Application by Teollisuuden Voima Oyj to supplement the Government's decision-in-principle of 6 May 2010 concerning the construction of the Olkiluoto 4 nuclear power plant unit; the Radiation and Nuclear Safety Authority's preliminary safety assessment concerning the supplementary application

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1. INTRODUCTION

On 20 May 2014, TVO submitted to the Government an application to supplement the construction project of a new nuclear power plant unit, whereby it requests a decision from the Government that would set a new deadline for the submission of the application for a construction licence and confirm that the project is still in line with the overall good of society after the change of deadline.

On 25 April 2008, Teollisuuden Voima Oyj (TVO) submitted to the Government an application for a decision-in-principle concerning the construction of a new nuclear power plant unit at Olkiluoto. At that time, on 12 September 2008, 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.


TVO reports in its supplementary application submitted to the Government on 20 May 2014 that since the completion of the Olkiluoto 3 nuclear power plant unit has been delayed, the company cannot make decisions concerning the construction licence application for the Olkiluoto 4 nuclear power plant unit. In its application, TVO proposes that the period of validity of the current decision-in-principle be extended by five years, corresponding to the period of validity of the decision-in-principle made in 2010. TVO further states in its application that the content of the Olkiluoto 4 nuclear power plant unit project has not changed since the 2010 decision-in-principle.

The Ministry of Employment and the Economy requested a statement from STUK (TEM/1011/08.04.01/2014, 18 June 2014) concerning whether the
preliminary safety assessment compiled in 2009 still corresponds to the requirements of Section 14(1) of the Nuclear Energy Act in that no factors have arisen indicating a lack of sufficient prerequisites for constructing a nuclear facility in accordance with the provisions of Section 6 of the Nuclear Energy Act. Further, the Ministry of Employment and the Economy requested a statement from STUK concerning the setting of a new deadline for the construction licence application of the Olkiluoto 4 nuclear power plant unit in accordance with Section 18 of the Nuclear Energy Act.

The preliminary safety assessment drawn up in 2009 comprised an evaluation of the safety of the plant alternatives and the site location at Olkiluoto, and an assessment of the organizations and quality management of the applicant and the plant suppliers. The preliminary safety assessment also addressed security arrangements, emergency arrangements, nuclear fuel management, nuclear waste management, nuclear liability and nuclear safeguards.

Since the 2010 Government decision-in-principle, the Finnish nuclear safety regulations have been developed further, taking the experiences from the Fukushima Nuclear Accident and other experience into consideration. In this preliminary safety assessment concerning the supplementary application, STUK has considered the new Government Decree on the Safety of Nuclear Power Plants (717/2013) and the Government Decree on Emergency Response Arrangements at Nuclear Power Plants (716/2013), and the Government Decree on Security in the Use of Nuclear Energy (734/2008) that was updated in May 2012. STUK also renewed its regulatory guides concerning nuclear power plants (YVL Guides) in their entirety, and essential parts of the new Guides were adopted in 2013 with regard to new nuclear power plants. The fulfilment of the requirements set in the YVL Guides shall be assessed in the construction licence phase.

In this preliminary safety assessment pursuant to the request for a statement by the Ministry of Employment and the Economy, STUK states whether any factors have arisen in the supplementary application of the Olkiluoto 4 project indicating a lack of sufficient prerequisites for constructing a nuclear facility as decreed in Section 6 of the Nuclear Energy Act. Furthermore, STUK states its opinion concerning the setting of a new deadline for the application of a construction licence.

2. ASSESSMENT OF THE DIFFERENT PLANT ALTERNATIVES

STUK evaluated the safety of the Olkiluoto 4 plant alternatives in appendix 1 to the preliminary safety assessment that it submitted to the Government in 2009. The outset for the assessment was the Government Decree on the Safety of Nuclear Power Plants (733/2008) that was in force in 2009. In its statement, the Radiation and Nuclear Safety Authority concluded that the
plant alternatives considered in the application do not, as such, meet the Finnish safety requirements. The Radiation and Nuclear Safety Authority estimates that the design of the plant alternatives can be modified to fulfil the Finnish nuclear safety requirements, and that the nature and extent of the modifications depend on the plant type. The plant alternatives presented in the supplementary application are those that STUK evaluated in the preliminary safety assessment from 2009.

Analyses performed after the decision-in-principle

After the 2010 decision-in-principle, TVO has, in co-operation with plant suppliers, performed suitability assessments in order to develop the safety features of the plant alternatives, taking into account the results from the preliminary safety assessment in 2009 and the new safety requirements. In 2013, TVO submitted to STUK for information a set of documents containing reports of the safety solutions of the different plant alternatives and the licensing plans for the plant alternatives. For example, STUK stated in the preliminary safety assessment that the strategy for stabilising a molten core during a severe accident proposed for the APR1400 and APWR plants does not meet the Finnish requirements. In connection with the new suitability analyses, the suppliers of these plant types have developed new solutions that meet the Finnish requirements in principle. The details of these solutions require detailed analyses that must be presented during the construction licence phase.

New Government Decree on the Safety of Nuclear Power Plants

The Government Decree on the Safety of Nuclear Power Plants has been renewed in 2013, and it is now known as decree 717/2013. As regards the evaluation of the plant alternatives, the most significant changes were made in Section 10, Limits for accident, and in Section 14, Safety functions and provisions for ensuring them. In the appendix to the supplementary application, TVO has considered the requirements of the new decree (717/2013), but it has not evaluated in detail how the various plant alternatives fulfil all new requirements.

