

Helen Nuclear Ltd

Environmental impact assessment for a nuclear power plant

Environmental impact assessment programme

Annex 1 International consultation summary document

September 2026

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1 PARTY RESPONSIBLE FOR THE PROJECT AND PURPOSE OF THE PROJECT

Helen Nuclear Ltd is planning to build a nuclear power plant in Helsinki (Figure 1). The purpose of a nuclear power plant, or SMR (Small Modular Reactor) plant, is to produce either district heat or both district heat and electricity. There are three alternative sites for the nuclear power plant: Salmisaari, Vuosaari and Norrberget (Figure 2).

The project is managed by Helen Nuclear Ltd, a nuclear energy project development company owned by Helen Ltd, whose task is to find out the prerequisites for the construction of nuclear energy production in Helsinki. Helen Ltd, owned by the City of Helsinki, is one of the largest energy companies in Finland. Helen Ltd produces electricity, district heat and district cooling, for example, in power and heating plants in different parts of Helsinki. The production palette also includes hydro, wind, solar and nuclear power.

Schedule wise, the aim is to complete the EIA procedure for the project by the end of 2027. The aim is for the nuclear power plant to start operating during the 2030s. The project is an important part of Helen Ltd’s aim to move away from combustion-based energy production by 2040, in addition to other projects already implemented and planned.

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Figure 1. Helsinki's location in Finland.

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Figure 2. Alternative locations for the nuclear power plant in Helsinki.

2 DESCRIPTION OF THE PROJECT

The plant options examined in Helen's nuclear power project are based on light water reactor technology, which is the most widely used nuclear power technology in the world and is also used in all of Finland's current nuclear power plants.

This project considers only small modular reactors (SMRs) as alternatives. These are the smaller modular nuclear power plants that have been deployed in recent decades. The plant options examined are either pressurised water or boiling water reactors. Both reactor types operate on the same basic principle, where the heat generated in the reactor is transferred to water, but they differ in whether steam is produced directly in the reactor or in a separate heat exchanger (vaporiser).

The modular approach means that the plant's components can be manufactured as ready-made modules in factories, and these modules are then assembled on site. The degree of

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modularity varies depending on the type and supplier of the plant. The modularity is designed to shorten the construction time of the plant compared to traditional nuclear power plants.

The energy production of a nuclear power plant is based on fission in a nuclear reactor, where heavy atomic nuclei split, releasing thermal energy. This heat is used either directly in the production of district heat or in the production of electricity through the turbine–generator chain.

The planned operating life of the nuclear power plant is at least 60 years.

2.1 Heating plant

The heating plant (HOP, Heat-Only Plant) is examined for the Salmisaari (project option VE1), Vuosaari (project option VE2a) and Norrberget (project option VE3a) plant sites. The process of a heating plant producing only district heat is simpler and the need for space is smaller than that of a combined heat and power plant. It produces only hot water, the energy of which is transferred in full to the district heating network, instead of also producing electricity. A heat-only nuclear power plant used for district heat production does not require cooling water from a water body, and therefore does not discharge heat into the aquatic environment.

The heating plant is used for supplying the district heating base load, meaning it is operated mainly at a steady full output. When necessary, the heating plant can also be operated for more flexible production at varying power levels in accordance with the plant's operating conditions and heat demand. In summer, for example, when the need for district heat is lower, the plant can be operated at a lower capacity.

