in case of an accident situation at the Loviisa nuclear power plant. This plan must be updated if the Nuclear Power Plant project is implemented at Gäddbergsö, and functions related to the two power plant sites must be harmonized.

Karsikko in Simo

At Karsikkoniemi in Simo, the permanent population is mainly located in the northern part of the area and along the coast, where there are also leisure homes. The communities nearest to the proposed power plant site are the Hepola, Rytikari and Ajos districts of the town of Kemi and the village of Maksniemi in Simo. Hepola is the nearest of these, being about 4 km away from the proposed power plant site. The protective zone, planned to extend in a radius of 5 km from the proposed power plant site, has a permanent population of about 1,250 and some 160 leisure homes. If the protective zone is expanded to include the communities that are wholly or in part within 4 to 6 km of the proposed power plant site, as per the regional land use plan proposal for the Kemi-Tornio area (June 8, 2009), i.e. Maksniemi in Simo and Hepola and Rytikari in Kemi, the permanent population of the protective zone will be about 3,000. The emergency planning zone, within a radius of about 20 km from the proposed nuclear power plant site, has a permanent population of about 32,000, and within a radius of 100 km the population is about 290,000. The Swedish coast and the town of Haaparanta on the Swedish side of the border are about 30 km away from Karsikkoniemi. The Finnish border runs about 20 km offshore from Karsikkoniemi. The nearest major industrial installation is the Veitsiluoto paper mill about 7 km away, and the nearest busy harbor is about 8 km away at Ajos in Kemi.

The population of the protective zone exceeds the requirements of the STUK Guide YVL 1.10. The Lapland Rescue Services, in its statement, proposes the following adjustments to achieve compliance with the safety level required in the YVL Guide: using modern technology for early warning of the population and for evacuation monitoring; efficient planning and implementation of evacuation; restricting the number of permanent residents in the protective zone and its immediate vicinity; and efficient communications and liaison with the authorities and rescue service partners. There are also smaller areas to the southeast and south of the proposed power plant site where early warning and possible evacuation of the population must be given particular attention. Two access routes are planned for the Karsikkoniemi site. Highway E4 can be used for eventual evacuation of the population in case of an accident situation.

STUK is satisfied that the safety level required in the Guide YVL 1.10 can be attained in the protective zone if a comprehensive rescue plan is drawn up on the basis of the statement of the Lapland Rescue Services and if the licensee ensures that the population can be quickly warned and protective measures rapidly implemented in case of an accident situation. This requires the rescue services to commit to action that will ensure successful protective measures.

N.B. This is unofficial translation.

Original:

http://www.stuk.fi/ydinturvallisuus/ydinvoimalaitokset/suomen_ydinvoimalaitokset/fi_FI/uudet_laitosyksikot/_files/82314730077945925/default/Alustava%20turvallisuusarvio_PAP-FV.pdf

Conclusions

STUK is satisfied that Fennovoima has the potential to implement emergency response arrangements at all alternative sites to prepare for eventual accidents at the Nuclear Power Plant as required by law. STUK is satisfied that the early warning and evacuation arrangements concerning the permanent population in the immediate vicinity that are the responsibility of the rescue services can be implemented at all alternative sites.

Security (physical protection) arrangements

‘Security arrangements’ refers to action taken to guard the use of nuclear energy against illegal activities at the nuclear facility or in its grounds, or in any other facility or transportation involved in using nuclear energy. Under section 71 of the Nuclear Energy Act, a nuclear facility shall have security staff trained for the planning and implementation of arrangements for security (security organization). The job duties and training requirements of the security organization and security staff must be defined, and they must have access to monitoring equipment, communications equipment, protective equipment and forcible means equipment commensurate with their duties.

Under section 8 of the Government Decree on the Security in the Use of Nuclear Energy (734/2008), security arrangements include control of vehicles, persons, objects and materials as well as goods transportation equipment in order to ensure that no dangerous objects are brought onto the nuclear facility site. Movement on the nuclear facility site shall be restricted and supervised so that effective account is taken of security and safety aspects. In particular, the licensee shall ensure that nuclear material, nuclear waste, radioactive materials or confidential information materials cannot be removed from the nuclear facility without the appropriate authorization.