Section 10 of Government Decree 717/2013 requires that the release of radioactive substances arising from a severe accident at a nuclear power plant shall not necessitate large scale protective measures for the population nor long-term restrictions on the use of extensive areas of land and water, and that the probability of a release during an early phase of an accident requiring population protective measures be extremely small. The requirement concerning prolonged restrictions on the use of large areas of land or water has not changed. However, the requirement in new decree that extensive population protective measures shall not be necessary as a result of a severe accident, and that the probability of a release during an early phase of an ac-
incident requiring population protective measures shall be extremely small, is stricter in wording than what it was in the previous decree.

During a severe accident, the containment of a nuclear power plant shall contain the releases of radioactive substances and ensure that no extensive or early population protective measures are required. A release that requires extensive or early population protective measures could only be caused by an accident that also leads to damage of the containment. The probability of these accidents shall be extremely small, and a probabilistic assessment is used to estimate it. In line with the preliminary safety assessment from 2009, STUK states that the suppliers of all plant alternatives employ methods by which the probabilistic assessments required by the Finnish requirements for severe accidents can be carried out. The fulfilment of the requirement shall be assessed in detail during the processing of the construction licence.

The requirement in Section 14 of the Government Decree on the Safety of Nuclear Power Plants (717/2013) concerning preparation for rare external events and disruptions in electricity supply has been specified further. The nuclear power plant shall have the necessary components and procedures for securing the removal of decay heat from the spent fuel in the reactor and storage pools for a period of three days independently of the off-site supply of electricity and water in a situation caused by a rare external event or a disruption in the on-site electrical distribution system. Fulfilling the new requirement requires that the plant area has sufficient inventory of water, fuel and other supplies for a period of three days, and the capability to recharge DC batteries, among other matters. Preparing for disruptions in the plant’s internal electricity supply network may require plant modifications. The fulfilment of the requirement shall be assessed at the construction licence phase.

Similarly to the preliminary safety assessment from 2009, STUK finds that, in accordance with the conclusion of the preliminary safety assessment compiled now, the plant alternatives evaluated do not, as such, meet the Finnish safety requirements. The Government Decree on the Safety of Nuclear Power Plants was has been renewed in 2013, and it is now known as decree 717/2013. TVO has developed the plant alternatives together with plant suppliers in order to render them compliant with the new requirements, and submitted to STUK certain plant-specific design solutions. STUK estimates that the plant alternatives may require plant modifications in order to fulfil the requirements set in the Government Decree (717/2013), or that demonstration of the operability of systems during rare external events may be required, for example. The fulfilment of the requirements shall be assessed at the construction licence phase.
3. ORGANIZATIONS

The Government Decree on the Safety of Nuclear Power Plants (717/2013) lays down the licensee’s duties concerning the implementation and operation of a plant project. These duties require the organization in question to have a wide range of expertise available. Furthermore, the Decree sets requirements for the management system. STUK evaluates the organizations against the Finnish requirements and, in its evaluation, draws on recent experiences of the construction of nuclear power plants.

Expertise

As regards the expertise required for the Olkiluoto 4 project, the general plans for the different project phases that TVO presented to STUK in 2009 are still applicable. In the documentation submitted, TVO proposes that the expertise available to the Olkiluoto 4 project be maintained and developed during the time extension sought. The persons who have worked on the project will, for example, participate in the other projects of the TVO group or, via TVO Nuclear Services Ltd, in projects outside of TVO. Furthermore, TVO arranges continuous training. TVO states that the persons who have been transferred from the Olkiluoto 4 project to other projects will be flexibly available to the Olkiluoto 4 project when needed.

When the Government Decree (717/2013) was amended in 2013, more requirements were added concerning risks related to the operations of the organization and the safety impacts of organizational changes. STUK considers it important that TVO defines comprehensive procedures for these actions within the project. TVO has presented STUK principles of how the risks related to the operations of the various organizations in the project are being managed.

STUK estimates that a scenario where the construction of the Olkiluoto 4 nuclear power plant unit is not started until the Olkiluoto 3 nuclear power plant unit is in operation would be beneficial to ensuring that TVO’s expertise is sufficient to manage the safety of the OL1, OL2 and OL3 units and the OL4 project.

In relation to expertise, no factors have arisen that would affect the conclusions presented in the Radiation and Nuclear Safety Authority’s preliminary safety assessment from 2009.

Management system during design and construction

In the documentation that it submitted to STUK prior to the 2010 decision-in-principle, TVO stated that it was creating a separate management system for the construction phase of the Olkiluoto 4 project in line with the general
part of TVO's management system. In the documentation that it submitted to STUK in 2014, TVO states that the Olkiluoto 4 project relies on TVO's management system and only creates separate functions for tasks or parts thereof where such an approach is considered purposeful. In all likelihood, this will result in a reduction in the number of procedures specific to Olkiluoto 4; for its part, this may simplify the transfer of TVO's personnel between TVO's other projects and the Olkiluoto 4 project.