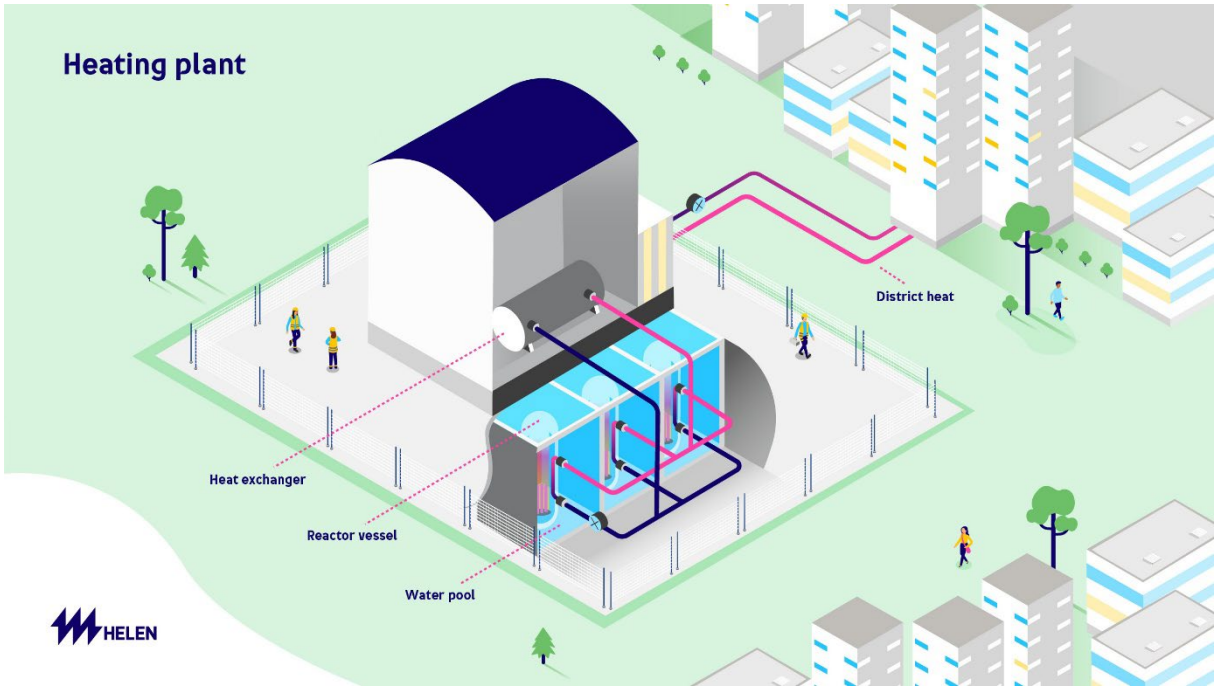


Figure 3. General process diagram of the heating plant (HOP).

In the EIA procedure, the heating plant under consideration has a maximum of 18 reactors. The heat output of the heating plant's reactors is a maximum of approximately 630 MWth and the district heat output is approximately 600 MW. The preliminary technical data of the heating plant are presented in table (Table 1).

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2.2 Combined heat and power plant

A CHP (Combined Heat and Power) plant is examined for the Vuosaari (project option VE2b) and Norrberget (project option VE3b) plant sites. A CHP plant produces both electricity and district heat. A CHP plant differs from the nuclear power plants currently in use in Finland in that part of the heat produced in the reactor is used for the production of district heat. In Finland's current nuclear power plants, heat that cannot be used for electricity production is discharged into the sea with cooling water.

The CHP plant is used for supplying the district heating base load, meaning it is operated mainly at a steady full output. When necessary, the plant can also be operated for more flexible district heat production in accordance with the plant's operating conditions and heat demand. If less district heat is produced, the corresponding energy is mainly used for electricity production. In summer, for example, when the need for district heat and possibly electricity is lower, the plant can also be operated at a lower capacity.

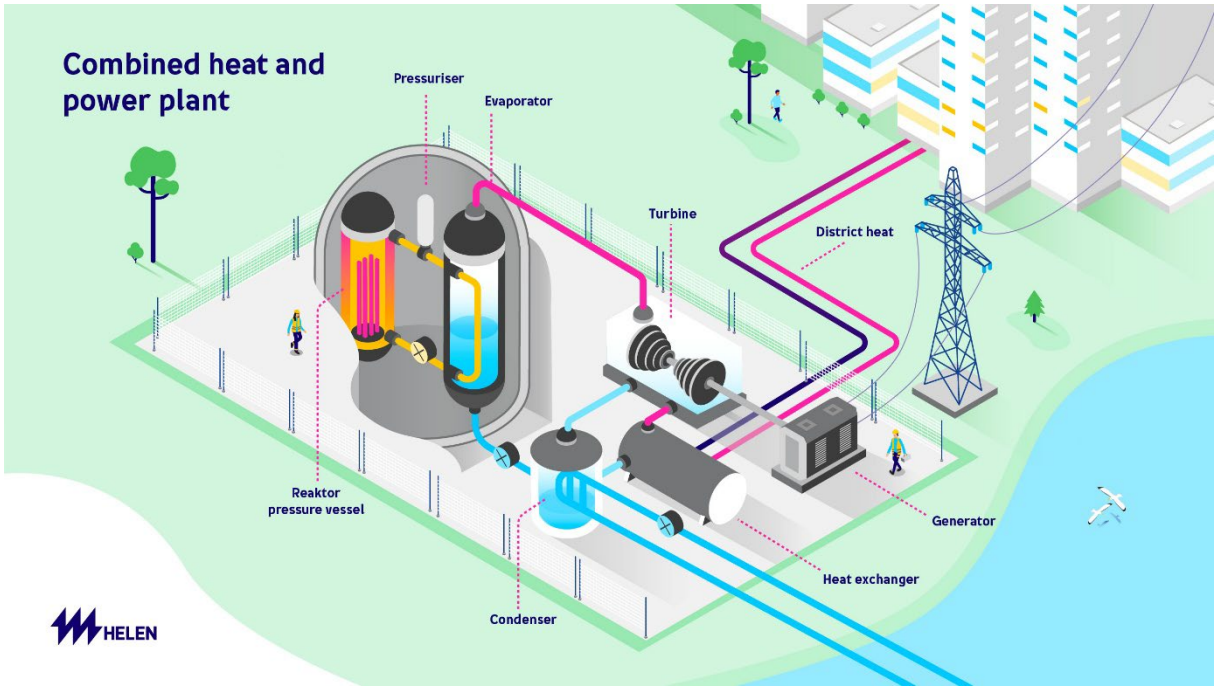


Figure 4. General process diagram of the CHP plant.

