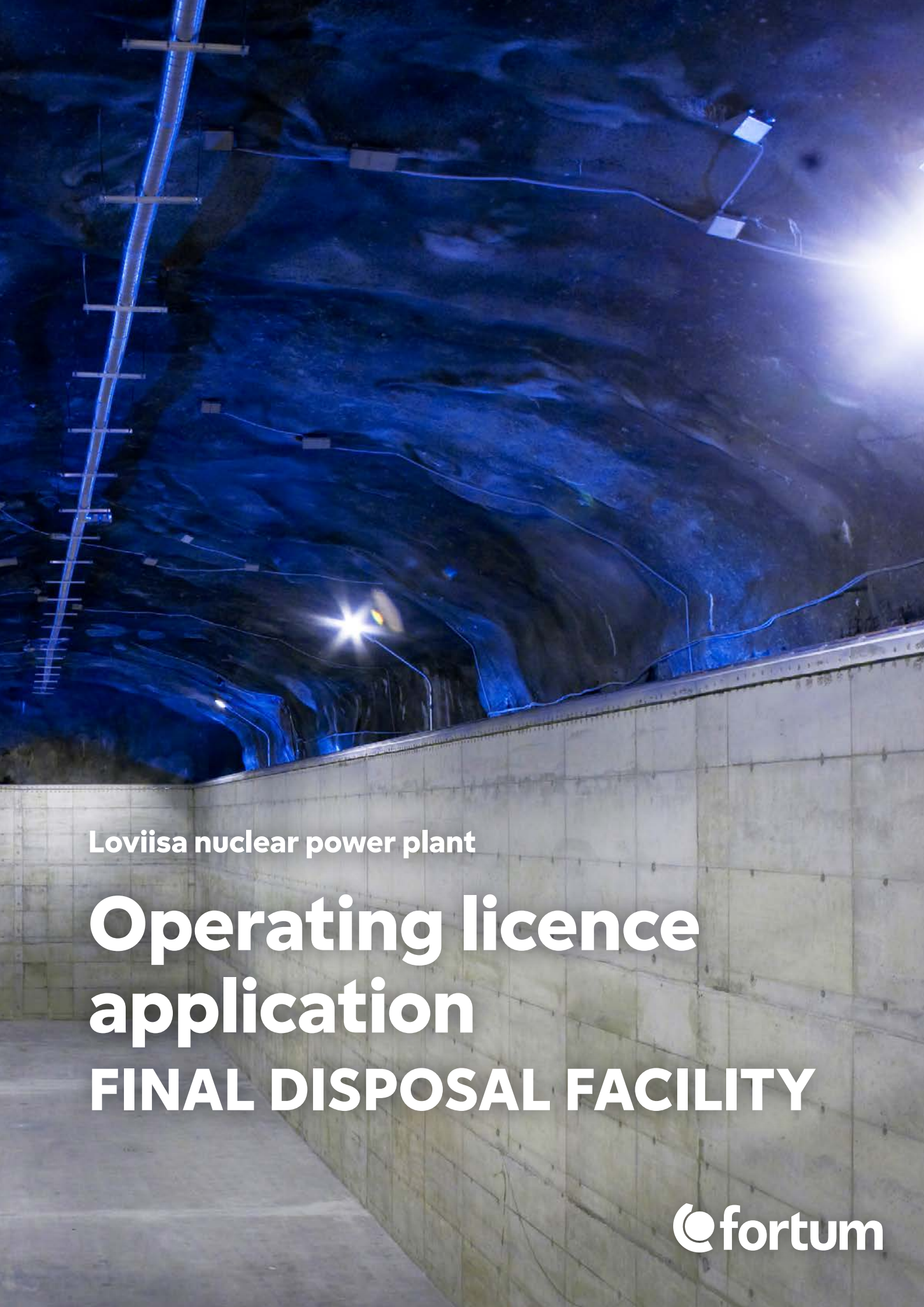

Loviisa nuclear power plant

Operating licence application

FINAL DISPOSAL FACILITY

fortum

Contact Details

Fortum Power and Heat Oy
Keilalahdentie 2-4, Espoo
P.O.Box 100
FI-00048 FORTUM
Tel. +358 10 4511
Y-0109160-2
fortum.fi