In accordance with the plans that TVO presented prior to the 2010 decision-in-principle, TVO has been performing suitability analyses related to safety, technology and licensing together with the plant supplier candidates. On the basis of this work, TVO submitted analyses and TVO's safety assessments to STUK for information in 2013. Furthermore, TVO has followed its plans and used different types of supplier analyses to assess the delivery capability of plant suppliers. The Radiation and Nuclear Safety Authority finds it important that TVO relies on up-to-date analyses when choosing a supplier.

TVO has developed the procurement procedures for the Olkiluoto 4 project based on experience from the Olkiluoto 3 project, among other things; it has presented to STUK the activity model it developed for the competitive bidding phase, wherein the safety significance of the delivery has been considered and where it affects the criteria set for the supplier and the quality management procedures related to the delivery.

TVO is utilising experience from the Olkiluoto 3 project in the Olkiluoto 4 project by defining the methods for gathering, analysing and rating experience, and by defining the necessary actions and follow-up for their impact. This work has already been started.

STUK finds it important that the development of the management system procedures is continuous before the construction licence application is submitted, and that the project has access to sufficient resources and expertise for this purpose. TVO has submitted to STUK preliminary plans for the Olkiluoto 4 project on the phasing of the project, the tasks related to the phases, and the resource needs for the period before the submission of the construction licence application. These tasks and resource requirements are, in part, dependent on the selected supplier and delivery model. If an extension is granted to the submission of the construction licence application, STUK finds it important that TVO specify and maintain the plans.

In relation to the management system in use during design and construction, no factors have arisen that would affect the conclusions presented in the Radiation and Nuclear Safety Authority's preliminary safety assessment from 2009.
In relation to the management system in use during plant operation, no factors have arisen that would affect the conclusions presented in the Radiation and Nuclear Safety Authority’s preliminary safety assessment from 2009.

4. SITE

The Nuclear Energy Act stipulates that, when 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(2)). Furthermore, there must be a site reserved for the construction of a nuclear facility in a local detail plan prepared in accordance with the Land Use and Building Act (132/1999), and the applicant must be in possession of the site as required for the operation of the facility (Nuclear Energy Act, Section 19(4)).

According to Section 11 of the Government Decree on the Safety of Nuclear Power Plants (717/2013), site selection must also take into account the impact of local conditions on safety as well as on security arrangements and emergency arrangements. The site shall be such that the impediments and threats posed by the plant to its vicinity remain extremely minor and plant heat removal to the environment can be reliably implemented.

Section 17 of Government Decree (717/2013) stipulates that the design of a nuclear facility shall take account of external events that may challenge safety functions. External events shall include exceptional weather conditions, seismic events, the effects of accidents that take place in the operating environment of the facility, and other factors resulting from the environment or human activity.

The requirements in the current Government Decree (717/2013) concerning the site location of the nuclear power plant and the site-specific external hazards (Sections 11 and 17) are essentially the same as those in the Government Decree (733/2008) that was in force when the preliminary safety assessment of 2009 was being prepared.

The preliminary safety assessment drawn up by STUK in 2009, and its appendix 2, evaluate in detail the suitability of Olkiluoto as a site location for a nuclear power plant.

General description of site location
The intended site of the new nuclear power plant is on the island of Olkiluoto, in the municipality of Eurajoki. The site is located approximately 13 kilometres from Rauma, and 33 kilometres from Pori. Olkiluoto is the site of the operating nuclear power plant units Olkiluoto 1 and 2, and the construction site of unit Olkiluoto 3. The area also includes several buildings and facilities related to the generation of nuclear power, such as the spent fuel interim storage (KPA storage), interim storages for power plant waste, final repository for power plant waste (VLJ cave), Posiva's ONKALO construction site (research tunnel for the final disposal facility for spent nuclear fuel), accommodation for approximately 1,000 persons, a visitor centre, and a gas turbine plant that is jointly owned by the national electrical grid operator Fingrid Oyj and Teollisuuden Voima Oyj.

Olkiluoto is an island of approximately 6 kilometres in length and 2 kilometres in width, and it is connected to the mainland by a short bridge. TVO owns 745 hectares, approximately 85%, of the land area on the island of Olkiluoto. Furthermore, TVO owns the water areas and nearby islands surrounding Olkiluoto completely or in part. The eastern part of Olkiluoto features constructed and unconstructed leisure properties, as well as a few larger land areas, owned by private individuals. The intended site of the new plant unit is in the western part of the island, north of the current units. No significant changes in the plant site or its ownership and possessory relations have taken place since the processing of the approved decision-in-principle.

Zoning at the site location

The Ministry of the Environment approved the provincial plan for Satakunta on 30 November 2011. The provincial plan supports the construction of power plants at Olkiluoto.

The partial disposition plans for Olkiluoto and the northern shore areas of Rauma have been approved. The partial disposition plan for Olkiluoto is legally valid.

As regards the pending amendment of the master plan governing the shore areas of Eurajoki, STUK has provided a statement on 15 June 2012 stating that, as regards STUK’s area of expertise, nothing has arisen to prevent further preparation of the plan. However, the statement requests planners to verify how the change of plan will affect the actual population of the area. The aforementioned plan change does not apply to the Olkiluoto plant area or the Natura 2000 areas.

Local plans are in force for the current nuclear power plant units, the plant unit under construction, and the planned Ol4 plant unit. Their up-to-
datedness has been verified in 2014. In Olkiluoto's local plan, the intended site for the new power plant unit is reserved for nuclear power plants.

