

The image shows a low-angle view of the Loviisa nuclear power plant. On the left, a large, curved building with a ribbed, golden-brown facade rises towards the sky. To its right, a tall, cylindrical chimney with a metal walkway at the top stands against a clear blue sky with some light clouds. The overall scene is brightly lit, suggesting a sunny day.

Loviisa nuclear power plant

**Operating licence  
application  
NUCLEAR POWER PLANT**



---

# TO THE FINNISH GOVERNMENT

## Operating licence application for Loviisa nuclear power plant

### 1 APPLICANT

The applicant is Fortum Power and Heat Oy (hereinafter Fortum), which has its registered office in Espoo and the business ID of which is 0109160-2. Fortum is the owner and operator of Loviisa nuclear power plant (hereinafter also “Loviisa power plant” or “power plant”), located on the island of Hästholmen, in the town of Loviisa.

Further details about the applicant can be found in Appendices 1, 2, 8, 10 and 11 to the application.

### 2 APPLICATION

Fortum is applying for a licence pursuant to section 20 of the Nuclear Energy Act (990/1987):

1. to use the nuclear power plant units Loviisa 1 and Loviisa 2 for the production of energy no longer than until the end of 2050 and in the manner required by the preparation for the power plant units’ decommissioning no longer than until the end of 2055.
2. to use the buildings and storage facilities, with any necessary extensions thereto, required for the management of nuclear fuel and nuclear waste no longer than until the end of 2090.

In relation to the aforementioned, Fortum is applying for a licence to possess, manufacture, handle, use and store nuclear waste and other nuclear materials<sup>1</sup> elsewhere in the power plant area<sup>2</sup> than in the final disposal facility for low- and intermediate-level waste as follows:

- A maximum of 12,800 fuel bundles of spent nuclear fuel generated in the operation of Loviisa nuclear power plant.
- A maximum of 10,000 m<sup>3</sup> operational waste<sup>3</sup> (including decommissioned radiation sources) generated in connection with or as a result of the operations of Loviisa nuclear power plant.
- A maximum of 2,000 m<sup>3</sup> of radioactive waste with an activity concentration equivalent to low- or intermediate-level waste generated elsewhere in Finland.

In addition, Fortum is applying for a licence to possess, handle, use and store the fresh nuclear fuel required in the operation of Loviisa nuclear power plant, provided that a licence for the import of the said fresh nuclear fuel has been granted pursuant to the Nuclear Energy Act.

Furthermore, Fortum is applying for a licence to possess, manufacture, handle, use and store other nuclear materials already in the power plant area and other nuclear materials besides those already mentioned, provided that a licence pursuant to the Nuclear Energy Act has been granted for any nuclear materials subject to an import licence.

According to section 7 g, subsection 2, a licence applicant and a licence holder must have a plan for the decommissioning of a nuclear facility. Unless otherwise mentioned in the terms of the licence, the licence holder must also, during the operation pursuant to the operating licence, regularly, at least

<sup>1</sup> Nuclear material refers to materials defined in section 1, subsection 1, paragraph 8 of the Nuclear Energy Decree (161/1988).

<sup>2</sup> Power plant area refers, pursuant to section 2, subsection 1, paragraph 8 of Radiation and Nuclear Safety Authority Regulation STUK Y/2/2018, to an area in use by nuclear power plant units and other nuclear facilities in the same area, and to the surrounding area, where movement and stay are restricted by the Decree of Ministry of the Interior issued under Chapter 9, section 8 of the Police Act (872/2011).

<sup>3</sup> Operational waste refers to the low- and intermediate-level waste accumulated in the operation of a nuclear power plant.

every six years, present an updated plan for the decommissioning of the nuclear facility for the approval of the Ministry of Economic Affairs and Employment. Fortum proposes that once the energy production has come to an end, the updated plan for the decommissioning of the buildings and operations necessary for the management of nuclear fuel and nuclear waste be submitted for the approval of the Ministry of Economic Affairs and Employment in connection with the periodic safety review referred to in section 7 e of the Nuclear Energy Act, i.e., at least every 10 years.

### 3 SUBJECT OF APPLICATION

#### 3.1 LOVIISA NUCLEAR POWER PLANT

The application pertains to Loviisa nuclear power plant, which comprises two power plant units, Loviisa 1 and Loviisa 2, each with a nominal thermal power of 1,500 MW; the support functions required for their operation, buildings included; and the related buildings, storages and operations necessary for the management of nuclear fuel and nuclear waste. At the time of this application's preparation, Loviisa nuclear power plant produces a total of approximately 8 terawatt hours (TWh) of electricity for the national grid every year. This is equal to approximately 10% of Finland's electricity consumption. The preparation for decommissioning, the decommissioning and the phase of independent operation, all described in more detail in section 3.3 of the application, will begin once the electricity production has ended.

The final disposal facility for low- and intermediate-level waste located in the power plant area (hereinafter also "final disposal facility") is a separate nuclear facility as referred to in the Nuclear Energy Act and Nuclear Energy Decree, but it is used in connection with Loviisa nuclear power plant and integrated into the power plant's operations. The operating licence application for Loviisa nuclear power plant does not apply to the final disposal facility, for which a separate operating licence application will be submitted.

Loviisa nuclear power plant's reactors are VVER-440-type water-moderated and water-cooled pressurised water reactors. The plant units were subject to several changes compared to a standard facility during the design phase to ensure their basic principles met Western requirements. Numerous projects aiming to improve nuclear safety have also been carried out over the years. The Loviisa 1 plant unit was commissioned in 1977 and the Loviisa 2 plant unit in 1980.

#### 3.2 LOCATION

Loviisa nuclear power plant is located approximately 12 km from the centre of the town of Loviisa, on the island of Hästholmen. The buildings and structures required for the power plant's support functions, such as security and temporary accommodation for workers employed for annual outages, are located on the mainland. The raw water is abstracted from Lake Lappomträsket, also located on the mainland.

Appendix 3 to the application contains a report on the location of Loviisa nuclear power plant as well as on any residential areas and other activities in its immediate surroundings and land use planning.

#### 3.3 INTENDED USE

The reactors of the plant units Loviisa 1 and Loviisa 2 are used to produce thermal energy and further to produce electricity for the national grid. Once the energy production has come to an end, which in accordance with this application will take place no later than in 2050, the nuclear power plant units will be used as required in the preparation of the plant units' decommissioning for no longer than until

the end of 2055. Among other things this means the storage of the spent nuclear fuel in the reactor buildings and the related operations.

The buildings and storages forming part of the nuclear power plant and necessary for the nuclear fuel and nuclear waste management are used for the handling and storage of the nuclear materials necessary for the power plant's operation and for the handling and storage of the nuclear waste generated in the power plant's operation. When necessary, these buildings and storages are also used for the handling and storage of radioactive waste with an activity level equivalent to low- and intermediate-level waste generated elsewhere in Finland as presented in the proposed terms of the licence in the power plant's application.

In accordance with this application, energy production at Loviisa nuclear power plant would end no later than in 2050, after which the preparation for the decommissioning would be commenced. Phase 1 of the power plant's decommissioning (the preparation and first dismantling phase) will begin once energy production has ended and will last for 6–10 years. Following the first dismantling phase, measures related to decommissioning and waste management will be carried out at the site of the facility and spent nuclear fuel from the plant units will be stored in the plant parts which have been made independent. The power plant's plant parts to be made independent are the interim storages for spent nuclear fuel, the liquid waste storage and the solidification plant, any necessary parts from the power plant's auxiliary buildings and the required support functions. The final disposal facility for low- and intermediate-level waste will also operate as an independent facility. Making a plant part independent refers to the separation of required functions, such as cooling or ventilation, from the systems of the power plant units to ensure the said plant parts to be made independent can function without the power plant units. The second dismantling phase, during which all plants parts made independent will be dismantled, will commence when all the spent fuel has been transferred to Posiva Oy (hereinafter Posiva) for final disposal.