A CHP plant requires seawater cooling. Part of the heat produced at a CHP plant is directed to the district heating network, part of the heat is transferred to the sea with cooling water due to the technical constraints of the plant or fluctuations in the need for district heating. In a CHP plant, approximately 25 m^3/s of cooling water is needed. According to the information currently available, cooling water at the nuclear power plant heats up to about 10–12 degrees. The heat discharge of cooling water to the sea is at its highest at about 1,000 MW. The heat discharge to the sea varies according to the seasons and the need for district heat. The heat discharge is at its highest in summer when there is no need for district heat. The heat discharge is at its lowest in winter, when a large part of the heat is directed to the district heating network.

In the EIA procedure, the CHP plant under consideration has one reactor. The heat output of the reactor is about 1,400 MWth, the electric power about 500 MWe and the district heat output about 700 MW. The table below (Table 1) shows the preliminary technical data of the CHP plant examined in the EIA procedure.

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Table 1. Preliminary technical data of the heating plant and CHP plant.

	Heating plant	Combined heat and power plant
Energy generated	District heat	District heat and electricity
Number of reactors (max.)	18	1
Heat output (max.)	630 MW	1,400 MW
District heat output	600 MW	700 MW
Electric power	–	500 MW
Efficiency	about 95%	65–75% (35% in condensing mode)
Heat output discharged to the water system	–	about 1,000 MW
Cooling water requirements	–	about 25 m^3/s
Space requirements of the plant area	about 12 ha	about 20 ha

2.3 Nuclear waste

Spent nuclear fuel accumulated during the operation of a nuclear power plant is initially stored in the reactor building and then transferred to an interim storage for spent nuclear fuel to cool down and await final disposal. An interim storage for spent nuclear fuel at a nuclear power plant may be located on site, at the final disposal site for spent nuclear fuel or elsewhere. The spent nuclear fuel will be finally disposed of at a licensed final disposal facility located in the Finnish bedrock. Alternatives to final disposal are final disposal by the company itself or the purchase of services from an industrial final disposal company.

The very low-level, low level and intermediate level waste generated at the nuclear power plant is stored and processed in an interim storage built on site. Very low-level, low level and intermediate level waste is disposed of in a final disposal facility, which is built either on site or elsewhere in Finland. The final disposal facility for low and intermediate level waste is mainly built in an underground space in the bedrock. Very low-level waste can be disposed of in a final disposal facility built on the ground.

2.4 Construction of the nuclear power plant and necessary new connections

Helen Ltd's power plant areas are currently located in the planning areas of Salmisaari and Vuosaari. Norrberget's planning area is mostly undeveloped. A description of the current state of the environment of the project areas is presented in the EIA programme.

The reactors of the heating plant can be built either in a cave to be excavated in the bedrock or in a trench below the ground level. The CHP plant will be built on the ground except that the reactor may be partially or fully below ground level. The construction of the nuclear power plant requires excavation in the planning area, and the amount of excavation required depends on the examined plant option and location.

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Depending on the project option, the nuclear power plant needs new electricity and district heat transmission connections, intake and discharge tunnels for cooling water, and road connections (see Table 2). The construction of the tunnel connections requires, for example, excavation work, and the construction of the electricity transmission connections requires the installation of new power lines or underground cables.

2.5 Options to be assessed in the EIA procedure

The nuclear power plant's plant options are a heating plant that produces only district heat and a CHP plant that produces electricity and district heat.

The project includes new connections to be built (electricity transmission connections, district heating connection, cooling water connections, and road connections). The new connections required depend on the project option.

For nuclear waste generated during the operation of the nuclear power plant, the processing and interim storage of spent nuclear fuel at the nuclear power plant site are included in this EIA procedure. The final disposal of spent nuclear fuel is not included in this EIA procedure. The processing, interim storage and final disposal for very low-level, low level and intermediate level waste at the nuclear power plant site are included in this EIA procedure. Final disposal at a site other than the plant site is not included in the EIA procedure. A separate EIA procedure for this will be undertaken, if required, at a later stage.

The project options examined in the EIA procedure are presented in the attached table (Table 2).

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Table 2. Project options and necessary new connections.

Project option	Nuclear power plant	New connections
VE1 Heating plant in Salmisaari	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	–
VE2a Heating plant in Vuosaari	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	–
VE2b CHP plant in Vuosaari	One reactor, heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW.	Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation. Cooling water tunnel connection to the sea, including an assessment of expanding the existing tunnels of the Vuosaari power plant and constructing entirely new cooling water intake and discharge tunnels.
VE3a Heating plant in Norrberget	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	The district heat transmission connection is carried out either entirely in a tunnel excavated in the bedrock or as a combination of a tunnel and a pipe excavated in the ground. Electricity transmission connection of 110 kV to Fingrid's current Länsisalmi substation. Backup power connection of 110 kV to the district heat transmission line. New road connections and utilities.
VE3b CHP plant in Norrberget	One reactor, heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW.	The district heat transmission connection is carried out either entirely in a tunnel excavated in the bedrock or as a combination of a tunnel and a pipe excavated in the ground. Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation. Backup power connection of 110 kV to the district heat transmission line. Cooling water tunnel connection to the sea, construction of new cooling water intake and discharge tunnels. New road connections and utilities.