Base maps: National Land Survey of Finland 2021
Translations: AAC Global Oy
Layout and design: Creative Peak
Print: Print Mill

The original language of the operating licence application is Finnish. Versions in other languages are translations of the original document which is the document Fortum is committed to.

TO THE FINNISH GOVERNMENT

Operating licence application for Loviisa's final disposal facility for low- and intermediate-level waste

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 "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

Loviisa's final disposal facility for low- and intermediate-level waste

Fortum is applying for a licence pursuant to section 20 of the Nuclear Energy Act (990/1987) to operate a final disposal facility for low- and intermediate-level waste located in Loviisa's existing power plant area[1] until the end of 2090.

In relation to the aforementioned, Fortum is applying for a licence to possess, handle, store and deposit in the final disposal facility for low- and intermediate-level waste as follows:

- a maximum of 50,000 m^3 in low- and intermediate-level waste generated in connection with or as a result of the operations of the nuclear facilities in Loviisa's power plant area or radioactive waste with properties equal to such waste (operational waste[2], decommissioning waste[3], other radioactive waste in the plant site with a similar activity concentration, and a small quantity of decommissioned radiation sources);
- a maximum of 2,000 m^3 in radioactive waste of the type mentioned above, and with equivalent properties, but generated elsewhere in Finland; and
- a maximum of 50,000 m^3 in waste with a very low level of activity, generated in the dismantling of the buildings in the decommissioning of the nuclear power plant.

[1] Power plant area refers, pursuant to section 2, subsection 1, paragraph 8 of Radiation and Nuclear Safety Authority Regulation 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).

[2] Operational waste refers to the low- and intermediate-level waste accumulated in the operation of a nuclear power plant.

[3] Decommissioning waste refers to low- and intermediate-level waste accumulated in connection with the decommissioning of the power plant or other nuclear facilities, such as the equipment and structures to be dismantled.

3 SUBJECT OF APPLICATION

3.1 LOVIISA'S FINAL DISPOSAL FACILITY FOR LOW- AND INTERMEDIATE-LEVEL WASTE

Loviisa's final disposal facility for low- and intermediate-level waste which is the subject of the application (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. Appendix 5 to the application contains a general description of the final disposal facility for low- and intermediate-level waste and of the technical principles of operation.

The radioactive waste generated during the operation of Loviisa power plant, excluding spent nuclear fuel, is deposited for final disposal in the final disposal facility for low- and intermediate-level waste quarried for the purpose. The facility is located on the island of Hästholmen, at a depth of approximately 110 metres.

The plan is also to excavate in the existing final disposal facility an extension for the decommissioning waste of the Loviisa nuclear power plant. Hence the extended final disposal facility allows for final disposal of all the radioactive waste, excluding spent nuclear fuel, generated during the operation and decommissioning of the power plant and its parts to be made independent.

3.2 LOCATION

The final disposal facility for Loviisa's low- and intermediate level operational waste is located in Loviisa's power plant area, on the island of Hästholmen, some 12 km from the centre of the town of Loviisa.

The halls of the final disposal facility have been quarried in the island's bedrock to a depth of approximately 110 metres. The location was selected on the basis of field studies focused on the bedrock and hydrological conditions, with consideration for the power plant operations carried out on the island. The final disposal halls have been designed in such a way that any significant water-bearing fracture zones of the bedrock do not intersect with the final disposal halls. The halls of the final disposal facility are located on the island in such a way that no part of them is under the sea or the existing power plant units or any sites reserved for units. The final disposal facility was built on the island of Hästholmen in the 1990s. The first phase of construction was finished in 1997 and the final disposal facility was expanded in 2010–2012.