Appendix 5 contains a report on Loviisa nuclear power plant's technical principles of operation. The reports on the quality and maximum quantity of the nuclear materials and nuclear waste produced, handled, used or stored at Loviisa nuclear power plant, as well as the plans on the arrangement of nuclear waste management, are presented in Appendices 4 and 9 to the application.

#### 3.4 POWER PLANT'S NOMINAL POWER

The reactors in the plant units Loviisa 1 and Loviisa 2 each have a nominal thermal power of 1,500 MW and the net electric power is currently around 507 MW. The total efficiency of the power plant units is therefore approximately 34%. The availability and load factors of Loviisa nuclear power plant have been excellent.

#### 3.5 PERIOD OF OPERATION

The power plant units are meant to be used for energy production until the end of the licensing period applied for in this application, i.e., until the end of 2050, and to the extent required by the preparation for decommissioning, until the end of 2055.

The buildings and storage facilities necessary for the management of nuclear fuel and nuclear waste, with any necessary extensions and support systems thereto, are meant to be used no longer than until the end of 2090. The spent nuclear fuel will be stored in the storages for spent fuel until such time as the transportation of spent fuel for final disposal to Posiva's encapsulation and final disposal facility are completed. The second dismantling phase, during which the plant parts that have been made independent will be decommissioned, can be carried out once all the spent nuclear fuel has been transported for final disposal. The final disposal facility will be closed permanently once all radioactive waste from the second dismantling phase has been deposited in final disposal.

### 3.6 CURRENTLY VALID OPERATING LICENCE

Government decision (Document no. 6/330/2006) of 26 July 2007 granted Loviisa power plant an operating licence pursuant to section 20 of the Nuclear Energy Act. This operating licence is valid until 31 December 2027 in terms of power plant unit Loviisa 1 and until 31 December 2030 in terms of power plant unit Loviisa 2. The licence also covers the use of the buildings and storage facilities necessary for nuclear fuel and nuclear waste management, as well as any extension thereto, until the end of 2030.

## 4 GROUNDS FOR THE PROPOSED TERMS OF THE LICENCE

The application presents the licence applied for and a proposal on the new terms of the operating licence. Each licence term proposed in the operating licence is shown below in italics, followed by the grounds for it.

*In relation to the aforementioned, Fortum is applying for a licence to possess, manufacture, handle, use and store nuclear waste and other nuclear materials elsewhere in the power plant area than in the final disposal facility for low- and intermediate-level waste as follows:*

*– A maximum of 12,800 fuel bundles of spent nuclear fuel generated in the operation of Loviisa nuclear power plant.*

Appendix 4 to the application includes an estimate of the number of spent fuel bundles in the event that operation for energy production is extended until 2050. In this case, the estimated number of bundles would be 11,400 bundles. The licence term proposed in the application contains a margin which covers, among other things, any changes in the method of fuel loading, changes in fuel planning and a planned increase in the number of dummy elements.

*– A maximum of 10,000 m<sup>3</sup> operational waste (including decommissioned radiation sources) generated in connection with or as a result of the operations of Loviisa nuclear power plant.*

Appendix 4 to the application includes an estimate on the volume of operational waste. The volume of waste proposed in the application's licence term, 10,000 m<sup>3</sup>, was determined on the basis of waste volumes and the storage capacities available for solid and liquid waste. The capacity applied for includes a margin for special circumstances (such as plant modifications or a need to return waste from the final disposal facility to the power plant), due to which it intentionally exceeds the needs of normal use. In recent years, the power plant and storage buildings have typically housed some 300–400 m<sup>3</sup> of low-level operational waste and some 1,300–1,400 m<sup>3</sup> of intermediate-level operational waste. The power plant has existing facilities suitable for the handling and storage of nuclear waste and a possibility to modify other premises or build additional facilities according to need. The operation of Loviisa power plant also involves the use of radiation sources for which there is a separate safety licence pursuant to the Radiation Act. These are used for some process measurements, for example, as well as for the testing and calibration of radiation measuring instruments. Contingencies for the radiation sources in question being deposited in Loviisa's final disposal facility once they are no longer in use have been made in the power plant's operations. The volume of waste generated by the radiation sources amounts to only a fraction of the volume of the rest of the waste to be deposited in final disposal. The radiation sources are described briefly in Appendix 4 to the application.

*– A maximum of 2,000 m<sup>3</sup> of radioactive waste with an activity concentration equivalent to low- or intermediate-level waste generated elsewhere in Finland.*

The volume of radioactive waste generated elsewhere in Finland is discussed in Appendix 4. The volume of the waste to be stored at the power plant is estimated to be significantly lower than the proposed licence term, and a large proportion of the waste is likely to be deposited in final disposal relatively quickly after its arrival. Nevertheless, the possibility that this waste will be placed in interim storage or handled at the power plant prior to its transfer to the final disposal facility, or that there will

be a need to return it from the final disposal facility to the power plant, needs to be considered. The first planned batch of waste generated elsewhere in Finland would consist of the decommissioning waste of the FIR 1 research reactor and the Otakaari 3 research laboratory for radioactive materials.

*In addition, Fortum is applying for a licence to possess, handle, use and store the fresh nuclear fuel required in the operation of Loviisa nuclear power plant. A licence for the import of the said fresh nuclear fuel has been granted pursuant to the Nuclear Energy Act.*

Loviisa power plant possesses, handles, uses and stores only fresh fuel required for the plant's own operations.

*Furthermore, Fortum is applying for a licence to possess, manufacture, handle, use and store other nuclear materials already in the power plant area and other nuclear materials besides those already mentioned, provided that a licence pursuant to the Nuclear Energy Act has been granted for any nuclear materials subject to an import licence.*

The import and possession of any nuclear materials, machines, equipment and data on site at the facility complies with the provisions of the Nuclear Energy Act and Nuclear Energy Decree.

*Fortum proposes that once the energy production has come to an end, the updated plan for the decommissioning of the buildings and operations necessary for the management of nuclear fuel and nuclear waste be submitted for the approval of the Ministry of Economic Affairs and Employment in connection with the periodic safety review referred to in section 7 e of the Nuclear Energy Act, i.e., at least every 10 years.*

According to section 7 g, subsection 2, a licence applicant and a licence holder must have a plan for the decommissioning of a nuclear facility. Unless otherwise mentioned in the terms of the licence, the licence holder must also, during the operation pursuant to the operating licence, regularly, at least every six years, present an updated plan for the decommissioning of the nuclear facility for the approval of the Ministry of Economic Affairs and Employment. This application proposes that once energy production has ended, the decommissioning plan referred to in the Nuclear Energy Act be updated in connection with the periodic safety review of the plant parts that have been made independent, i.e., at least every 10 years, in accordance with section 7 e of the Nuclear Energy Act. In line with this application, energy production at Loviisa nuclear power plant would end no later than in 2050. As described in section 3.3 of the application, plant parts of the power plant will be made independent once the energy production has ended. The applicant considers the updating of the decommissioning plan in terms of these plant parts to be made independent at least every six years to be inexpedient, given that the plant parts and operations to be made independent are fairly limited in relation to the power plant. It is the applicant's opinion that the decommissioning plan could be updated in connection with the periodic safety review of the plant parts to be made independent, which is prepared every 10 years, in accordance with section 7 e of the Nuclear Energy Act. This updating interval would guarantee that the decommissioning plan is up to date.

## 5 CONDITIONS FOR THE GRANTING OF A LICENCE (SECTION 20 OF THE NUCLEAR ENERGY ACT)

The conditions for granting an operating licence to Loviisa nuclear power plant are presented below.

### 5.1 THE OPERATION OF LOVIISA NUCLEAR POWER PLANT IS SAFE

Appendix 5 contains a general description of the technical solutions, principles of operation and other arrangements ensuring safety. A report on the safety principles complied with and an assessment on the realisation of the principles are provided in Appendix 6 to the application.