Fennovoima notes in its application for a Decision-in-Principle that planning and action for the event of emergency situations are being prepared in cooperation with security authorities. Fennovoima also notes that in the case of all power plant unit alternatives it is preparing to combat illegal activities with a variety of structural and organizational security arrangements and intends to draw on the security expertise of the German E.ON power company in its emergency response arrangements.

Preliminary security and emergency response plans for the new nuclear power plant unit must be submitted to STUK for the processing of the

eventual construction license application, and the final plans in connection with the eventual operating license application.

STUK is satisfied that Fennovoima has the potential to implement security arrangements at all alternative sites as required by law.

7. NUCLEAR FUEL MANAGEMENT

The nuclear fuel supply for the new Nuclear Power Plant is discussed in a supplement to the application for a Decision-in-Principle. In the procurement of fresh nuclear fuel, it is customary to procure only the first few fuel charges at the time of the power plant delivery. The standard procedure in the nuclear fuel market is to invite tenders from suppliers in the nuclear fuel production chain, and the choice of power plant unit type will not affect the availability of nuclear fuel as such. Nuclear fuel designs are constantly being developed, so the expectation is that fuels of different designs and from different producers will be used in the reactor. The nuclear fuel would be produced abroad, and only transportation and storage of fresh fuel would take place in Finland. These functions are established practices using established technology and do not involve significant safety risks. STUK is satisfied that Fennovoima will have no difficulty in organizing the nuclear fuel management for its proposed Nuclear Power Plant in compliance with safety requirements.

8. NUCLEAR SAFEGUARDS ARRANGEMENTS

The purpose of nuclear safeguards arrangements is to ensure that nuclear fuel and other nuclear materials and products are only used for peaceful purposes as specified in the relevant licenses and notifications and that nuclear facilities and technology are only used for peaceful purposes. The licensee is obliged to plan, manage and document any and all nuclear materials in its possession, to submit reports to the authorities and to allow access to nuclear materials inspectors from STUK, the European Commission and the International Atomic Energy Agency (IAEA).

STUK asked Fennovoima to submit a further report to augment the application for a decision-in-principle containing a summary of the expertise and readiness required for implementing nuclear materials monitoring. Fennovoima submitted the requested report on July 31, 2009.

The report demonstrates that Fennovoima has an appropriate plan in place regarding how it intends to implement nuclear materials monitoring and to carry out its related obligations. The practices cited are largely equivalent to practices observed at existing nuclear power plants in Finland, for instance as regards employees in charge of nuclear materials monitoring.

The report contains a summary of governing factors. The report does not mention the power plant's nuclear safeguards arrangements manual, which is an important part of the quality documentation of the power plant to be planned. In this document, the operator must describe how it intends to prevent the spreading of nuclear weapons and to ensure compliance with international conventions. Fennovoima has identified most of the matters that need to be covered by the nuclear safeguards arrangements manual and is planning to include them in its management system; STUK considers this sufficient for the time being.

It is also noted in the report that in the area of nuclear materials monitoring at the preparation phase, Fennovoima relies mainly on the expertise and experience of E.ON Kernkraft (Germany) and E.ON Sweden.

STUK is satisfied that Fennovoima has access to the required expertise and competence in arranging the monitoring required for the non-proliferation of nuclear weapons so that Finland will comply with international obligations in this respect. Information available to STUK suggests that Fennovoima has sufficient resources to carry out its nuclear safeguards arrangements obligations in accordance with current requirements.

9. NUCLEAR WASTE MANAGEMENT

Nuclear waste management

In accordance with section 24 of the Nuclear Energy Decree, an application for a Government Decision-in-Principle must be supplemented for each nuclear facility project with a general description of the applicant's plans and available methods for implementing nuclear waste management. The Fennovoima application for a Decision-in-Principle contains a plan for the management of reactor waste, spent fuel and decommissioning waste. The report also briefly discusses the options for the final disposal of spent nuclear fuel and preparation for the costs of waste management.