The municipal council of Eurajoki approved the local plan governing the disposal of spent fuel in June 2010. The local plan covering the disposal area indicates the areas and permitted building volumes for the buildings and structures of the disposal facility. The local plan is legally valid.

At present, there is only one road connection leading to the Olkiluoto nuclear power plant. Chapter 5 discusses the need for a second road connection with a view to emergency arrangements. The planning map of the provincial plan of Satakunta indicates the need for a second road connection between main road 8 and Olkiluoto. It is the considered opinion of STUK that, apart from the second road connection, the construction of the power plant unit will not affect the other plans that are in force in the area.

Natural conditions at site location

Over 35 years of experience is now available on the operation of the Olkiluoto 1 and 2 plant units at Olkiluoto. The conditions and suitability of the site location have been surveyed in order to design the operating nuclear facilities and those under construction. The site location has not been found to have any particularly negative features as regards the siting of nuclear facilities.

The preliminary safety assessment drawn up by STUK in 2009, and its appendix 2, evaluate in detail the suitability of Olkiluoto as a site location for a nuclear power plant. After the preparation of the above documents, nothing has arisen concerning the site location or its vicinity that would affect the plant site suitability assessments.

The geological and seismic properties of Olkiluoto have been surveyed in connection with the design of the operating nuclear power plant units, those under construction, and the nuclear waste disposal facilities. The host rock of the area is suitable for the construction of overground nuclear facilities and underground disposal facilities. Olkiluoto is located in the seismically quiet zone of Southern Finland. Earthquakes are taken into consideration in the design of new nuclear facilities. The design basis earthquake of the plant site has been determined for the purpose of designing the Olkiluoto 3 plant unit.

STUK stated the following concerning the design basis earthquake in its preliminary safety assessment from 2009: “The studies will be updated for the design of the new plant unit and assessed in connection with the review of the possible application for a construction licence.” So far, TVO has not performed a detailed assessment of the earthquake analyses on which the de-
sign basis earthquake is based. Based on the changed schedule of the Olkiluoto 4 project, TVO has stated that it will not submit to STUK the plan concerning the assessment and possible update of the earthquake analyses before the end of 2014. Earthquake issues have been treated in the Finnish Research Programme on Nuclear Power Plant Safety, SAFIR2014, since 2011. It is the considered opinion of STUK that the results from additional earthquake studies will in all likelihood not affect the acceptability of the plant site. In principle, however, they may have minor effects on the ground acceleration values used as the design basis of the plant and, therefore, on the implementation of the systems, structures and components.

Extreme weather conditions and extreme values of sea water level have been studied in connection with the risk analyses of the operating plant units and the design of the Olkiluoto 3 plant unit. During the design of the Olkiluoto 3 plant unit, special attention was paid to extremely high and low outside air temperatures and the extreme values and frequencies of strong local winds (tornadoes). The weather conditions in the area have no unfavourable features that differ from the rest of Southern Finland, and the extreme weather conditions in the area can be accounted for in the design of the nuclear power plant. Seawater level variations are relatively minor on the coast of the Bothnian Sea, and ice conditions are regular.

The occurrence of extreme weather phenomena and the impact of climate change upon them have been studied in the Finnish Research Programme on Nuclear Power Plant Safety during the programme terms SAFIR2010 and SAFIR2014. The adequacy of the design bases of the new nuclear power plant related to extreme weather phenomena will be assessed in cooperation with the Finnish Meteorological Institute, and on the basis of the latest information available in the field, during the review of the eventual construction licence application.

Large quantities of sea water are required to cool the turbine condenser of the Olkiluoto 4 plant unit. There are no known obstacles to implementing the sea water intake and discharge arrangements as presented in the application for a decision-in-principle. TVO will commission the detailed geological surveys required for the excavation of the sea water tunnels during the construction licence phase. The effects of the heated cooling water that is discharged into the sea have been studied in the environmental impact assessment report.

The processes of a nuclear power plant require substantial quantities of purified fresh water. Olkiluoto has the facilities for the pumping, storage, purification and demineralization of raw fresh water. The raw water is extracted from the Eurajoki river, located approximately eight kilometres away, using a pipeline. The application for a decision-in-principle does not discuss the extraction of raw fresh water. TVO has stated that it has a related long-term
Surrounding industry, transport routes and electrical grid connections

There are no industrial or storage facilities, land transportation routes or gas pipes in the vicinity of Olkiluoto where accidents could pose a hazard to the nuclear power plant. The routes used for oil transport on the Gulf of Bothnia do not pass near Olkiluoto. The probability of an oil accident that would affect the availability of seawater at the Olkiluoto power plant is considered low. The clogging of seawater systems due to oil, algae and ice formation will be taken into account in the design of the new plant unit. Although the risk of oil accidents at Olkiluoto has been determined to be very low, TVO is continuing to improve the oil prevention operations in the vicinity of Olkiluoto together with the rescue and environment authorities.

The new nuclear power plant unit requires a connection to the Finnish national grid. 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. In order to connect the power plant to the national grid, a new 400 kV power line connection and a line passage to Rauma will be built. The transfer connections from Rauma to the rest of the national grid will be boosted. Reliable connections from the nuclear power plant to the national grid are necessary to ensure undisrupted electricity production and transfer and, if necessary, the feeding of electricity from the national grid to the plant. The environmental impact assessment procedure for the 400-kilovolt and 110-kilovolt (kV) lines required by the Olkiluoto 4 project was completed in the spring of 2013. Fingrid Oyj has selected the power line routes that will be used in further planning as the implementation schedule of the plant is specified.