In Finland, the nuclear energy industry falls within the remit of the Ministry of Economic Affairs and Employment (hereinafter the MEAE). The Radiation and Nuclear Safety Authority (hereinafter STUK) functions as the regulatory control authority for the use of nuclear energy. STUK's monitoring activities are based on radiation and nuclear safety legislation, regulations and procedures. The applicant's operations meet the requirements of the national authorities. The applicant's operations also account for international recommendations and rules as applicable. In addition, the applicant is involved in international activities and peer reviews, and any improvement suggestions brought up in their context are taken into account in the applicant's operations. The applicant also actively follows the events of other nuclear power plants and takes their best practices and knowledge into consideration in its operations.

The professional skills of the applicant's personnel play an important role in the safe operation of Loviisa nuclear power plant. The applicant provides its personnel and contractors with training focused particularly on the nuclear power plant's special characteristics, operating methods, safety culture and technology. Appendix 8 contains a review of the expertise at the applicant's disposal and the nuclear facility's operating organisation.

In accordance with the applicant's safety and quality policy, the plant's operations are based on a first-rate safety culture and quality as well as continuous improvement. Several projects aiming to improve nuclear safety have been implemented at Loviisa nuclear power plant throughout its operation. In recent years, extensive renewals have been carried out on the automation of the power plant, and ageing systems and equipment have been modernised. In 2014–2018, Loviisa power plant implemented the most extensive modernisation programme in the plant's history, in which Fortum invested approximately EUR 500 million. Loviisa nuclear power plant is now considerably safer than when it was originally commissioned, although it already complied with the requirements valid at the time.

In accordance with a good safety culture, the licence applicant is committed to the continuous improvement of the nuclear power plant's safety until the end of the plant's operation. The periodic safety review, which is an extensive self-assessment concerning the organisation and the plant's technology, is an important aspect of continuous improvement. Its content is determined in accordance with applicable international and national recommendations and practices as well as the regulations and requirements issued by STUK. Fortum conducts the safety reviews of the power plant units Loviisa 1 and Loviisa 2 and the final disposal facility in accordance with the valid legislation<sup>4</sup> applicable to nuclear safety.

Loviisa power plant's ageing management has been paid attention to throughout its operation. Well-managed and professional ageing management and maintenance are prerequisites for ensuring the safe, reliable and profitable operation of a nuclear power plant. The ageing management programme and procedures cover Loviisa power plant in its entirety.

**Loviisa nuclear power plant's extended operation in energy production no longer than until the end of 2050 is safe. Extending the use of buildings and storages necessary for the management of nuclear fuel and nuclear waste at Loviisa nuclear power plant until the end of 2090 is safe.**

## 5.2 ENVIRONMENTAL IMPACT AND CONSIDERATION OF THE SAFETY OF EMPLOYEES AND GENERAL POPULATION IN THE NUCLEAR POWER PLANT'S OPERATION

The environmental impact of Loviisa nuclear power plant's extended operation and decommissioning was assessed in 2020–2021 in accordance with the Act on the Environmental Impact Assessment Procedure (252/2017). The Environmental Impact Assessment Report (EIA Report) was inspected by the MEAE, as the coordinating authority. In its reasoned conclusion, the MEAE stated as follows:

<sup>4</sup> Section 7 e of the Nuclear Energy Act (990/1987).

*The assessment report is extensive and diligently prepared. A sufficient number of options for the project are presented. No factors which cannot be mitigated to an acceptable level, or which would prevent the realisation of an option, emerged in the environmental impact assessment.*

The EIA Report can be found in Appendix 13 to this application. The reasoned conclusion given by the MEAE is Appendix 15 to the application and the consideration of the reasoned conclusion in the operations of Loviisa nuclear power plant and final disposal facility are reviewed in Appendix 16.

Option VE1 assessed in the EIA Report involves the direct and indirect impact of the extended operation of Loviisa nuclear power plant, this impact affecting:

- the population as well as the health, living conditions and comfort of people;
- soil, ground, water, air, climate, vegetation as well as organisms and biodiversity, especially protected species and habitats;
- community structure, tangible property, landscape, townscape and cultural heritage;
- use of natural resources; and
- the mutual interaction between the aforementioned factors.

In accordance with the recommendations of the National Nuclear Waste Management Cooperation Group set up by the MEAE, the application for an operating licence covers a preparedness for the reception, handling, interim storage and final disposal, in the Loviisa power plant area, of small amounts of radioactive waste generated elsewhere in Finland.

Loviisa nuclear power plant's environmental impact is minor in light of the operations' significance. As a reliable energy source free of carbon dioxide emissions and independent of weather conditions, nuclear power contributes to meeting today's energy requirements and mitigating climate change. The extended operation of Loviisa nuclear power plant would support the security of supply of Finland's energy system and reduce the need to import electricity as its consumption grows in the future. The most significant environmental impact is caused by the thermal load that the power plant's cooling water discharges has on the sea. The impact of the thermal load is nevertheless highly local and limited primarily to the area of Hästhölmfjärden.

Loviisa nuclear power plant has been producing clean electricity for more than 40 years, and the applicant has a long track record as a responsible producer of nuclear power. The applicant operates in accordance with the terms of the licence, continuously aiming to reduce the operations' impact on the environment by using the best practices and technologies insofar as possible. The operations of Loviisa power plant have been certified to the ISO 14001 Environmental Management Standard.

The emissions of Loviisa nuclear power plant's radioactive substances into the environment are monitored with continuously operating measuring instruments and sampling. Fortum monitors the environment of Loviisa power plant in accordance with the environmental radiation control programme. The status of radioactive substances in the surroundings of Loviisa power plant has been monitored for a long time. The baseline studies began as early as 1966, before the construction of the power plant began. Loviisa power plant's radioactive emissions into the environment have amounted to a fraction of the limits set for them. The emissions' impact on the people in the vicinity and the surrounding environment is minimal. The emissions of Loviisa power plant are reported to STUK quarterly. The independent control carried out by STUK supplements the control carried out by the power plant.

The calculated radiation dose caused by Loviisa nuclear power plant to residents in the surrounding area has been clearly less than a per cent of the dose constraint set in the Nuclear Energy Decree, which is 0.1 mSv a year. The dose constraint is approximately one sixtieth of the average annual radiation dose of a person residing in Finland (5.9 mSv)<sup>5</sup>. In 2010–2019, the calculated radiation dose at Loviisa nuclear power plant has been 0.00014–0.00029 mSv a year.

<sup>5</sup> Siiskonen Teemu (ed.). *Suomalaisten keskimääräinen efektiivinen annos vuonna 2018. STUK-A263. Helsinki 2020, p. 48.*

The safety of employees working at Loviisa power plant is accounted for in the appropriate manner and occupational safety is considered in all operations. Radiation safety and control is described in Appendix 5 to the application. The radiation doses of the people working at Loviisa nuclear power plant remain significantly below the dose limits for employees.

The emissions of radioactive substances and radiation exposure are assessed in the EIA Report found in Appendix 13. A report on the measures aiming to limit the nuclear power plant's environmental stress is in Appendix 7 to the application.

**Extending the operation of Loviisa power plant until the end of 2050 will be safe for the environment and the population. Extending the use of buildings and storages necessary for the management of nuclear fuel and nuclear waste at Loviisa nuclear power plant until the end of 2090 is safe for the environment and the population.**

### 5.3 THE MANAGEMENT OF THE NUCLEAR WASTE OF THE LOVIISA 1 AND LOVIISA 2 PLANT UNITS IS TAKEN CARE OF IN THE APPROPRIATE MANNER

The operation of a nuclear power plant generates both radioactive nuclear waste and conventional (non-radioactive) waste. The starting point in nuclear waste management is that the waste is isolated from humans and organic nature for as long as necessary, accounting for the radioactivity of the waste.

In addition, the decommissioning of the nuclear power plant generates decommissioning waste and other dismantling waste. The plan pertaining to the power plant's decommissioning is updated and submitted to the authorities at six-year intervals. The last time Fortum updated the plan in terms of Loviisa power plant was in 2018. The EIA Report also covers any decommissioning occurring after energy production extending until 2050. This application proposes that once energy production has ended, the decommissioning plan referred to in the Nuclear Energy Act be updated in connection with the periodic safety review of the plant parts that have been made independent, i.e., at least every 10 years.