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 final disposal facility is used for the final disposal of the low- and intermediate-level waste generated in connection with or as a result of the operation of Loviisa power plant and its parts to be made independent or for the final disposal of radioactive waste with equivalent properties. In addition, small quantities (a maximum of 2,000 m^3) of radioactive waste with properties similar to the aforementioned waste, but generated elsewhere in Finland, are meant to be deposited in the final disposal facility.

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 are presented in Appendix 4 to the application.

3.4 PERIOD OF OPERATION

An operating licence is being sought for the final disposal facility for low- and intermediate-level waste until the end of 2090. In accordance with plans, the operation of the final disposal facility is expected to come to an end prior to this, no later than during the 2080s. The final disposal facility will be permanently closed during the validity of the operating licence pursuant to this application once the radioactive waste from the decommissioning of Loviisa power plant has been deposited in final disposal.

3.5 CURRENTLY VALID OPERATING LICENCE AND PREVIOUS OPERATING LICENCES

Government decision (Document no. 1/812/97) of 2 April 1998 granted a licence for the use of the final disposal facility for power plant waste located in the power plant area for the final disposal of the low- and intermediate-level waste generated in the operation of the Loviisa 1 and Loviisa 2 plant units and the storage of spent fuel and, as necessary, for the final disposal of small quantities of waste generated in operations other than the operation of Loviisa power plant until 31 December 2055.

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, handle, store and deposit for final disposal low- and intermediate-level waste in the final disposal facility as follows:

– a maximum of 50,000 m^3 in low- and intermediate-level waste generated in connection with or as a result of the operations of the nuclear facilities in Loviisa's power plant area or radioactive waste with properties equal to such waste (operational waste, decommissioning waste, other radioactive waste in the plant site with a similar activity concentration, and a small quantity of decommissioned radiation sources);

Appendix 4 to the application includes an estimate of the volume of operational waste and decommissioning waste to be deposited in final disposal. The waste volume of 50,000 m^3 proposed in the application's licence term is based on an estimate of the volume of the waste to be deposited in final disposal in the event that the power plant units operation ends in 2050. The licence term also includes a reasonable margin accounting for the waste volumes, the timespan of the operations and the related uncertainties. The objective is nevertheless to effectively limit the volume of the operational waste and decommissioning waste generated in connection with the operation and decommissioning of the nuclear facilities, and thereby set to be deposited in final disposal. 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 m³ in radioactive waste of the type mentioned above, and with equivalent properties, but generated elsewhere in Finland; and

The volume of the radioactive waste generated elsewhere in Finland is discussed in Appendix 4. The actual volume of the waste to be deposited in the final disposal facility is expected to be significantly lower than the proposed licence term. Given that Loviisa power plant already has functions and facilities suitable for the handling and final disposal of radioactive waste in place, their availability as part of the overall social solution would be natural and in line with the recommendations of the National Nuclear Waste Management Cooperation Group[4]. 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.

– a maximum of 50,000 m³ in waste with a very low level of activity, generated in the nuclear power plant's decommissioning and the dismantling of the buildings.

In addition to low- and intermediate-level waste, the final disposal facility may also come to house conventional dismantling waste or dismantling waste with a very low level of activity, such as crushed concrete. The maximum volume of the waste with a very low level of activity would be 50,000 m³, and it would be used, to the extent possible, as the final disposal facility's filling material, along with quarried rock. The use of concrete as a filling material will increase the pH of the water in the final disposal facility, thereby slowing down corrosion and contributing to the long-term safety of the final disposal halls.

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

The conditions for granting an operating licence to Loviisa's final disposal facility for low- and intermediate-level waste are presented below.