Management of reactor waste

The Fennovoima application for a Decision-in-Principle contains general plans for the management of reactor waste. The processing and storage methods described for reactor waste are largely similar to those used at

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Original:

http://www.stuk.fi/ydinturvallisuus/ydinvoimalaitokset/suomen_ydinvoimalaitokset/fi_FI/uudet_laitosyksikot/_files/82314730077945925/default/Alustava%20turvallisuusarvio_PAP-FV.pdf

existing nuclear power plants in Finland, except for the melting of metal waste. Equipment of the kind required for this is not in use in Finland at the moment, but section 7b of the Nuclear Energy Decree allows for processing to take place abroad. According to the documentation for the power plant unit alternatives submitted by Fennovoima, adequate facilities and appropriate processing methods are planned for the processing and storage of low level and medium level waste generated during operation.

The plan is to build a repository for low level and medium level reactor waste at the power plant site. This concept is similar to that employed at existing nuclear power plant sites in Finland, except that Fennovoima proposes ground disposal for very low level waste rather than disposal in the bedrock. The reference for this practice presented in the material submitted to STUK is the similar facility at Oskarshamn in Sweden. It is possible to design and implement ground disposal safely as proposed by Fennovoima.

Requirements for a final disposal site are given in section 12 of the Government Decree 736/2008. The geological characteristics of the disposal site shall, as a whole, be favorable to the isolation of the radioactive substances from the environment; any area with a feature that is substantially adverse to long-term safety shall not be selected as the disposal site. The planned repository shall contain sufficiently large, intact rock volumes that facilitate the construction of the waste emplacement rooms. For the purposes of disposal facility design and acquiring data required for safety assessments, the geological characteristics of the host rock at the site shall be characterized through investigations at the intended disposal depth, in addition to surface based investigations.

Section 12 of the Government Decree 736/2008 further states that “any area with a feature that is substantially adverse to long-term safety shall not be selected as the disposal site”. The preamble to the Decree explains this as meaning the proximity of exploitable natural resources, unusually high stress levels in the bedrock, seismic or tectonic anomalies, or exceptional values of key ground water parameters.

The studies conducted and reports produced show no proximity of natural resources that would compromise final disposal on site. No other factors contraindicating final disposal on site have been found in surface surveys or drill sampling.

There are differences in the bedrock between the alternative power plant sites, but they are so slight that the reactor waste repository could be built at any of them. It is the considered opinion of STUK that no bedrock or

ground water properties have emerged at any of the three alternative sites that would prevent the safe implementation of a repository for reactor waste on site.

Interim spent nuclear fuel storage and transportation

Spent fuel is removed from the reactor and transferred to spent fuel pools in the reactor building or nuclear fuel building. It is kept there for one to three years, after which it is moved to a separate interim spent nuclear fuel storage facility. STUK estimates that the plans to store the spent nuclear fuel in the reactor building or nuclear fuel building are sufficient at this point.

The application for a Decision-in-Principle indicates that an interim spent nuclear fuel storage facility will be built at the power plant site and scaled to accommodate the spent nuclear fuel from the entire life span of the Fennovoima Nuclear Power Plant. The options presented for interim spent nuclear fuel storage are fuel pools or dry storage. Existing Finnish nuclear power plants use fuel pools. Interim dry storage of spent nuclear fuel is based on a technology tried and tested elsewhere in the world. Both options have been described to a sufficient extent for the purposes of the Decision-in-Principle process.

After interim storage, the spent fuel will be transported away for final disposal. Fennovoima has submitted to STUK a report on spent nuclear fuel transportations and their risks. The routes that would be used for spent nuclear fuel transportations are described for each of the alternative sites.

Transporting spent nuclear fuel is subject to a permit as per the Nuclear Energy Decree, granted by STUK (Nuclear Energy Decree, section 56). STUK presents detailed safety requirements for transportations in the Guide YVL 6.5. There is plenty of experience in transporting spent nuclear fuel, for instance in transporting spent nuclear fuel to centralized interim storage facilities and reprocessing plants. Under normal circumstances, such transportations have no effect on human health or on the environment. The risk of an accident that would damage the transportation container and the fuel inside must be very low. According to the Guide YVL 6.5, transportation plans must include contingency planning.

STUK knows of nothing that would prevent the processing, interim storage and transportation of spent nuclear fuel being managed in compliance with safety requirements.

