Basis for the scoping consultation

Date: 19.02.2025

VATTENFALL

Contents

Administrative details

Administrative details	
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Activity codes (preliminary)	40.30 (nuclear reactor) 40.50-i (combustion plant) 24.32-i (manufacture a maximum of 20,000 tonnes of non-metals, metal oxides or other inorganic compounds per calendar year) 90.460 (treatment of high-level radioactive waste/storage of radioactive waste) 90.470 (processing/storing spent nuclear fuel, etc.)
County:	Halland
Local authority	Varberg
Regulatory body:	County Administrative Board of Halland County (environmental protection and water operations) Swedish Radiation Safety Authority (radiation protection, nuclear safety and nuclear non-proliferation)

WSP Sverige AB has been tasked with preparing the consultation document together with Vattenfall AB. The consultation document is based on information about the operations provided by Vattenfall.

1. Introduction

1.1. Background

Sweden has set itself the target of achieving zero net greenhouse gas emissions by 2045. Sweden imports 130 TWh of fossil fuels annually, with oil accounting for more than 100 TWh. Oil is supplemented by coal, coke and natural gas.[1] Sweden needs to achieve our climate targets while strengthening our competitiveness through extensive electrification of industry and the transport sector. In addition, the Swedish Parliament has adopted a target that electricity production in Sweden should be completely fossil-free by 2040.[2] To meet the increased demand for electricity, Vattenfall believes that all available sources of fossil-free power need to be expanded. Nuclear power can produce large amounts of electricity using minimal amounts of fuel over a minimal surface area and will constitute an important part of the fossil-free electricity system in meeting Sweden's increasing electricity needs.

1.2. Purpose of operation

The purpose of the planned operations is to produce fossil-free and plannable electricity using a new source of nuclear power on the Värö Peninsula in the Varberg Local Authority Area. Production should be in place by the mid-2030s. Predictable production will help stabilise the electricity grid, and for the electricity system to function, there must be balance. This means that the generation of electricity at any given time needs to be equal to its consumption.

There are two types of electricity generation: plannable and non-plannable. Nuclear power and hydropower are both plannable forms of energy, in the sense that electricity generation is predictable and can be planned in advance, which helps to strengthen the power system's security of supply. Wind power and solar power are weather-dependent and therefore non-plannable forms of power, as generation depends on the weather and cannot be planned in advance.

The site on the Värö Peninsula, see Figure 1, has been designated as being of national interest for thermal power-based energy generation and is adjacent to the existing Ringhals Nuclear Power Plant. It is strategically located on Sweden's west coast, between the metropolitan regions of Gothenburg and Malmö, whose demand for electricity is not only high, but is expected to increase because of planned industrial investments linked to the green transition. As a result of the existing operations at the Ringhals Nuclear Power Plant, there is already infrastructure at the site that can be jointly utilised for new nuclear power operations.

Vattenfall also believes that the closure of Ringhals 1 and 2 has made it possible to connect new power generation without major investments in the national grid. Moreover, Vattenfall has had and maintains a successful collaboration with Varberg Local Authority. Indeed, the region has developed expertise among subcontractors and authorities regarding nuclear power operations. This makes

[1] The state of energy 2023 in figures (energimyndigheten.se).

[2] Bill 2022/23:99, Report 2022/23:FiU21, Parliamentary Communication 2022/23:254.

the Värö Peninsula a suitable choice for the first site in Sweden to establish new nuclear power to meet the country's demand described above.