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In addition, the EIA procedure examines the zero option (VE0), that is, a situation in which a nuclear power plant is not built. In this case, the positive and negative environmental impacts of the project will not materialise. Helen will not move away from combustion-based energy production, but energy production in Helsinki will continue at the current production facilities. In addition, the production investments already decided at Helen will be implemented.

3 NUCLEAR AND RADIATION SAFETY

In Finland, the use of nuclear energy must be safe under the Nuclear Energy Act and must not pose a risk to people, the environment or property. The nuclear safety requirements applicable to a nuclear facility are based on the Nuclear Energy Act (990/1987)[1] and the Nuclear Energy Decree (161/1988)[2], supplemented by the regulations issued by the Radiation and Nuclear Safety Authority (STUK)[3] and by the detailed requirements set out in the Regulatory Guides on nuclear safety (YVL Guides)[4] and Regulatory Guides on preparedness (VAL Guides)[5]. The Radiation Act (859/2018)[6] and the Government Decree on Ionizing Radiation (1034/2018)[7] lay down requirements for radiation safety. In addition to STUK's regulations and YVL Guides, requirements and limit values are set in the plant's safety-technical operating conditions, which STUK approves. STUK monitors the safe use of nuclear power.

In 2024, STUK published an updated regulation on the emergency arrangements of a nuclear power plant (Y/2/2024), in which the determination of the precautionary action zone and emergency planning zone was changed from fixed kilometre boundaries to a case-by-case assessment. This enables new nuclear projects to be zoned closer to the point of use in the same manner as in district heat production.

The comprehensive reform of the Nuclear Energy Act is currently underway in the Ministry of Economic Affairs and Employment. The goal for the entry into force of the new Nuclear Energy Act being discussed in Parliament is in 2027.

3.1 Nuclear safety

Nuclear power plants are designed, implemented and maintained according to strict quality standards to ensure that operational incidents are rare. However, in case of operational incidents and accidents, the plant will be equipped with effective safety systems that will be able to handle the situations in such a way that there will be no consequences for the environment. The safety systems include parallel subsystems which operate independently of each other. This prevents a single fault from stopping the system from operating. In addition, the plant has systems that operate on different principles but share the same function, ensuring that if several subsystems fail for the same reason, another system with a different operating principle can still perform the task. Furthermore, the subsystems are physically separated from each other so that they are not exposed to a common hazard, such as a fire.

[1] Nuclear Energy Act 990/1987 (https://www.stuklex.fi/en/ls/19870990)
[2] Nuclear Energy Decree 161/1988 (https://www.stuklex.fi/en/ls/19880161)
[3] STUK Regulations (https://www.stuklex.fi/en/maarays)
[4] Regulatory Guides on nuclear safety (YVL) (https://www.stuklex.fi/en/yvl-ohje)
[5] Regulatory Guides on preparedness (VAL) (https://www.stuklex.fi/en/val-ohje)
[6] Nuclear Energy Act 859/2018 (https://www.finlex.fi/en/legislation/2018/859)
[7] Government Decree on Ionizing Radiation 1034/2018 (https://www.finlex.fi/en/legislation/2018/1034)

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The plant and safety systems are protected and scaled for very abnormal situations, such as a direct collision of a large commercial aircraft, earthquakes and extreme flooding. These scaling principles ensure that the plant is able to operate even in challenging conditions.

Safety solutions primarily rely on inherent safety features. For example, the reactor core is designed so that the reactor power naturally decreases if the temperature rises. If a leak of cooling water occurs in the reactor, the reactor will naturally shut down as the chain reaction stops. In addition, the cooling of all reactor options of the nuclear power plants examined in the project is based on passive safety systems. Passive safety systems are based on gravity, pressure differences and natural circulation, and therefore do not require power supply or user intervention for their operation. Plants must be able to cool the reactor for several days without external power supply or other supplementary material.

The safety of nuclear power plants is based on compliance with the safety principle of defence-in-depth. Several independent levels of protection are applied simultaneously in the design and operation of the plant. For example, the release of radioactivity from the fuel into the environment is prevented by several nested technical barriers. These technical barriers include a ceramic fuel pellet, metal cladding of the fuel rods, and a cooling circuit that can withstand the pressure of the reactor. The outer barrier is a gas-tight containment around the reactor. Each of these barriers alone must be sufficient to prevent the release of radioactive substances into the environment.

The design of the nuclear power plant also prepares for the worst possible accident, which in a light water reactor is the meltdown of the reactor core. Although such a severe reactor accident is very unlikely, plants must be designed to withstand the effects of a severe reactor accident in such a way that no significant environmental impacts occur.

The reliability and safety of the plant's operation is also maintained through continuous training of staff and an excellent safety culture. In addition, the nuclear power plants in operation and their operating organisations are continuously developed in terms of safety and reliability of operation, taking into account operating experience, the results of safety studies and scientific and technical progress.