5.1 LOVIISA'S FINAL DISPOSAL FACILITY FOR LOW- AND INTERMEDIATE-LEVEL WASTE IS SAFE

Loviisa's final disposal facility meets the safety requirements pursuant to the Nuclear Energy Act. Appendix 5 to the application 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 is provided in Appendix 6 to the application. The Environmental Impact Assessment Report (EIA Report) in Appendix 13 also describes Loviisa nuclear power plant's decommissioning as well as the handling of radioactive waste and its final disposal in the final disposal facility.

In Finland, the nuclear energy industry falls within the remit of the Ministry of Economic Affairs and Employment (MEAE). The Radiation and Nuclear Safety Authority (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.

[4] In June 2017, the Ministry of Economic Affairs and Employment appointed a working group to explore the objectives, development measures and alternative solutions for safe and cost-effective nuclear waste management and other radioactive waste management from today until well into the future. The final report of the National Nuclear Waste Management Cooperation Group can be found at http://urn.fi/URN:ISBN:978-952-327-435-8.

The professional skills of the applicant's personnel play an important role in the safe operation of the final disposal facility. The applicant provides its personnel and contractors with training that focuses on the nuclear facility's special characteristics, operating methods, safety culture and technology. The expertise and operating organisation at the applicant's disposal are described further below in the application.

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. Safety is reviewed comprehensively at regular intervals in the periodic safety review. Fortum conducts the safety reviews of the final disposal facility in accordance with the valid legislation applicable to nuclear safety. The content of the periodic safety review is determined in accordance with applicable international and national recommendations and practices as well as the regulations and requirements issued by STUK. The periodic safety review submitted by Fortum in 2020 was approved by STUK in 2021[5].

As part of continuous improvement, the applicant is involved in international activities and peer reviews, and any improvement suggestions brought up in their context are considered in the applicant's operations. The applicant also actively follows the events of other nuclear facilities and takes their best practices and knowledge into consideration in its operations.

After the operational phase, the final disposal facility will be permanently closed. Long-term safety refers to the safety following the closure of the final disposal facility, in which the primary objective is to limit the radiation exposure caused by the waste to people living in the vicinity of the closed facility and other living beings. Based on the reviews and analyses conducted, the final disposal can be carried out safely. Long-term safety is described in more detail in Appendices 5 and 13.

Extending the operation of Loviisa's final disposal facility for low- and intermediate-level until the end of 2090 is safe.

5.2 ENVIRONMENTAL IMPACT AND CONSIDERATION OF THE SAFETY OF EMPLOYEES AND GENERAL POPULATION

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 report also covered the environmental impact of the final disposal facility under different options, including the expansion of the facility for decommissioning waste and the reception of radioactive waste generated elsewhere in Finland. The EIA Report was inspected by the MEAE, as the coordinating authority. In its reasoned conclusion, the MEAE stated as follows:

The assessment report is extensive and diligently prepared. A sufficient number of options to 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 in Appendix 15 to the application and the consideration of the reasoned conclusion in the operations of Loviisa nuclear power plant and final disposal facility is reviewed in Appendix 16.

[5] STUK 5/A42215/2021. Loviisan matala- ja keskiaktiivisen jätteen loppusijoituslaitosta koskeva määräaikainen turvallisuusarviointi. 17.12.2021.

The final disposal facility is located deep within the bedrock, due to which the waste deposited there for final disposal causes no harm to human health or the natural environment. Further details on the operational waste can be found in Appendix 4 to the application. Appendix 5 contains a general description of the final disposal facility. A description of the final disposal facility's role as part of Loviisa nuclear power plant's nuclear waste management can be found in Appendix 9.

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.

The applicant operates in accordance with the terms of the licence, continuously aiming to reduce the operations' impact on the environment by making use of best practices and technologies insofar as possible. The operations of Loviisa power plant have been certified to the ISO 14001 Environmental Management Standard.