In order to ensure that the power plant’s safety systems have power in case of a disturbance or an accident, the nuclear power plant units have their own emergency power supply.

The gas turbine plant located at Olkiluoto and jointly owned by Fingrid Oyj and TVO is a reserve power plant intended to control disturbances occurring in the national grid, and to supply the nuclear power plants at Olkiluoto. The gas turbine plant also increases the reliability of electricity supply for the safety systems of the Olkiluoto power plant.

The intended site of the Olkiluoto 4 power plant unit has been studied sufficiently for the application for a decision-in-principle to be processed. No changes have taken place in them that would affect the conclusions in
STUK’s preliminary safety assessment from 2009. It is the considered opinion of the Radiation and Nuclear Safety Authority that the new plant unit and the other related nuclear facilities stated in the application can be constructed at the intended location in the manner required in Section 6 of the Nuclear Energy Act.

5. SECURITY ARRANGEMENTS AND EMERGENCY ARRANGEMENTS

Emergency arrangements

According to Section 7 of the Nuclear Energy Act, sufficient security arrangements and emergency arrangements as well as other arrangements to limit nuclear damage and protect the use of nuclear energy against unlawful action are a prerequisite for the use of nuclear energy. ‘Emergency arrangements’ refer to advance preparation for accidents or events impairing safety at the nuclear facility or in its area (Nuclear Energy Act, Section 3). Emergency arrangements must take the event that significant quantities of radioactive material are released from the plant, even if the likelihood of such an event is extremely low, into consideration. The emergency arrangements to be implemented by the licensee include the emergency plan, a trained emergency organization and the facilities, equipment and communication systems commensurate with the duties in question. Requirements for emergency arrangements are given in Section 7p of the Nuclear Energy Act and in the Government Decree on Emergency Arrangements at Nuclear Power Plants (716/2013), which was updated in 2013. The most significant changes in comparison to the Government Decree (735/2008) that was in force in 2009 are related to the lessons learned from the Fukushima Nuclear Accident.

Section 3(2) of Government Decree 716/2013 states that the planning of emergency arrangements shall take account of simultaneous emergency situations occurring in all nuclear facilities in the site area and their potential consequences, especially the radiation situation on the site and in the surrounding area and the opportunities to access the area. Planning shall take account of the fact that the emergency situation could continue for a long-term period. TVO has updated its emergency arrangements for the plant units Olkiluoto 1 and 2, and it will be demonstrating the functionality of its emergency arrangements relating to the Olkiluoto 3 plant unit, as required in Section 7 of Government Decree 716/2013, by arranging an emergency exercise before nuclear fuel is transferred into the reactor at the Olkiluoto 3 plant unit. As regards the Olkiluoto 4 plant unit, the emergency arrangements will be evaluated during the construction licence phase and on the basis of the preliminary emergency response plan submitted by TVO.

At present, there is only one road connection leading to the Olkiluoto nuclear power plant. The current road to Olkiluoto has heavy traffic especially
during annual outages and the construction of facilities, when thousands of people are working at the site simultaneously. The road has large amounts of heavy traffic and special transport. The selection of the site should note that para. 402 of Guide YVL A.2, which was adopted in 2013, states that “At least two road connections to the site area or its immediate vicinity shall be available, or it shall be possible to make them available, to ensure rescue operations and plant safety also under exceptional traffic conditions and other conditions”. Para. 409 of Guide YVL A.2 states that “Exit routes from the area shall be built according to the instructions and requirements given by the rescue authorities, in a manner that allows for safe evacuation with no disturbance to the rescue activities under exceptional natural conditions, traffic conditions, or following an accident in the area”. STUK will take a stand on the construction of a road connection when it issues a decision to enforce Guide YVL A.2 in 2015.

Under the Government Decree on Emergency Arrangements at Nuclear Power Plants (716/2013), there must be a precautionary action zone and an emergency planning zone around a nuclear power plant. The precautionary action zone is an area that extends approximately 5 km from the power plant and where land use restrictions are in force. The emergency planning zone extends approximately 20 km from the plant, and authorities must draw up an external rescue plan for this zone as laid down in Section 48(1)(1) of the Rescue Act (379/2011). The external rescue plan defines the procedures by which accidents and their consequences can be limited and controlled as effectively as possible. In case of a severe nuclear power plant accident, possible protective measures include taking cover indoors, ingesting iodine tablets and, as an extreme measure, relocating the population or evacuating the danger area. By virtue of the Rescue Act, the external rescue plan and implementation of exercises shall be supervised by the Regional State Administrative Agency. Therefore, the construction of a nuclear power plant also imposes obligations on the authorities.

A precautionary action zone and an emergency planning zone referred to in Section 2 of the Government Decree on Emergency Arrangements at Nuclear Power Plants (716/2013) have been defined for the Olkiluoto power plant, covering the municipalities of Eurajoki and Luvia and the town of Rauma (with the exception of the areas in the former municipalities of Lappi and Kodisjoki; however, the village of Murtamo in the former municipality of Lappi is part of the emergency planning zone). The Satakunta rescue department is currently in the process of updating the external rescue plan covering the area, and STUK has provided statements on the plan on 16 March 2012 and 26 March 2014. The precautionary action zone and the land use restrictions pertaining to it are described in the provincial plan of Satakunta. The construction of the new plant unit and the extensions of the nuclear waste facilities described in the application for a decision-in-principle will
not cause significant changes to the precautionary action zone or the emergency planning zone.