3.2 Radiation and its monitoring

In a nuclear power plant, radioactive substances are generated as fission products when the atomic nuclei of the fuel split, through neutron activation in or near the reactor, and as products of the radioactive decay of the substances described above.

Systems containing radioactive substances are located within the controlled area, where specific safety instructions are followed to ensure protection against radiation. In the design of a nuclear power plant, the ALARA (As Low As Reasonably Achievable) principle is applied, meaning that all radiation exposures are kept as low as possible through practical measures, taking economic and societal factors into account.

Before a nuclear power plant is commissioned, a baseline environmental survey will be carried out within the plant area and its surroundings to determine the prevailing radiation conditions prior to the start of operation. During operation, radiation and releases of radioactive substances are monitored in accordance with the radiation monitoring programme approved by STUK.

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Helen's nuclear power plant is designed so that its releases and radiation doses caused by releases are below all the limits set for radioactive releases. The limit values for radiation doses to the public arising from the operation of a nuclear power plant are defined in the Nuclear Energy Decree (161/1988, Section 22b). The limit on the annual dose received by an individual of the population from the normal operation of a nuclear power plant is 0.1 millisieverts, which is less than 2% of the average annual radiation dose (5.9 mSv)[8] of Finns. The majority of the annual radiation dose to Finns is caused by indoor radon (4 mSv). The radiation dose caused by Finland's operating nuclear power plants to the surrounding population has been less than one percent of the set annual dose limit[9].

3.3 Security arrangements and preparing for external threats

The nuclear power plant is designed to withstand the loads caused by various external threats. These include extreme weather conditions, sea and ice phenomena, earthquakes, various flying objects, explosions, fires, flammable and toxic gases, and intentional damage.

The design of the nuclear power plant takes into account weather-related phenomena such as low and high temperatures, rain and snowfall, snow load, strong winds, whirlwinds, downbursts, air humidity, and lightning. With regard to extreme natural phenomena, the design values of safety systems are selected in accordance with official regulations so that they are estimated to be exceeded less often than once every 100,000 years. Even rarer conditions have been prepared for so that the most important safety functions can also be implemented if the design values are exceeded.

The design accounts for both low and high sea levels. The plant is designed so that it is not endangered even in very exceptional flood situations.

The design of the cooling systems for the CHP plant takes into account factors that may affect seawater intake, including oil spills in the sea area, formation of ice ridges, slush ice (ice crystals formed in supercooled water), high seawater temperatures, and abundant algae deposits and fish stocks. Different impurities are removed from seawater with the help of valves and filters. Despite these design solutions, preparations are also being made for a situation where seawater cooling is completely lost.

In the design of the plant, possible power supply interruptions are taken into account, for example, in connection with various extreme natural phenomena. Passive systems ensure the safety of the plant even in possible power loss situations.

Other issues to take into account in the planning are the possible effects of climate change, such as the increase in extreme phenomena, the warming of seawater and the rise in the average seawater level.

The nuclear power plant is also designed to withstand earthquakes, although Finland is located within the interior of the Eurasian tectonic plate, making strong earthquakes extremely rare and unlikely.

[8] Radiation and Nuclear Safety Authority 2026a. Average radiation dose for a Finn. https://stuk.fi/en/the-average-radiation-dose-received-by-a-finn
[9] Radiation and Nuclear Safety Authority 2026b. Radiation safety of nuclear facilities. https://stuk.fi/en/radiation-safety-of-nuclear-facilities

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Various crisis and exceptional situations, as well as cyber threats, are prepared for already at the planning and development stage of operations. Safety is taken into account comprehensively in technical solutions, operating models and the organisation's readiness. The nuclear power plant will be built in such a way that it can withstand, among other things, a collision of a large commercial aircraft without significant releases to the environment.

The nuclear power plant and the nuclear materials used are protected against illegal activities such as vandalism and sabotage. Threats arising from terrorism, cyber threats, other illegal activities or societal emergencies and crises are prepared for with thorough and continuous security arrangements. They complement the protection provided by the robust structure and the protection of sensitive parts required by the basic safety design of the plant. The current global situation in terms of safety requires both power companies and authorities to continuously develop their operation in possible crisis conditions.

4 EIA PROCEDURE

The EIA Directive (2011/92/EU, amended 2014/52/EU) has been implemented in Finland by the Act on the Environmental Impact Assessment Procedure (252/2017) and the Government Decree on the Environmental Impact Assessment Procedure (EIA Decree, 277/2017). The planned activity corresponds to item 7(b) of the project list in Annex 1 of the Environmental Impact Assessment Act: Nuclear power stations and other nuclear reactors.

This project is subject to the Espoo Convention on Environmental Impact Assessment in a Transboundary Context.

4.1 International consultation procedure

The assessment of environmental impacts in a transboundary context is governed by the Espoo Convention (*Convention on Environmental Impact Assessment in a Transboundary Context*). Finland ratified this United Nations Economic Commission for Europe convention in 1995. The Espoo Convention entered into force in 1997. In Finland, the obligations of the Espoo Convention have been implemented through the Environmental Impact Assessment Act and the Decree on the entry into force of the Convention on Environmental Impact Assessment in a Transboundary Context (SopS 67/1997). Internationally, public participation and rights of appeal are regulated in the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (SopS 121–122/2004, the Aarhus Convention). The Aarhus Convention aims, among other objectives, to enable the public to participate in decision-making in environmental matters. The Aarhus Convention has been implemented in the EU through a number of directives, including the EIA Directive.