The waste described in the application's proposed licence terms will be deposited for final disposal in the final disposal facility located in the power plant area. The plan is also to excavate in the existing final disposal facility an extension for the decommissioning waste of the Loviisa nuclear power plant. Hence the extended final disposal facility allows for final disposal of all the radioactive waste, excluding spent nuclear fuel, generated during the operation and decommissioning of the power plant and its parts to be made independent.

The concentrations of radioactive substances in the exhaust air duct and the water on the floors of the facility will be monitored during the final disposal facility's operational phase, and in practice, no radioactive substances causing a dose are released into the environment.

The safety of employees working in Loviisa's power plant area and the final disposal facility 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, and the waste handling and other measures carried out in the final disposal facility account for only a fraction of the radiation exposure of the power plant's personnel.

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's final disposal facility for low- and intermediate-level until the end of 2090 is safe for the environment and the population.

5.3 THE METHODS AVAILABLE TO THE APPLICANT FOR ARRANGING NUCLEAR WASTE MANAGEMENT ARE SUFFICIENT AND APPROPRIATE

The operation of the final disposal facility will not produce any new nuclear waste, due to which it will not require separate nuclear waste management measures in addition to those carried out at the power plant. Loviisa's final disposal facility forms a key part of Loviisa power plant's nuclear waste management.

The operation of a nuclear power plant generates both radioactive waste and conventional (non-radioactive) waste. The starting point in nuclear waste management is that the radioactive 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 conventional dismantling waste. The plan for the decommissioning of the power plant is updated and submitted to the authorities at regular intervals. The last time Fortum updated the plan in terms of Loviisa power plant was in 2018.

All radioactive waste generated in the operation of the power plant and its parts to be made independent and decommissioning requiring final disposal, excluding spent fuel, will be deposited for final disposal in the final disposal facility.

The final disposal of nuclear waste in bedrock is based on multiple release barriers, which effectively limit the migration of radioactive substances from the final disposal halls, thereby ensuring 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.

Further details on the operational waste can be found in Appendix 4 to the application. Appendix 5 contains a general description of the final disposal facility. A description of the final disposal facility's role as part of Loviisa nuclear power plant's nuclear waste management can be found in Appendix 9.

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 on the use of nuclear power, nuclear waste management 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. The final disposal facility for low- and intermediate-level waste 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 power plant and is integrated into the power plant's operations. This also applies to the expertise and appropriate operating organisation at the disposal of the final disposal facility's operations. 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 the applicant's operating organisation 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 costs of the final disposal facility have been prepared for as part of preparing for Loviisa power plant's nuclear waste management. The applicant ensures 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 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, subsection 3 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.

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 (Otakaari 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 consequently be stored and possibly even deposited for final disposal somewhere else.

In addition, the new operating licence for the final disposal facility would enable the applicant to organise nuclear waste management in a safer and more flexible manner. Loviisa's final disposal facility forms a key part of Loviisa power plant's nuclear waste management. An operating licence for extending Loviisa nuclear power plant's energy production until 2050 is being applied for with a separate operating licence application. It is also important to secure a licence for the nuclear waste management and the final disposal facility in the new operating licence period being sought for Loviisa power plant.

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 – Environmental Impact Assessment Report
Appendix 14.	Loviisa nuclear power plant's Environmental Impact Assessment 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.

Appendix 16
Consideration of the reasoned conclusion in the operations of Loviisa nuclear power plant and the final disposal facility

CONTENTS

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[1].

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 excavating 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 excavation 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.

[1] *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 icthyofauna and fishing. The reasoned conclusion does not include remarks concerning the icthyofauna 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 icthyofauna will come to an end once the power plant is decommissioned. The reasoned conclusion does not include remarks related to the icthyofauna or fishing which would require Fortum to undertake any measures.

With decommissioning, the area's icthyofana 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 excavation 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 excavation material generated during the expansion of the final disposal facility.

The EIA Report reviews several alternative further uses for the excavation 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.