The most central buildings and functions related to nuclear waste management at Loviisa nuclear power plant are the final disposal facility for low- and intermediate-level waste, the interim storages for spent nuclear fuel, the liquid waste storage and solidification plant, as well as the facilities for storing and handling dry waste. All radioactive waste, excluding spent nuclear fuel, is meant to be deposited in the final disposal facility.

The final disposal of nuclear waste in the bedrock is based on multiple release barriers, which effectively limit the migration of radioactive substances from the final disposal halls, thereby ensuring a minimal impact on people and organic nature. The bedrock itself is one of the release barriers. Engineered release barriers include the waste matrix that binds the radioactive substances, the waste container, the buffer surrounding the waste container, the backfilling of the final disposal halls and the closing structures of the disposal facility. The final disposal of nuclear waste is planned and implemented in a way that does not require continuous supervision of the final disposal location to ensure long-term safety. According to international and Finnish surveys, the necessary nuclear waste management measures can be implemented in a controlled and safe manner.

Nuclear fuel becomes highly radioactive in the reactor during operation. In Finland, spent fuel is not processed further; instead, it is highly radioactive nuclear waste that requires final disposal.

At Loviisa power plant, spent nuclear fuel removed from the reactor is typically stored underwater in the spent fuel pool of the reactor building for 1–3 years, which allows its reactivity and heat production to decrease considerably. The spent fuel is then transferred to the power plant's interim storage for spent nuclear fuel, where it is stored in pools of water. Water acts as a radiation shield and cools the spent fuel. During the storage, the activity and heat production of the spent fuel will continue to drop.

Once final disposal becomes topical, the spent fuel is transported in special containers from the interim storage to Posiva's encapsulation and final disposal facility under construction in Olkiluoto,

Eurajoki. Posiva submitted an application for the operating licence of an encapsulation and final disposal facility for spent nuclear fuel to the Government on 30 December 2021. Posiva is tasked with the transportation, encapsulation and final disposal of the spent nuclear fuel of the companies which own it. Fortum has a 40% stake in Posiva. The remaining 60% of Posiva is owned by Teollisuuden Voima Oyj, which is the owner and operator of the Olkiluoto nuclear power plant.

The transport from Loviisa to Olkiluoto can take place either by road or as a combination of road-maritime-road transport. The transport of spent nuclear fuel is strictly regulated by national and international regulations and agreements. In Finland, the transport of spent nuclear fuel requires a permit from STUK.

At the Posiva encapsulation plant, spent fuel is packed and sealed in final disposal capsules, after which it is moved to the final disposal facility for spent nuclear fuel, located underground at a depth of approximately 420 metres. According to current plans, the final disposal of Loviisa power plant's spent nuclear fuel in Posiva's encapsulation and final disposal facility would begin in the 2040s.

Appendices 4 and 9 to the application contain further information on the operational waste as well as the applicant's plans for arranging nuclear waste management and the methods available for it, including the dismantling of the nuclear facility and the final disposal of nuclear waste, and an account of the schedule and estimated costs of the nuclear waste management.

**The applicant is responsible for the safe storage and final disposal of different types of nuclear waste.**

### 5.4 FORTUM HAS THE NECESSARY EXPERTISE AT ITS DISPOSAL AND ITS OPERATING ORGANISATION IS SUITABLE

Over the roughly 40 years of Loviisa power plant's operation, the applicant's personnel have accumulated considerable expertise in the use of nuclear power and plant modifications.

The applicant develops and trains its personnel continuously, thereby ensuring and maintaining the entire personnel's competence at the level required by the tasks, in terms of knowledge, skills and attitudes. Personnel development is defined in the company's strategy, and it must be first-rate, long-range, systematic and proactive in nature. The applicant's personnel have an either direct or indirect impact on the safety of the nuclear facilities. Fortum provides its personnel and contractors with training focused particularly on the nuclear power plant's special characteristics, operating methods, safety culture and technology.

Loviisa power plant has an extensive and suitable operating organisation, which covers several different functions. In addition, Loviisa power plant can rely on the support functions of Fortum Group and the technical support of the Generation division.

Further details on the expertise at the applicant's disposal and on the operating organisation of the power plant units Loviisa 1 and Loviisa 2 can be found in Appendix 8 to the application. Appendix 8 also includes a more detailed description of the personnel's competence management and training.

**The applicant has sufficient expertise, and its operating organisation is suitable.**

### 5.5 FORTUM POSSESSES THE FINANCIAL AND OTHER NECESSARY MEANS TO PURSUE THE OPERATIONS SAFELY

The applicant's financial means for engaging in the operations are reviewed in Appendices 10 and 11 to the application. The other means necessary for pursuing the operations safely are presented in Appendices 5 and 6 to the application.

The applicant has ensured that it has taken out the liability insurance for a nuclear facility required by the Nuclear Liability Act (484/1972) or another financial guarantee of equal coverage, the insured amount of which is EUR 1,200 million.

The applicant is not aware of any changes to the facility's operation, legislation or international obligations which would have a significant impact on the applicant's means to operate the facility safely and in accordance with Finland's obligations based on international conventions and agreements.

**The applicant has sufficient financial and other means for Loviisa power plant's safe operation in accordance with legislation and Finland's obligations based on international conventions and agreements.**

## 6 SUMMARY AND ENFORCEMENT

Based on what is presented above and in the more detailed reports and reviews in the Appendices to the application, the applicant is of the opinion that the conditions for granting an operating licence referred to in section of the Nuclear Energy Act and the requirements provided in sections 5–7 of the Nuclear Energy Act – pertaining to the overall good of society, nuclear waste management and the safety of Loviisa power plant – have been met, and the operating licence sought by the applicant can be granted.

The applicant requests that the Government, when granting the licence, decides by virtue of section 122 of the Administrative Judicial Procedure Act (808/2019) that the decision be enforced regardless of a possible appeal, given that the decision's enforcement should not be postponed due to the public interest.

Climate change and the transition to a low-carbon energy system make reliable and emission-free electricity production even more important than before. The consistent availability and stable price of electricity are also important for society. Loviisa nuclear power plant will continue to play a significant role as a stable base power free of carbon dioxide emissions, supporting steady electricity production alongside the varying production of hydro-, wind and solar power. Loviisa power plant plays an important role as a producer of steady and emission-free electricity, and it produces approximately 10% of the electricity used in Finland. Loviisa nuclear power plant has been producing clean electricity for more than 40 years, and Fortum has a long track record as a responsible producer of nuclear power. An extension to the service life will require a continued investment in the facility's usability and safety – work which has been carried out successfully throughout Loviisa nuclear power plant's history. The work is of a long-range nature and the planning of modifications to be carried out in the future must be started now.

It is in the public interest to dismantle the FiR 1 research reactor in Otaniemi, Espoo, and deposit the radioactive waste of the research reactor and the research laboratory for radioactive materials (Ota-kaari 3), which is set to be decommissioned, at Loviisa power plant. Any delay in the enforcement of the power plant's and final disposal facility's licence application would also cause a delay in the reception of the aforementioned waste, which should therefore be stored and possibly even deposited for final disposal somewhere else.

In accordance with section 20 a of the Nuclear Energy Act, the licence for the decommissioning of the nuclear facility must be applied for well in advance so that the authorities have adequate time to assess the application before the termination of the nuclear facility's operating licence. Should the enforcement be delayed, Fortum would have to commence the preparatory measures for decommissioning and the application process pertaining to the decommissioning licence.