The parties to the Espoo Convention have the right to participate in an environmental impact assessment procedure carried out in another country if the harmful and likely significant environmental impacts of the project under assessment may affect their country ("the affected party"). The international consultation procedure is necessary if a proposed project listed in Annex 1 to the Espoo Convention is likely to have significant adverse transboundary effects. This list of projects includes nuclear power plants and other nuclear reactors. Accordingly, the transboundary environmental impact assessment procedure under the Espoo Convention is applied to nuclear power plant projects.

The Point of Contact of the party (country) of origin notifies the Points of Contact of those parties (countries) considered likely to be affected by the project of the commencement of the

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EIA procedure and offers them the opportunity to participate in the procedure. If the affected party (country) decides to participate in the assessment procedure, it will make the project documentation provided by the party (country) of origin publicly available in the affected country for comments and opinions from its authorities and the public. The Point of Contact of the affected Party (country) compiles the comments and opinions received and then submits them to the Point of Contact of the Party (country) of origin. The Point of Contact of the Party (country) of origin submits the comments and opinions received to the competent authority for consideration in its own statement.

In the transboundary consultation procedure under the Espoo Convention, the competent authority for Finland (Party of origin) is the Finnish Environment Institute (Syke). The scope of notification for the international consultation is determined on the basis of the area in which the potential significant adverse environmental impacts of the planned project may extend. During the EIA programme phase, a decision has been made to notify the following states pursuant to the Espoo Convention: Sweden, Norway, Denmark, Germany, Poland, Lithuania, Latvia, Estonia and Austria. These countries have typically been notified of the EIA procedures for nuclear power plant projects in Finland. Finland has a bilateral agreement with Estonia on the assessment of transboundary environmental impacts (Finnish Treaty Series 51/2002), which aims, among other things, to enhance bilateral cooperation in the environmental impact assessment procedure. The Finnish Point of Contact (Syke) submits the comments and opinions received from the affected Parties to the national EIA authority (Ministry of Economic Affairs and Employment), which takes the comments and opinions/feedback into account in its own statement.

The procedure under the Espoo Convention is completed once the permits for the project have been granted and publicly announced in the countries that have participated in the transboundary consultation.

4.2 EIA procedure in Finland

The objective of the EIA Act is to promote environmental impact assessment and the uniform consideration of the assessment in planning and decision-making. The EIA procedure is an open process, and one of its objectives is to improve access to information and participation opportunities for all stakeholders.

The environmental impacts of the project must be assessed in the statutory EIA procedure at the earliest possible phase of project planning, when the alternatives are still open. The EIA procedure does not involve making decisions on the project, but it is a prerequisite for subsequent decision-making. It is therefore provided that the authorities may not grant permits for the implementation of the project, or make other comparable decisions, before the EIA procedure has been completed.

The EIA procedure is a two-step process. In the first phase of the EIA procedure, an environmental impact assessment programme (EIA programme) is drawn up, which is a plan for the organisation of the EIA procedure and the surveys required for it. The EIA programme is submitted to the Ministry of Economic Affairs and Employment, which acts as the competent authority, and the Ministry announces the EIA programme by publishing a public notice on its website. In this EIA procedure, the EIA programme is made available for public review for a period of 60 days.

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During the public notice period, the authorities, local residents and other parties concerned may submit statements and opinions on the EIA programme to the competent authority. An international consultation will take place in parallel with the national consultation procedure. The competent authority compiles all the statements and opinions submitted on the EIA programme and issues its own statement on the basis of them to the person responsible for the project within one month of the end of the public display period.

In the next phase of the EIA procedure, an environmental impact assessment report (EIA report) is prepared on the basis of the EIA programme and the competent authority's statement on it. The results of the assessment are compiled in the EIA report, which is submitted to the competent authority. A public notice of the EIA report will be issued in the same manner as for the EIA programme, and during the public display period of the EIA report, an international consultation will be carried out in parallel with the national consultation with those Parties to the Espoo Convention that have announced their participation in the assessment procedure. In the international consultation, Syke shall also offer the other State the opportunity to negotiate the potential transboundary effects of the project and the measures envisaged to reduce or eliminate such effects. On the basis of the EIA report and the statements and opinions submitted during both the national and international consultation procedures, the competent authority prepares its reasoned conclusion on the significant environmental impacts of the project. The permit applications for the project must include the EIA report and the reasoned conclusion.

When a Member State of the European Union has participated in the assessment procedure, the competent authority submits its opinion on the assessment programme as well as the reasoned conclusion and the translations of their relevant parts to Syke. Syke sends them to the Member State.

The Finnish EIA procedure ends with the reasoned conclusion issued by the competent authority. The conclusion must be attached to the project's permit applications. During the permit phase, the reasoned conclusion is checked to ensure that it is up to date. The permit decision must specify how the EIA report, the reasoned conclusion and the documents concerning the international consultation, as well as the results of any negotiations, have been duly taken into account.