In emergency situations, the licensee shall be prepared to carry out radiation monitoring in the site area and in the precautionary action zone. The licensee shall also take meteorological measurements and it shall be capable of assessing the dispersion of radioactive materials in the emergency planning zone (Section 4 of Government Decree 716/2013). TVO has implemented these arrangements for the Olkiluoto power plant and its precautionary action zone.

The licensee shall, in cooperation with the local rescue services, supply the population with advance instructions on preparing for nuclear emergency occurring in the emergency planning zone, and distribute iodine tablets in advance to the population within the precautionary action zone. In the event of an accident, the licensee shall participate in warning any members of the population inside the precautionary action zone (Government Decree 716/2013, Section 13). TVO has fulfilled these requirements.

It is advantageous for emergency arrangements if the plant is located in a sparsely populated area, well away from large population centres. In this case, the measures preparing for an accident concern a small population. The areas in the immediate vicinity of Olkiluoto may be considered sparsely populated, but the precautionary action zone does include a substantial amount of holiday housing, approximately 550 leisure time properties. The emergency planning zone, within a radius of about 20 km from the nuclear power plant, has a permanent population of about 46,000 residents. Within a radius of 100 km, the population totals some 500,000 residents. No essential changes have occurred in the population of Olkiluoto, the precautionary action zone or the emergency planning zone that would have an effect on emergency activities.

In order to test the emergency arrangements, emergency exercises are held at regular intervals at the Olkiluoto nuclear power plant jointly with the local rescue services and with regional and national authorities.

Security arrangements

Security arrangements refer to the measures needed to protect the use of nuclear energy against unlawful action at a nuclear facility, in the area of the facility and some other location or vehicle where nuclear energy is used. According to Section 71 of the Nuclear Energy Act, a nuclear facility shall employ security staff with training on the planning and implementation of security arrangements (security organization). The duties of and training requirements for the security organization and security staff must be defined, and they must have access to the monitoring equipment, communications
equipment, protective equipment and equipment for use of force commensurate with their duties.

According to Section 24(2)(5) of the Nuclear Energy Decree, the application for a decision-in-principle must include a report on the suitability of the proposed site for its purpose, considering the effects of local conditions on security arrangements.

According to Section 8 of the Government Decree on Security in the Use of Nuclear Energy (734/2008), the security arrangements include the control of vehicles, persons, objects and materials as well as goods transportation equipment in order to ensure that no dangerous objects are brought into the nuclear facility. Movement at the nuclear facility shall be restricted and controlled so that the security arrangements aspects and safety aspects can be taken into consideration effectively. In particular, the licensee shall ensure that no nuclear use items, nuclear waste, radioactive materials or confidential nuclear information can be removed from the nuclear facility without appropriate authorization. The Government Decree on Security in the Use of Nuclear Energy (734/2008) was last updated in 2012 concerning the determination of the design basis threat and special stipulations regarding forcible means equipment.

The Olkiluoto nuclear power plant has in place security arrangements that are based on the Nuclear Energy Act. Due to changes in the general operating environment and local conditions, the requirements concerning the security arrangements and emergency arrangements, and the threats that form their basis, may also change. The security arrangements and emergency arrangements are constantly being evaluated and developed. A detailed analysis is performed at the construction and operating licence phases, and not less frequently than every ten years during the periodic safety assessments.

In order to determine the threat level of unlawful action, STUK has verified on 30 May 2013 the Design Basis Threat (DBT) referred to in Section 2(1a) of the Government Decree on Security in the Use of Nuclear Energy (734/2008), which must be used as the basis for planning and assessing the security arrangements for which the licensee is responsible. According to Section 71 of the Nuclear Energy Act, the security arrangements for the use of nuclear energy shall be based on threat scenarios applicable to the use of nuclear energy and analyses of the need for protection.

TVO has implemented at Olkiluoto the security arrangements detailed in the Nuclear Energy Act in co-operation with the local and regional authorities. The plans related to the Design Basis Threat (DBT) require further action that must be completed for the new nuclear power plant unit before the construction licence application for the unit is submitted.
Information security of the Olkiluoto 4 project is not discussed in the application. STUK has assessed TVO’s security arrangements (including information security) on a regular basis, and TVO has developed the security arrangements by following the principle of continuous improvement. Ensuring information security in the OL4 project requires further action from TVO.

In the application for a decision-in-principle, TVO states that the current security plans and emergency plans for Olkiluoto can be expanded to cover the new nuclear power plant unit and the expansions of the nuclear waste facilities. The preliminary security plan and emergency plan of the new nuclear power plant unit shall be submitted to STUK during the construction licence phase, and the final plans shall be submitted in connection with the operating licence application.

It is the considered opinion of STUK that TVO has the prerequisites to implement the licensee’s security arrangements and emergency arrangements of the new nuclear power plant unit, and the other related nuclear facilities stated in the application, in accordance with legislation. It is the considered opinion of STUK that the alarm and rescue arrangements for the immediate vicinity of the power plant falling under the responsibility of the rescue authorities are sufficient but that they should be developed further.