**It is the applicant's opinion that the granting of a new operating licence and its immediate enforcement would be in the interest of the overall good of society.**

*Espoo, March 18, 2022*

**Simon-Erik Ollus**  
*CEO, Fortum Power and Heat Oy*

**Sasu Valkamo**  
*Vice President, Loviisa Nuclear Power Plant*

## APPENDICES

- Appendix 1.** An extract from the Trade Register (separate appendix, not included in this hand-out version)
- Appendix 2.** A copy of the Articles of Association and register of shareholders (separate appendix, not included in this hand-out version)
- Appendix 3.** Report on the residential areas and other activities in the location of the nuclear power plant and its immediate surroundings and on land use planning.
- Appendix 4.** Report on the quality and maximum quantity of the nuclear materials or nuclear waste manufactured, produced, handled, used or stored at the nuclear power plant
- Appendix 5.** General description of the technical solutions, principles of operation and other arrangements ensuring safety
- Appendix 6.** Report on the safety principles complied with and an assessment on the realisation of the principles
- Appendix 7.** Report on the measures aiming to limit the nuclear power plant's environmental stress
- Appendix 8.** Review of the expertise at the applicant's disposal and the nuclear facility's operating organisation
- Appendix 9.** Review of the applicant's plans for arranging nuclear waste management and the methods available for it, including the dismantling of the nuclear facility and the final disposal of nuclear waste, and an account of the schedule and estimated costs of the nuclear waste management
- Appendix 10.** Review of the applicant's financial position and the applicant's financial management plan and production plan
- Appendix 11.** The applicant's financial statements for the years 1996–2020 (separate appendix, not included in this hand-out version)
- Appendix 12.** Report on the applicant's compliance with the valid terms of the operating licence
- Appendix 13.** Loviisa nuclear power plant, EIA Report
- Appendix 14.** Loviisa nuclear power plant's EIA Report, International Hearing Document
- Appendix 15.** Reasoned conclusion of the Ministry of Economic Affairs and Employment concerning the environmental impact assessment report for Loviisa nuclear power plant
- Appendix 16.** Account of the consideration of the reasoned conclusion in the operations of Loviisa nuclear power plant and the final disposal facility

*Appendices 1 through 12 are not available in English.*





SAUVA OP60  
MAX RAJ.  
300 300 W/cm

MINIMIVARA  
ALIKAN MAX T60 324°C  
SAUVAT MAX T60 160°C



LAAK T MAX 61°C  
OLJYN T MAX 59°C  
INJ.VESI PIIRIIN MIN 0.147 kg/s

RA00P901 44.0

49
39



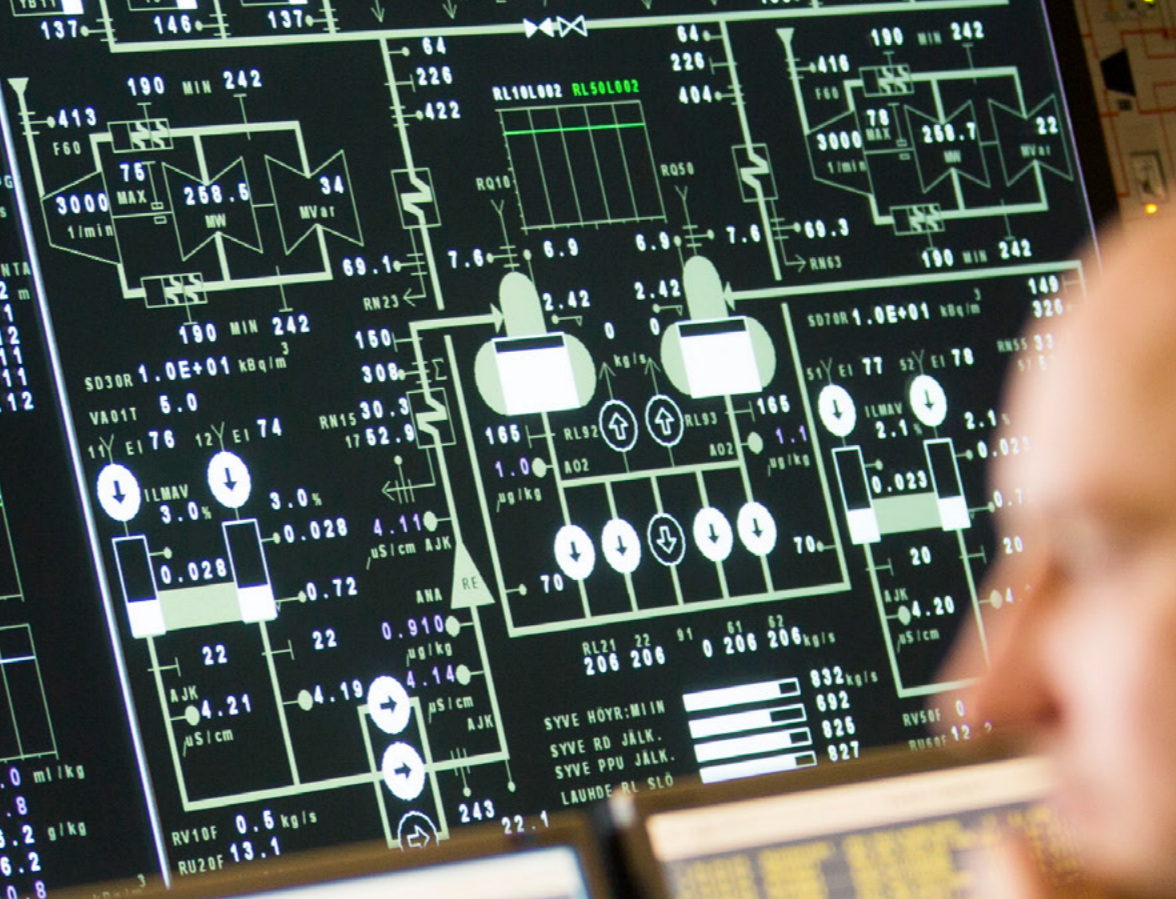
YB11-56 PINTA  
YB11 2.12 m  
YB15 2.11  
YB13 2.12  
YB54 2.11  
YB52 2.11  
YB56 2.12

RL30T 226  
RL70T 226

TK10L001 2.66  
TK50L001 2.53

TE23L001 1.14
---------------

TV12 AH2 0.0 ml/kg  
TV12 APH 20.8  
TV04 ABO 6.2 g/kg  
TV29 ABO 6.2  
TV07 APH 10.8



SD30R 1.0E+01 kgq/m<sup>3</sup>  
VA01T 5.0  
11 EI 76 12 EI 74

ILMAV 3.0%  
0.028  
0.72

22 22  
AJK 4.21  
4.19

0.910  
4.14  
249

RV10F 0.6 kg/s  
RU20F 13.1

RL10L002 RL50L002

166  
1.0  
A02

RL92  
RL93

206 206  
0 206 206

832 kg/s  
892  
826  
827

SYVE HOYR:MIIN  
SYVE RD JALK.  
SYVE PPU JALK.  
LAUHDE RL SL0



# Appendix 16

## Consideration of the reasoned conclusion in the operations of Loviisa nuclear power plant and the final disposal facility

## CONTENTS

### APPENDIX 16: CONSIDERATION OF THE REASONED CONCLUSION IN THE OPERATIONS OF LOVIISA NUCLEAR POWER PLANT AND THE FINAL DISPOSAL FACILITY ..... 18