The preparation of the EIA report begins immediately after the programme phase. The EIA procedure is expected to be completed by the end of 2027.

5 DESCRIPTION OF THE ASSESSMENT WORK

5.1 Assessed impacts

Environmental impacts refer to the direct and indirect impacts of the project on the environment. In accordance with Section 2 of the EIA Act, the assessment examines the environmental impacts caused by the project on:

- The population and people's health, living conditions and comfort
- Land, soil, water, air, climate, vegetation, organisms and biodiversity
- Urban structure, material assets, landscape, cityscape and cultural heritage
- Exploitation of natural resources, and
- Interactions between these factors.

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The environmental impact assessment considers impacts during construction and operation, as well as impacts arising after the end of operations. The impacts of the non-implementation of the project are also assessed (zero option). The results of the environmental impact assessment, as well as the uncertainties related to the assessment and the measures to prevent and mitigate adverse impacts, are presented in the EIA report.

The impact assessment is carried out in the form of expert assessments. The assessment work is based on existing and publicly available materials, as well as on terrain and marine area surveys and models carried out as part of the assessment work. The material to be used is described in more detail in the EIA programme.

5.2 Baseline data and project-specific studies

The environmental impact assessment is based on existing data, publicly available material and information generated during the plant's preliminary design. As part of the environmental impact assessment work related to this project, a large number of different studies will be carried out to support the existing material. The studies to be carried out include:

- Nature surveys, such as
  - Vegetation and habitat type surveys
  - Bird surveys
  - Species surveys, including Siberian flying squirrel (*Pteromys volans*), scarce fritillary (*Euphydryas maturna*), bats
- Marine area surveys, such as
  - Studies related to fish stocks and fisheries
  - Sediment sampling and contaminant analysis
  - Benthic fauna survey
- Natura assessment of the impact of the project on the Natura 2000 area of the Mustavuori grove and the waterfowl habitat in Östersundom, and on the Natura 2000 area of Kallahti ridge, meadow and water areas
- Archaeological inventories
- Dispersion modelling of heat discharge of cooling water
- Noise modelling for the construction and operational phases
- Illustrative images of the nuclear power plant
- Severe accident modelling (see section 5.3.1)
- Resident survey.

The studies to be carried out during the EIA procedure are described in more detail in section 7.3 of the EIA programme. The results of the surveys are presented in the EIA report. The impact assessment methods and the current state of the environment in the project areas are described in the EIA programme.

5.3 Identified key environmental impacts and assessment of transboundary impacts extending beyond the borders of Finland

The environmental impact assessment is targeted at the likely significant environmental impacts of the project. Based on preliminary assessments and the project option, the main impact categories identified for this project are:

- Water system impacts of the CHP plant during operation (intake and discharge of cooling water, heat discharge to the sea)

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- Impacts on nature during construction
  - Norrberget: plant site and new connections needed
  - Vuosaari: electricity transmission connection
- Impacts on nature during operations
  - Norrberget: plant site and electricity transmission connection
  - Vuosaari: electricity transmission connection
- Impacts on land use
- Impacts on people's health, living conditions and comfort
  - Social impacts (acceptability of the project)
  - Spread of release after a severe reactor accident
- Climate impacts (changes in the way energy is produced).

A preliminary assessment of the significance of impacts across all areas is presented in section 7.2 of the EIA programme, with further evaluation of the significance of the impacts provided in section 7.5. Within the EIA procedure, the assessment covers both the impacts occurring within Finland and any potentially harmful transboundary impacts caused by the project.

Preliminary assessment indicates that the project is not likely to cause significant transboundary impacts. Only a severe reactor accident and the resulting release of radioactive substances could potentially have harmful transboundary effects. In the EIA report phase, potential transboundary impacts of Finland are assessed using dispersion modelling, in which the impacts of radioactive releases from an accident scenario are examined up to a distance of 1,000 kilometres. The modelling method is described in section 5.3.1.

The climate impacts of the project are assessed by calculating the carbon footprint during the project's life cycle. The positive climate impacts of the project are assessed by comparing the emission intensity of the energy produced in the project with the emission intensity of the district heat and/or electrical energy produced in other ways due to the non-implementation of the project. The impacts of climate change on the project are assessed by examining the risks caused by extreme weather events and the adaptation measures required by them. The climate impact assessment is described in more detail in section 20 of the EIA programme.

5.3.1 Severe accident modelling

As part of the environmental impact assessment, a highly unlikely severe accident at the nuclear power plant is modelled and the impacts of the accident are assessed. The modelling is done separately for the CHP plant and heating plant options. In the modelling, the radioactive release is scaled for the most important emission nuclides on the basis of 100 TBq cesium-137 of the Nuclear Energy Decree (161/1988 § 22 b) and 4,300 MW of the heat output of the Olkiluoto 3 nuclear power plant unit, as follows:

- CHP plant (1,400 MWth) 33 TBq cesium-137
- Heating plant (210 MWth) 5 TBq cesium-137.