In relation to the implementation of the security arrangements and emergency arrangements, no factors have arisen that would affect the conclusions presented in the Radiation and Nuclear Safety Authority’s preliminary safety assessment from 2009. The development of the emergency arrangements shall consider the Government Decree on Emergency Response Arrangements at Nuclear Power Plants (716/2013) which was amended in 2013.

6. NUCLEAR FUEL MANAGEMENT

According to Section 24(2)(7) of the Nuclear Energy Decree, the licence applicant shall append an outline plan on nuclear fuel management to the application for a decision-in-principle. TVO has appended an updated outline plan for nuclear fuel management to the supplementary application.

STUK’s preliminary safety assessment of the OL4 project, M211/8, 29 May 2009, stated the following: “In one Appendix to the application for a decision in principle, nuclear fuel management with respect to the new plant unit is described. The starting point in the procurement of fresh fuel is usually that only the initial fuel for the plant is included in the plant delivery. The normal practice on the nuclear fuel market is to invite tenders from the suppliers involved in the nuclear fuel manufacturing chain and the choice of the plant design does
not in itself limit the possibilities to purchase nuclear fuel. Fuel types are constantly developed, which makes it necessary to take into account that different fuel types procured from different manufacturers will be used in the reactor. The nuclear fuel would be manufactured abroad and only transport and storage of fresh fuel would take place in Finland. These activities represent well established technology and do not involve any significant safety risks.”

STUK has evaluated TVO’s updated baseline plan for fuel management and states that no factors have arisen in relation to nuclear fuel management that would affect the conclusions presented in the Radiation and Nuclear Safety Authority’s preliminary safety assessment from 2009.

7. NUCLEAR SAFEGUARDS

The purpose of nuclear safeguards is to ensure that nuclear fuel as well as other nuclear materials and nuclear use items are only used for peaceful purposes, as specified in the relevant licenses and declarations, and that nuclear facilities and nuclear technology are only used for peaceful purposes. The licensee has the obligation to plan and take care of its nuclear safeguards, document any and all nuclear use items in its possession, submit reports to authorities and allow access to nuclear safeguards inspectors from STUK, the European Commission and the International Atomic Energy Agency (IAEA). In accordance with Section 118 b of the Nuclear Energy Decree, the use of nuclear energy shall be planned and implemented so that the legislative requirements are met. A nuclear facility shall not contain premises, materials or functions which are relevant to nuclear safeguards and which are not included in the declared information. The licensee shall have in place an accounting and reporting system which ensures the correctness, scope and consistency of information in order to implement the regulatory control necessary for the non-proliferation of nuclear weapons.

In accordance with Section 118 of the Nuclear Energy Decree, the national safeguard system maintained by STUK covers the use of nuclear energy and the control necessary for the non-proliferation of nuclear weapons as defined in the international agreements that Finland is party to. Based on STUK’s supervision, TVO has, as a user of nuclear energy and a licensee, in its employ the necessary expertise and competence to arrange the control required for the non-proliferation of nuclear weapons, thereby enabling Finland to comply with the international contractual obligations in this respect.

On 13 November 2012, TVO submitted to STUK and the European Commission the preliminary design information concerning the OL4 plant project, in order to allow the European Commission and the IAEA to plan and implement their control on this basis. In relation to nuclear safeguards, no factors
have arisen that would affect the conclusions presented in the Radiation and Nuclear Safety Authority’s preliminary safety assessment from 2009.

8. NUCLEAR WASTE MANAGEMENT

According to Section 24 of the Nuclear Energy Decree, an outline of the applicant’s plans and available methods for nuclear waste management shall be supplemented to an application for a decision-in-principle granted by the Government.

No significant amendments have been made to that application for a decision-in-principle and its safety assessment which TVO submitted to the Government in 2008. The amended Government Decree (717/2013) remains unchanged as concerns the requirements in Sections 15 and 16 discussing the processing and storage of fuel and nuclear waste. The amendments made to Section 20 of the decree are text corrections, not additional requirements, and they have no bearing on the processing of the issue.

The management of operational waste at the Olkiluoto 4 power plant unit relies on the same methods, and largely the same facilities, as the power plant units that are currently operating or under construction. The Olkiluoto 4 plant unit has reservations for sufficient facilities for the processing and storage of low and intermediate level operational waste. Waste from the operating plant units is transferred to the disposal facility for low and intermediate level operational waste at Olkiluoto. The facility can be extended to accommodate waste from the Olkiluoto 3 and 4 plant units. The facilities have also been designed to be extended to accommodate all the decommissioning waste from the dismantling of all four plant units. The extension of the disposal facility will be designed and constructed according to the safety requirements presented in Government Decree 736/2008 and other legislation.

The spent fuel from the Olkiluoto 4 plant unit will be stored, and is planned to be disposed of, in a manner similar to the fuel from the existing plant units. The spent fuel will be stored for a number of years in the fuel pools of the Olkiluoto 4 power plant unit’s reactor building, after which it will be transferred into the spent fuel interim storage for approximately 50 years. Additional space for spent fuel on the island of Olkiluoto can be provided by either extending the current storage facilities or constructing a new storage facility.

assesses the disposal solution of the disposal facility and the suitability of the site in a separate statement that covers the application for the decision-in-principle.