Spent nuclear fuel management

The interim spent nuclear fuel storage solutions presented in the application for a Decision-in-Principle are intended to be kept in place only for as long as final disposal is being arranged. They are not suitable for final disposal.

The Fennovoima application for a Decision-in-Principle contains a general description of how the final disposal of nuclear waste will be technically handled. The plan is to pack the spent fuel into copper capsules and bury it some 500 m down in the bedrock. This concept is the same as the KBS-3 final disposal solution in preparation in Finland and Sweden, so this conceptually fulfills the requirements of the law and is sufficient in extent at this point in the process.

The final disposal development and implementation plan included in the Fennovoima application indicates that the primary alternative is to cooperate with other licensees under a nuclear waste management obligation in Finland. However, there is no concrete demonstration of such cooperation apart from a reference to section 29 of the Nuclear Energy Act, which indicates that the Ministry of Employment and the Economy can order licensees under a nuclear waste management obligation to undertake waste management measures jointly.

Fennovoima notes that if this cooperation is not achieved, it will have about 40 years to come up with another final disposal solution, based on the KBS-3 concept or some other method that fulfills the requirements for long-term safety. There are no alternative plans in the application material.

STUK does not know whether Fennovoima actually has a chance of getting its spent nuclear fuel disposed of at Olkiluoto. Previously conducted final disposal site studies concluded that the differences in the bedrock between the five areas studied were so small that it was impossible to rank the areas according to safety. The bedrock at Olkiluoto is not unique; there is bedrock suitable for the final disposal of spent nuclear fuel elsewhere in Finland too. A final disposal site for spent nuclear fuel will require a separate Decision-in-Principle.

10. NUCLEAR LIABILITY

Nuclear liability is provided for in the Nuclear Liability Act (484/1972). This Act takes into account international conventions binding upon Finland that set minimum levels for liability for nuclear damages. Higher compensation levels may be enacted at a national level, and some governments have done so. Negotiations regarding the development of these international conventions have been concluded, and the Finnish Nuclear Liability Act was amended in 2005 to increase minimum liability considerably. The amended Nuclear Liability Act also provides an unlimited liability for damages for the operator of a nuclear facility in case insurance is insufficient to cover the damage. The amended Act has not yet entered into force; this will be separately determined by decree once the amendments to the international conventions regarding the new compensation liabilities have entered into force.

STUK is satisfied that the applicant could fulfill the obligations of the Nuclear Liability Act as it now stands with regard to nuclear liability.

11. CONCLUSIONS

Pursuant to section 6 of the Nuclear Energy Act, the use of nuclear energy must be safe and must not cause injury to people, or damage to the environment or property. In the preliminary safety assessment, nothing has emerged that would argue against it being possible to build the new nuclear power plant proposed by Fennovoima in accordance with the provisions of section 6 of the Nuclear Energy Act.

The nuclear power plant alternatives proposed in the application do not in and of themselves fulfill Finnish nuclear safety requirements. However, STUK estimates that the proposed alternatives can be redesigned so as to bring them into compliance. The nature and extent of the changes that would be required are different for each alternative, ranging from relatively minor changes to extensive structural alterations. Some technological issues have not yet been resolved.

Fennovoima has the potential to create a management system conducive to safety and quality management and a good safety culture for the construction and operating phases of the power plant units. Fennovoima is also prepared to recruit a sufficient number of expert personnel for the various phases of the project. It is necessary to increase the size of the organization and its collective expertise continuously and systematically to ensure that Fennovoima will have sufficient nuclear safety and radiation safety resources in its own organization at every phase of the project.

STUK has assessed the suitability of the proposed alternative sites of the Fennovoima nuclear power plant for the purpose, and also the potential for implementing security and emergency preparedness, nuclear waste management and nuclear material control systems at these sites. It is the considered opinion of STUK that there are no features at any of the proposed alternative sites that would constitute an obstacle to the construction of a new nuclear power plant and related facilities in compliance with the safety requirements. Security and emergency response arrangements can be implemented at all proposed alternative sites for the new nuclear power plant in compliance with existing regulations.

12. SUPPLEMENTS

Appendix 1 Feasibility assessment for plant options, October 19, 2009

Appendix 2 Feasibility assessment for alternative sites, October 19, 2009