<b>1</b>	<b>INTRODUCTION .....</b>	<b>20</b>
<b>2</b>	<b>EIA REPORT'S ADEQUACY AND QUALITY .....</b>	<b>20</b>
2.1	Impact on surface waters .....	20
2.2	Impact on soil, bedrock and groundwater .....	21
2.3	Impact on climate .....	21
2.4	Impacts of a severe reactor accident .....	21
2.5	Other remarks made in the statements .....	21
2.6	International hearing .....	22
<b>3</b>	<b>REASONED CONCLUSION BY THE COORDINATING AUTHORITY .....</b>	<b>22</b>
3.1	Significant environmental impact of extended operation (VE1) .....	22
3.1.1	Surface waters .....	22
3.1.2	Fish and fishing .....	23
3.1.3	Greenhouse gas emissions and climate change .....	23
3.1.4	People's living conditions and comfort, community structure, tangible property .....	23
3.1.5	Radioactive waste and its management .....	23
3.1.6	Severe reactor accident, other incidents and accidents .....	23
3.2	Significant environmental impact of decommissioning (VE0, VE0+) .....	23
3.2.1	Surface waters .....	23
3.2.2	Fish and fishing .....	23
3.2.3	Greenhouse gas emissions and climate change .....	23
3.2.4	People's living conditions and comfort, community structure, tangible property .....	23
3.2.5	Landscape and cultural environment .....	24
3.2.6	Traffic .....	24
3.2.7	Noise .....	24
3.2.8	Radioactive waste and its management .....	24
3.2.9	Severe reactor accident, other incidents and accidents .....	24
3.3	Significant environmental impact of L/ILW repository's expansion (VE1, VE0, VE0+) .....	24
3.3.1	Soil and bedrock .....	24
3.3.2	Groundwater .....	24
3.3.3	Noise .....	24
3.3.4	Use of natural resources .....	24
3.4	Other impacts .....	25
<b>4</b>	<b>SUMMARY .....</b>	<b>25</b>

## 1 INTRODUCTION

This account is part of the operating licence applications of Loviisa power plant and final disposal facility for low- and intermediate-level waste<sup>1</sup>.

In accordance with section 10 of the Act on the Environmental Impact Assessment Procedure (252/2017, hereinafter the EIA Act), Fortum Power and Heat Oy's (hereinafter Fortum) coordinating authority in the project is the Ministry of Economic Affairs and Employment. Pursuant to section 23 of the EIA Act, the Ministry of Economic Affairs and Employment has reviewed the adequacy and quality of Fortum's Environmental Impact Assessment Report (hereinafter EIA Report) and prepared its reasoned conclusion on the project's significant environmental impact.

In addition to the EIA Report in Appendix 13 to the application for the operating licence, the reasoned conclusion on the project given by the coordinating authority is appended to the application as Appendix 15, as required by section 25 of the EIA Act. Furthermore, the EIA Report's International Hearing Document can be found in Appendix 14 of the application for the operating licence.

According to the provisions in section 26 of the EIA Act, the licence decision must indicate how the EIA Report, reasoned conclusion and any documents pertaining to an international hearing pursuant to section 29 have been considered.

The Ministry of Economic Affairs and Employment gave its reasoned conclusion on the project on 10 January 2022. In its reasoned conclusion on the project, the Ministry of Economic Affairs and Employment states, among other things, that the project options reviewed do not have any significant harmful environmental impact which would be unacceptable, or which could not be prevented or mitigated to an acceptable level.

According to the reasoned conclusion of the Ministry of Economic Affairs and Employment, the comparison of the different options has been carried out in a sufficient manner in the EIA Report.

Based on the requirements of the EIA Act referred to above and the remarks made in the reasoned conclusion of the Ministry of Economic Affairs and Employment, Fortum addresses, in the following, how the matters and needs for further investigations raised in the coordinating authority's reasoned conclusion and in the statements of the other parties are accounted for, if necessary, in the application for the operating licence. In addition, the focus lies on how the matters and investigative needs mentioned in the reasoned conclusion and statements are or will be accounted for in the applicant's operations insofar as the matters, according to Fortum's own view, pertain to the operating licence application and operating licence now under discussion. Given that decommissioning is not yet topical, the matters and needs for further investigations related to the decommissioning are discussed in general terms alone. The decommissioning will be planned in detail, and the matters raised in the reasoned conclusion and statements will be accounted for as necessary as part of its planning.

## 2 EIA REPORT'S ADEQUACY AND QUALITY

In its reasoned conclusion concerning the project, the Ministry of Economic Affairs and Employment states that Fortum's EIA Report on Loviisa nuclear power plant meets the content requirements provided for in section 19 of the EIA Act and in the EIA Decree (277/2017), and that it is dealt with as required by the EIA legislation. The EIA Report was prepared in consideration of the project's assessment programme and the statement on it provided by the coordinating authority. The project owner has had sufficient expertise at its disposal for the execution of the environmental impact assessment and the separate reports and reviews.

The Ministry of Economic Affairs and Employment furthermore notes that the EIA Report is extensive and diligently prepared. A sufficient number of options for the project are presented. No factors which cannot be mitigated to an acceptable level, or which would prevent the realisation of an option, emerged in the environmental impact assessment.

However, the Ministry of Economic Affairs and Employment took the view that, based on the review as well as statements and opinions received, the assessment could be specified in some respects.

This section discusses in more detail the matters addressed in chapter 3 of the reasoned conclusion given by the Ministry of Economic Affairs and Employment. The headings used below are the same as those used in chapter 3 of the said reasoned conclusion. In addition, Fortum deals with the international hearing under heading 2.6.

### 2.1 IMPACT ON SURFACE WATERS

In the reasoned conclusion, the Ministry of Economic Affairs and Employment states that the impact assessment concerning the surface waters and the discussion of the mitigation measures are at a sufficient level at this stage of the project's planning, but that they must be specified in the future.

Fortum continues its investigations aiming to supply the power plant with cooler cooling water and mitigate the impact of the cooling water, and to gain a deeper understanding of the factors affecting the state of the nearby sea area. These efforts are currently carried out as a research and development programme of Fortum, and there are no plans aiming for the implementation of water engineering works.

Fortum contributes to the achievement of the objectives related to water resources management and may take part in the planning of measures improving the state of the waterway in cooperation with the Uusimaa Centre for Economic Development, Transport and the Environment (hereinafter the Uusimaa ELY Centre) and the town of Loviisa.

The manner in which the impact of the power plant's cooling water is accounted for in the operations is discussed below, in section 3.1.1.

### 2.2 IMPACT ON SOIL, BEDROCK AND GROUNDWATER

The statements draw attention to Loviisa's final disposal facility for low- and intermediate-level waste and particularly its planned expansion as well as its impact on the soil, bedrock and groundwater. Attention is also paid to the monitoring programme which is to be carried out to prove the effectiveness of the release barriers.

The planned expansions of the final disposal facility are located in the immediate vicinity of the existing bedrock spaces. Individual rock fissures are likely to be cut during the excavating, in which case they will be injected in accordance with the methodologies of normal rock engineering if necessary, as has been done during the earlier construction phases.

The positioning of the expansion spaces will be ensured during detailed engineering prior to the excavating, the aim being to avoid positioning the spaces too close to any significant water-conductive structures. Among other measures, the positioning will be ensured prior to the actual excavation by drilling a pilot trial hole.

The understanding of the bedrock surrounding the final disposal facility and its groundwater conditions is based on studies commenced prior to the construction of the final disposal facility, the monitoring programmes (rock mechanics, hydrology and groundwater chemistry) to be implemented during its usage phase and the modelling supporting them. This understanding is compiled into the regularly updated long-term safety case. Its preparation includes an assessment of the quality of the baseline data used in the groundwater flow calculations and further studies, if necessary.

The monitoring programmes were reviewed in the final disposal facility's periodic safety review drawn up in 2020, in which they were deemed sufficiently extensive and comprehensive. Their extent and comprehensiveness are reviewed when necessary, such as before the excavating work related to the expansion of the final disposal facility begins, as is also mentioned in the EIA Report.

The Radiation and Nuclear Safety Authority (hereinafter STUK) also assesses the extent and implementation of the monitoring programmes as part of its continuous supervision. The measurement of the boundary level between fresh and saline water, mentioned in one of the statements, has been found problematic in terms of its interpretation and discontinued, given that the said boundary level's position in the open hole does not describe the groundwater's salinity in the rock. Instead, it depends solely on the division of the pressure height and the hydraulic properties of the most water-conductive fissures/structures' points intersecting the hole. STUK had no comments on the extent of the hydrological monitoring in its inspection of the final disposal facility's periodic safety review.