The heating plant consists of several plant units. A plant unit consists of reactors located in the same building and the same pool. For the heating plant, the modelling considers the loss of one complete plant unit (4–6 reactors), not just one reactor.

The Olkiluoto 3 nuclear power plant unit has been selected as the reference plant due to its modern design and advanced safety systems, which are considered representative of the accident management capabilities of new nuclear power plants.

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The severe accident release considered in the modelling includes not only caesium-137, but also other nuclides released in a severe accident. The release height has been set at 30 metres and the release duration at 12 hours. The release is modelled using a combination of the ARTM (Lagrange) and ATSTEP (Gauss) models up to a distance of 1,000 km.

In the modelling, either a representative year or meteorological data for five years are used as weather data. The 95th percentile is used for the weather data, taking into account all weather conditions.

In the short term, the model calculates the external radiation dose from the release plume and fallout, as well as the internal radiation dose from inhalation. Long-term radiation doses also take into account food routes and external exposure from environmental contamination. Recommendations and dose coefficients by the International Commission on Radiological Protection (ICRP) are used in the calculation of radiation doses.

The results of the modelling are presented as radiation doses, fallout, and possible restrictions on the use of foodstuffs, the environment and areas. The transboundary impact assessment presents country-specific maximum results for radiation doses.

6 PERMITS, PLANS AND DECISIONS REQUIRED FOR THE PROJECT

Once the environmental impact assessment procedure has been completed, the project proceeds to the permit phases. The EIA report and the reasoned conclusion issued by the competent authority are attached to the permit applications.

6.1 Decisions and licences under the Nuclear Energy Act

Finland is currently undergoing a comprehensive reform of nuclear energy legislation, and as a result, changes in licensing procedures are expected in the future, which will also be taken into account in this project. The current licensing and decision-making process related to the use of nuclear energy is briefly described below.

According to the Nuclear Energy Act, the construction of a nuclear facility requires a Government decision-in-principle that the construction of the nuclear facility is in line with the overall interest of society. The decision-in-principle requires the approval of Parliament. At the application phase for the decision in principle, STUK will conduct a preliminary safety assessment of the project, and will provide its views on the prerequisites for the construction of the nuclear facility in its statement. In its safety assessment, STUK states whether the prerequisites for the construction of the nuclear facility are met as required by the Nuclear Energy Act. In this phase, the technology and safety of the future nuclear facility are not yet being assessed on a detailed level.

The decision in principle also requires a statement from the Ministry of the Environment and the municipality where the plant will be located, as well as from neighbouring municipalities. Support from the host municipality is a prerequisite for the decision-in-principle. An environmental impact assessment (EIA) in accordance with environmental legislation must be carried out for new nuclear facility projects before applying for a decision-in-principle.

Under the Nuclear Energy Act, a construction licence for a nuclear facility is applied for by submitting a written application to the Government. STUK issues a statement on the construction licence application and carries out a safety assessment. The safety assessment includes

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a statement on the fulfilment of the requirements that fall within STUK's area of responsibility. The documents and information to be submitted to STUK in connection with the construction licence application are specified in Guide YVL.A1 (Regulatory oversight of safety in the use of nuclear energy) [10]. Other more specific requirements are presented in the YVL for different topics. [11]

Once the nuclear facility has been completed, an operating licence under the Nuclear Energy Act must be applied for. The operating licence is granted for a fixed period of time. The operating licence for a nuclear facility is applied for from the Government by means of a written application. YVL A.1 contains more detailed information about the documents to be submitted to STUK in connection with the operating licence application.

6.2 Local detailed plan required for the project

The construction of a nuclear power plant requires at least master planning and a local detailed plan based on it. The master planning is intended to begin after the consultation on the EIA programme phase, and local detailed planning will then be prepared for a single area once the plant site has been selected. The City of Helsinki is responsible for the planning process within its area, and the City of Vantaa is responsible for planning within its area where necessary.

International consultations on planning procedures are carried out as separate procedures from the EIA procedure, in accordance with the Protocol on Strategic Environmental Assessment to the Espoo Convention (SEA Protocol). The procedure is based the Directive of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment (2001/42/EC, the so-called SEA Directive).

The current land use and planning of the project areas is described in section 8 of the EIA programme.

6.3 Other permits

The implementation of the project requires several different permits, decisions and notifications. According to the Building Act (751/2023), a building permit is required for, among other things, the buildings of a nuclear power plant. The operation of a nuclear power plant requires an environmental permit in accordance with the Environmental Protection Act (527/2014). A water permit under the Water Act (587/2011) is required, among other things, for water-related construction work at the CHP plant (cooling water intake and discharge structures) and for the extraction of water from the sea.

The permits, decisions and notifications required for the project are described in more detail in section 5 of the EIA programme.

[10] Regulatory oversight of safety in the use of nuclear energy YVL A.1 (https://www.stuklex.fi/en/ohje/YVLA-1)
[11] Regulatory Guides on nuclear safety (YVL) (https://www.stuklex.fi/en/yvl-ohje)

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