In relation to nuclear waste management, no factors have arisen that would affect the conclusions presented in STUK’s preliminary safety assessment from 2009.

9. NUCLEAR LIABILITY

Nuclear liability is provided for in the Nuclear Liability Act (484/1972). This Act takes into account the international conventions binding upon Finland that set the minimum levels of liability for nuclear damages. The international negotiations on the revision of the so-called Paris and Brussels agreements on nuclear liability were concluded in 2004. The negotiations agreed on increasing the funds available for damages and on the unlimited liability of the licensee of the facility. However, the enforcement of these agreements has been continually postponed. Therefore, Finland decided to enact the current higher insurance sums and the unlimited liability of the licensee on a national level. The temporary amendment of the Nuclear Liability Act entered into force in early 2012. The amendment will be repealed once the aforementioned agreements enter into force.

The licensee of a nuclear facility located in Finland has unlimited liability in respect of all nuclear damage inflicted in Finland as a result of a single nuclear incident. The funds available for damages in an accident consist of three different sources: the funds of the licensee, the country of operation of the facility, and the so-called international compensation community. A total of SDR600,000,000 is available for an accident from all of these sources. SDR (Special Drawing Right) is the value of a currency basket specified by the International Monetary Fund (IMF) based on the value of a number of currencies. In 2013, the currency basket was valued at approximately €1.12. Even if a nuclear facility has been granted an operating licence, the operation of the facility may not be started before STUK has deemed that the licensee of the nuclear facility has arranged indemnification regarding liability in the case of nuclear damage according to the law.

STUK is not aware of any obstacles that would prevent TVO from fulfilling its nuclear liability obligations in accordance with the Nuclear Liability Act.

10. CONCLUSIONS

Concluding the preliminary safety assessment, STUK states the following:

1. The preliminary safety assessment for the Olkiluoto 4 project, drawn up by STUK in 2009, and its appendix 1, evaluate the
plant alternatives ABWR, ESBWR, APR 1400, APWR, and EPR that TVO had analyzed. TVO’s supplementary application contains the same plant alternatives.

TVO has continued the development and suitability assessment of the plant types in order to ensure that the Finnish safety requirements are met. In 2013, TVO submitted to STUK for information a set of documents containing analyses of the safety solutions of the different plant alternatives, TVO’s safety assessments concerning them, and licensing plans for the plant alternatives.

In line with its preliminary safety assessment from 2009, STUK states that the plant alternatives do not, as such, meet the Finnish safety requirements yet. The new requirements in the Government Decree on the Safety of Nuclear Power Plants (717/2013) that came into force in 2013 are also causing eventual needs for modification. The Radiation and Nuclear Safety Authority states that the design of the plant alternatives can be modified to fulfil the latest nuclear safety and radiation safety requirements of the Government decrees. The nature and extent of the necessary modifications varies by plant type.

2. The preliminary safety assessment for the Olkiluoto 4 project, drawn up by STUK in 2009, and its appendix 2 evaluate in detail the planned site location of the facility. After the 2009 assessment, natural phenomena (such as extreme weather conditions, seawater level variations and seismic effects) that may affect the safety of the facility have been further analysed in the Finnish Research Programme on Nuclear Power Plant Safety, SAFIR2014, for example. No changes have occurred in the nearby industry, transport of dangerous goods or other human activities that would affect the safety of the planned facility.

In relation to the site location, no factors have arisen that would affect the conclusions presented in the Radiation and Nuclear Safety Authority’s preliminary safety assessment from 2009.

3. No factors have arisen in relation to the expertise made use of in the Olkiluoto 4 project or the management system employed during design, construction or operation that would affect the conclusions of the preliminary safety assessment presented by the Radiation and Nuclear Safety Authority in 2009.
4. In relation to the implementation of security arrangements and emergency arrangements, no factors have arisen that would affect the conclusions presented in the Radiation and Nuclear Safety Authority's preliminary safety assessment from 2009. The development of the emergency arrangements shall consider the Government Decree on Emergency Response Arrangements at Nuclear Power Plants (716/2013) which was amended in 2013.

5. No factors have arisen in relation to nuclear fuel management, nuclear safeguards, nuclear waste management and nuclear liability that would affect the conclusions presented in the Radiation and Nuclear Safety Authority's preliminary safety assessment from 2009.

STUK concludes the following concerning TVO's application for setting a new deadline for submitting the construction licence application of the Olkiluoto 4 nuclear power plant unit in accordance with Section 18 of the Nuclear Energy Act:

6. From the point of view of ensuring the safety of the Olkiluoto 4 project, STUK finds that no issues have arisen that would prevent the setting of a new deadline. It is the considered opinion of STUK that the additional time will be spent on creating the documentation to be submitted at the construction licence phase and ensuring its compliance by, for example, developing the safety properties of the selected plant alternative to meet the renewed Finnish requirements, on updating the site location analyses, and on developing expertise and the management system.

The Radiation and Nuclear Safety Authority states that, in the preliminary safety assessment, no factors have arisen indicating a lack of sufficient prerequisites for constructing the new nuclear power plant proposed by Teollisuuden Voima Oyj in accordance with the provisions of Section 6 of the Nuclear Energy Act.

11. APPENDICES
Statement from the Advisory Committee on Nuclear Safety, 14 August 2014