### 2.3 IMPACT ON CLIMATE

Fortum agrees with the view of the Ministry of Economic Affairs and Employment according to which the impact of the produced electricity's greenhouse gas emission-free nature is much greater in significance than the project's direct climate impact.

Extending operation will have a significant effect on the achievement of the national targets for emission reductions and thereby on combating climate change.

### 2.4 IMPACTS OF A SEVERE REACTOR ACCIDENT

Many statements commented on the selected source term. The selected source term was 100 TBq of the caesium isotope 137 and the emissions of other substances had been scaled to correspond to it. As is noted by the Ministry of Economic Affairs and Employment in its reasoned conclusion, in Finland, section 22 b of the Nuclear Energy Decree sets 100 TBq of caesium-137 as the limit value for a high emission, and this value is generally used as the source term in Finnish environmental impact assessments.

With regard to mitigating the impact of a severe reactor accident, Estonia's environmental administration commented on the responsible parties.

In this respect, Fortum points out that STUK is responsible for the communications, both nationally and internationally. The mitigation measures to be conducted abroad will be decided on and carried out by local parties.

### 2.5 OTHER REMARKS MADE IN THE STATEMENTS

The statements expressed that research related to climate change should be monitored in the future and that the accumulated data should be used to improve the facility's safety in accordance with the EIA Report.

Fortum follows climate change-related research through the Finnish Research Programme on Nuclear Power Plant Safety (SAFIR), for example, and takes into account the accumulated data in assessing and, if necessary, improving the facility's safety.

Regarding chemicals, the statements pointed out that neither the chemicals discharged into the sea nor their impact was discussed in the report.

Fortum refers to the EIA Report, in which it is stated that the annually used quantities of chemicals will remain unchanged if operation is extended. In respect of waters conducted into the sea, the company also complies with the limit values set in the conditions of the environmental permit and in legislation. No effects caused by chemicals have been detected in the impact monitoring focused on Loviisa power plant's nearby sea area.

The statements also note that the consultants who had prepared the EIA Report lacked competence on the impact of radioactive substances.

Fortum is an expert on radiation safety and on assessing the impact of radioactive substances in terms of its operations. Fortum also points out that the impact monitoring concerning radioactive substances ending up in the environment is carried out in accordance with an observation programme approved by the authorities. Based on the results of the emission monitoring, the radioactive emissions into the environment have remained considerably below the limits set for the emissions of a nuclear power plant. The results of the impact monitoring show that the quantities of radioactive substances in the surroundings of the power plant are low.

<sup>1</sup> The final disposal facility for low- and intermediate-level waste is also referred to as the L/ILW repository.

The power plant's ageing and the attendant increase in risks was a cause for concern among several of the parties providing statements.

Fortum underscores that the ageing management of Loviisa power plant has been accounted for throughout the power plant's operation. Appropriately executed ageing management and maintenance are prerequisites for ensuring the safe, reliable and profitable operation of a nuclear power plant. STUK will assess the safety of the project in connection with the safety review related to application for an operating licence.

In respect of the power plant's decommissioning and the expansion of the final disposal facility, the statements drew attention to, among other things, the possible contamination of the land areas of the power plant location and mentioned that special attention should be paid to the prevention of noise and dust nuisance during future planning and the licence and permit processes.

Fortum notes that the dismantling of Loviisa power plant is not yet topical. Fortum is unaware of any contaminated soil or land areas within the area. The appropriate studies, aiming to detect any contaminated soil, will be conducted well in advance of the start of the construction and dismantling work. If any contaminated soil or land areas are detected, the matter will be reported to the authorities and the areas will be rehabilitated in accordance with the requirements of the applicable legislation.

Fortum aims to mitigate the noise nuisance in terms of both the expansion of the final disposal facility and the power plant's decommissioning with various measures, such as scheduling the noisiest work appropriately and the selection of the location where the concrete is crushed. Fortum will also pay attention to dust management methods when planning the dismantling.

## 2.6 INTERNATIONAL HEARING

In the international hearing, statements were made by the authorities of Austria, Lithuania, Sweden and Estonia. In addition, the Ministry of the Environment received 12 statements from European citizens and organisations.

The statements primarily objected to the use of nuclear energy based on the risk of accidents and concern about the safety of spent nuclear fuel.

Should operation be extended, the work to improve safety will be continued. STUK will assess the project's safety in connection with the application for an operating licence. It is Fortum's view that the issues related to safety are discussed to a sufficient extent in the EIA Report.

Some of the statements included a wish that the presentations made in the public event be translated into English or that another event be held for an international audience. The statements invoked the Espoo Convention and the Aarhus Convention.

The Ministry of Economic Affairs and Employment addresses in its reasoned conclusion the realisation of the process related to the international hearing in Loviisa power plant's EIA procedure. Fortum agrees with the ministry's view and points out that the international hearing is implemented in

accordance with both the Espoo and Aarhus Conventions and in compliance with the provisions of the EIA legislation.

Furthermore, the question pertaining to transboundary impacts posed in the international hearing is addressed in section 2.4 above and the questions pertaining to the power plant's ageing made in the hearing are addressed in section 2.5.

## 3 REASONED CONCLUSION BY THE COORDINATING AUTHORITY

This section discusses in more detail the project's most significant environmental impacts in terms of extended operation, decommissioning and the expansion of the final disposal facility, addressed in chapter 4 of the reasoned conclusion of the Ministry of Economic Affairs and Employment. The headings used below are the same as those used in chapter 4 of the said reasoned conclusion.

### 3.1 SIGNIFICANT ENVIRONMENTAL IMPACT OF EXTENDED OPERATION (VE1)

#### 3.1.1 Surface waters

In its reasoned conclusion concerning Loviisa power plant, the Ministry of Economic Affairs and Employment requires the impact of the power plant's cooling water to be considered in the operations.

Fortum points out that Loviisa power plant has valid environmental and water permits which include specifications on the volume and temperature of the cooling water, among other things. The operations comply with the permit regulations and the results of the related monitoring are reported to the authorities regularly.

The EIA Report includes an assessment on the operations' impact on the nearby sea area and presents potential measures for mitigating any harmful effects.

As part of the option of extended operation, Loviisa power plant's EIA Programme investigated the possibility of carrying out water engineering projects in the area, in front of the cooling water intake and the nearby sea area. Based on the preliminary investigations, it can be assumed that by decreasing the temperature of the abstracted cooling water, it would be possible to reduce the temperature of the discharged cooling water, although this would not affect the thermal load being conducted to the sea in any material way. Based on the techno-economic investigations carried out, the water engineering projects were nevertheless removed from the environmental impact assessment procedure. The matter will continue to be studied, separate from the EIA Report, in Fortum's research project, which aims to find the most cost-effective technical solutions for reducing the temperature of the abstracted cooling water with the help of modelling. However, there are no plans aiming for the execution of water engineering work.

In terms of the Klobbfjärden body of water, the reduction of the diffuse source input, a significant portion of which is derived from the river Tesjoki, plays a key role. The most effective measures include the agricultural measures to be carried out in the river's catchment area, such as the application of gypsum in agricultural fields.

For its part, Fortum supports the achievement of the targets set for the state of the bodies of water in legislation. Fortum may take part in the planning of measures aiming to improve the state of the waterway in cooperation with the Uusimaa ELY Centre and the town of Loviisa. Over a longer term, Fortum aims to further deepen its knowledge of Loviisa power plant's impact on the state of the Klobbfjärden body of water. The reports may be related to the state of the benthic fauna and sediment of the nearby sea area, for example, so that the background material of the classification would be sufficient and representative.

#### 3.1.2 Fish and fishing

The power plant has an impact on the ichthyofauna and fishing. The reasoned conclusion does not include remarks concerning the ichthyofauna or fishing which would require Fortum to undertake any measures beyond those assessed and discussed in Fortum's EIA Report.

Loviisa power plant has valid environmental and water permits which include specifications on the volume and temperature of the cooling water. Fortum also pays an annual fisheries charge pursuant to the permit regulation which is used for mitigating any harmful effects of the cooling water in its impact area.

#### 3.1.3 Greenhouse gas emissions and climate change

The power plant's operations have a significant positive climate impact. The reasoned conclusion does not include remarks concerning greenhouse gas emissions or climate change which would require Fortum to undertake any measures beyond those assessed and discussed in Fortum's EIA Report.

#### 3.1.4 People's living conditions and comfort, community structure, tangible property

The operations of Loviisa power plant have an impact on people's living conditions and comfort. The reasoned conclusion does not include remarks concerning people's living conditions and comfort, community structure or tangible property which would require Fortum to undertake any measures beyond those assessed and discussed in Fortum's EIA Report.

#### 3.1.5 Radioactive waste and its management

The power plant's extended operation would increase the total volume of the accumulation of spent nuclear fuel as well as low- and intermediate-level waste. The reasoned conclusion does not include remarks concerning the accumulation of spent nuclear fuel or low- and intermediate-level waste

which would require Fortum to undertake any measures beyond those assessed and discussed in Fortum's EIA Report.

#### 3.1.6 Severe reactor accident, other incidents and accidents

Fortum addresses the possibility of a severe reactor accident as well as other incidents and accidents in section 2.4 above and the reasoned conclusion does not include any remarks concerning them which would require Fortum to undertake measures beyond those assessed and discussed in Fortum's EIA Report.

### 3.2 SIGNIFICANT ENVIRONMENTAL IMPACT OF DECOMMISSIONING (VE0, VE0+)

#### 3.2.1 Surface waters

The thermal load caused by the cooling water will end with the decommissioning and the reasoned conclusion does not include comments on the planning of the decommissioning and Fortum's operations in terms of the surface waters.

Fortum points out that in the future too, what will play a key role in terms of the state of the Klobbfjärden body of water is the reduction of the diffuse source input, a significant portion of which derives from the river Tesjoki.

#### 3.2.2 Fish and fishing

The thermal load caused by the cooling water which has an impact on the ichthyofauna will come to an end once the power plant is decommissioned. The reasoned conclusion does not include remarks related to the ichthyofauna or fishing which would require Fortum to undertake any measures.

With decommissioning, the area's ichthyofauna and fishing opportunities may return to a state similar to that prevailing in the surrounding sea areas.

#### 3.2.3 Greenhouse gas emissions and climate change

The climate impact of the decommissioning following the current operating period is expected to be reasonably negative. The reasoned conclusion does not include remarks related to greenhouse gas emissions or climate change which would require Fortum to undertake any further measures.

#### 3.2.4 People's living conditions and comfort, community structure, tangible property

The decommissioning of Loviisa power plant will have an impact on people's living conditions and comfort and on the energy market, security of supply and the regional economy. The reasoned conclusion does not include remarks concerning these issues which would require Fortum to undertake any measures beyond those assessed and discussed in Fortum's EIA Report.

### 3.2.5 Landscape and cultural environment

The decommissioning of Loviisa power plant will have an impact on the landscape and cultural environment.

Prior to the dismantling of the buildings, Fortum will commission a report on the architectural history of the area's building stock.

### 3.2.6 Traffic

The decommissioning of Loviisa power plant will have an impact on traffic. The reasoned conclusion does not include remarks concerning traffic which would require Fortum to undertake any measures beyond those assessed and discussed in Fortum's EIA Report.

### 3.2.7 Noise

The dismantling measures will cause noise during the decommissioning phase.

Fortum aims to mitigate the noise nuisance with various measures, such as by scheduling the noisiest work appropriately and by the selection of the location where the concrete is crushed.

### 3.2.8 Radioactive waste and its management

The power plant's dismantling will generate considerable amounts of radioactive waste. The final disposal of the radioactive waste will require a significant expansion of the final disposal facility. The reasoned conclusion does not include remarks concerning the radioactive waste and its management which would require Fortum to undertake any measures other than those assessed and discussed in Fortum's EIA Report.

#### **Contaminated soil and conventional waste**

Regarding the contamination of soil, the Ministry of Economic Affairs and Employment notes that the contamination must be assessed in connection with the dismantling and that the appropriate handling of conventional waste must be ensured. Fortum addresses the matter in section 2.5 above.

### 3.2.9 Severe reactor accident, other incidents and accidents

The nuclear power plant's risk level will decline considerably when it is decommissioned. The reasoned conclusion does not include remarks concerning a severe reactor accident or other incidents which would require Fortum to undertake any measures other than those discussed and assessed in Fortum's EIA Report.

## 3.3 SIGNIFICANT ENVIRONMENTAL IMPACT OF L/ILW REPOSITORY'S EXPANSION (VE1, VE0, VE0+)

### 3.3.1 Soil and bedrock

The expansion of the final disposal facility will result in significant changes to the bedrock as more rock spaces are quarried. This is discussed in section 2.2 above. The reasoned conclusion does not include any remarks that would give reason for changing the current plans. The expansion will be planned in more detail closer to its implementation.

### 3.3.2 Groundwater

The expansion of the final disposal facility will result in changes to the groundwater flow conditions as more rock spaces are quarried. In addition to the EIA Report, this is discussed in section 2.2 above. Section 2.2 also describes some of the questions made about the monitoring programmes in the statement in more detail than the EIA Report does.

While the reasoned conclusion does not include any remarks that would give reason for changing the current plans, both the extent of the monitoring programmes and the impact that the excavation of the expansion spaces will have will be assessed in more detail closer to the implementation of the expansion.

### 3.3.3 Noise

The reasoned conclusion draws attention to the noise that will be caused by the excavation, crushing and transports during the expansion of the final disposal facility.

Fortum considers the possible noise nuisance and aims to mitigate them by a variety of means. The detailed planning of the final disposal facility's expansion will account for the use of the quarry material and the noise resulting from its crushing. The construction work will be planned and carried out in such a way that the noise nuisance will be mitigated to the extent possible.

### 3.3.4 Use of natural resources

The reasoned conclusion draws attention to the use of the quarry material generated during the expansion of the final disposal facility.

The EIA Report reviews several alternative further uses for the quarry material generated in the expansion of the final disposal facility. The reasoned conclusion does not include remarks concerning the use of natural resources which would require Fortum to undertake any measures other than those assessed and discussed in Fortum's EIA Report.

## 3.4 OTHER IMPACTS

The significance of any other impacts is expected to be minor at most.

The reasoned conclusion does not include remarks concerning other impacts which would require Fortum to undertake any mitigating measures other than those assessed and discussed in Fortum's EIA Report.

## 4 SUMMARY

In its reasoned conclusion concerning Fortum's project, the Ministry of Economic Affairs and Employment states that the project options reviewed in Fortum's EIA Report do not have any significant harmful environmental impact which would be unacceptable, or which could not be prevented or mitigated to an acceptable level. The comparisons between the various options have been implemented in a sufficient manner. The project's assessment programme and the statement given on it by the coordinating authority has been considered in the preparation of the EIA Report, and the EIA Report is extensive and diligently prepared. It is the opinion of the Ministry of Economic Affairs and Employment that the project owner has had sufficient expertise at its disposal for the execution of the environmental impact assessment and the separate reports and reviews. The Ministry of Economic Affairs and Employment therefore considers Fortum's EIA Report to fulfil the content requirements provided in section 19 of the EIA Act and in the EIA Decree and to have been prepared in accordance with the EIA legislation.

In the above, Fortum explains how the matters and needs for investigation raised in the reasoned conclusion of the Ministry of Economic Affairs and Employment and in the statements submitted by other parties are considered in the application for an operating licence, if necessary. In addition, the above discussed how the matters and investigative needs mentioned in the reasoned conclusion and statements are or will be accounted for in the applicant's operations insofar as the matters pertain to the operating licence application and operating licence now under discussion. Considering the reasoned conclusion of the Ministry of Economic Affairs and Employment and the matters discussed by Fortum above, Fortum is of the opinion that the reasoned conclusion and its processing within the operating licence application meet the requirements of the Nuclear Energy Act and the EIA legislation.