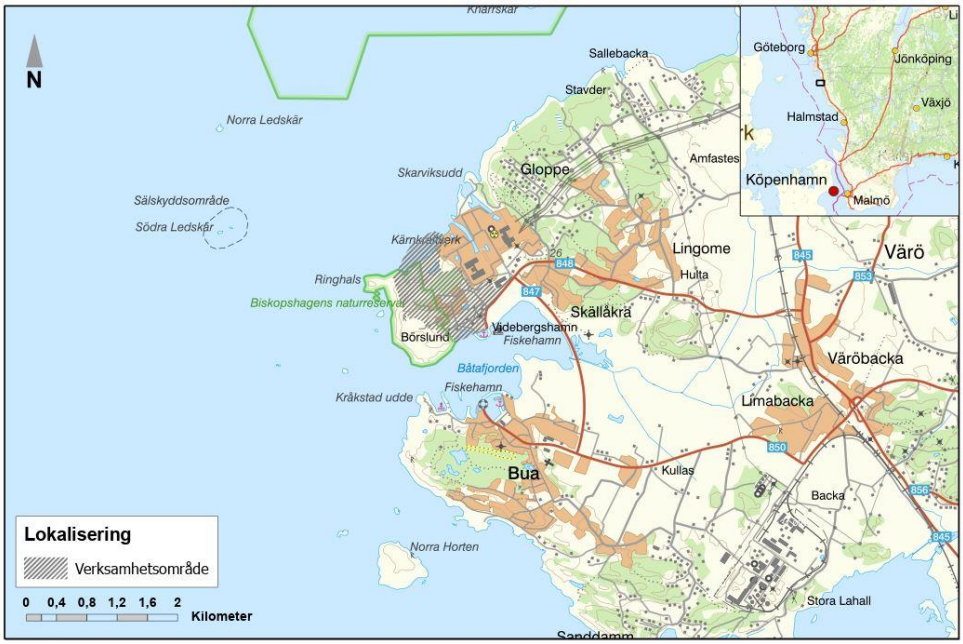


Figure 1. Overview map of the planned operational area (Lantmäteriet, Sweden's equivalent to the Ordnance Survey).
Lokalisering - Localisation
Verksamhetsområde - Area of activity

1.3. Purpose of document

The planned operations are subject to a permit under Chapters 9 and 11 of the Environmental Code (1998:808) and are assumed to have a significant environmental impact under Article 6 of the Environmental Assessment Regulations (2017:966). For operations that can be assumed to have significant environmental impact, no investigation consultation is required, and no such consultation has been carried out for the planned operation.This document provides the basis for the scoping consultation to be carried out pursuant to Chapter 6 of the Environmental Code.

The main purpose of the consultation is to exchange information with and provide local residents, the public, authorities, organisations and other stakeholders with the opportunity to submit comments on the content of the upcoming application for permit, the environmental impact assessment and related documentation, as well as to consult on the location, scope and design of the operations and the environmental effects it is likely to have.

A preliminary assessment shows that the planned operations are covered by the Act (1999:381) on Measures to be Taken to Prevent and Limit the Consequences of Major Chemical Accidents (Seveso Act). This means that the consultation must, in accordance with Chapter 6, Article 29 of the Environmental Code, also cover the prevention and containment of major chemical accidents resulting from the operations. The consultation also concerns factors in the environment that may affect the safety of the operations, in accordance with Article 13 of the

Seveso Act, with particular focus on the distances to other operations covered by the Seveso legislation.

As the operations may have a significant impact on a nearby Natura 2000 site, the consultation also includes examining the possible need for a so-called Natura 2000 permit (Chapter 7, Article 28 a of the Environmental Code) The forthcoming environmental impact assessment will provide the basis for assessing the need for and, where applicable, the granting of such a permit.

The planned operations are of such a nature that, under the Espoo Convention (Convention on Environmental Impact Assessment in a Transboundary Context), they entail an obligation to also consult with the neighbouring countries concerned. Consultations under the Espoo Convention are planned to take place both on the planned applications for permit for the development and operation of the nuclear power plant and on the planning procedure under the Planning and Building Act (2010:900). The Swedish Environmental Protection Agency (EPA) is coordinating the Espoo Consultation, and Vattenfall will have an ongoing dialogue with the Swedish EPA regarding the design and implementation of the Espoo Consultation.

2. The permitting process

2.1. The boundary between the permit processes.

New nuclear facilities must be authorised under both the Nuclear Activities Act (1984:3) and the Environmental Code. Under the current system, a permit application for a new nuclear facility must be submitted to the Swedish Radiation Safety Authority, which prepares the case under the Nuclear Activities Act, and to the Land and Environment Court which prepares the case under the Environmental Code. The cases are then forwarded to the government, which decides on the issue of permissibility under the Environmental Code and issues permission under the Nuclear Activities Act. If the government decides to grant a permit, the matter will return to the Land and Environment Court, which will decide on the permit in accordance with the Environmental Code and any terms and conditions of the permit. Both the application under the Nuclear Activities Act and the application under the Environmental Code must include an environmental impact assessment and must be preceded by a consultation pursuant to Chapter 6 of the Environmental Code. Figure 2 below illustrates an example of the issues to be examined as part the Environmental Code review and the Nuclear Activities Act review, as well as any issues overlapping between the two reviews.

Figure 2. Differences and overlaps between parallel review procedures under the Environmental Code and the Nuclear Activities Act (Vattenfall).

2.2. Scope and definition of permit applications

Vattenfall intends to apply for a permit under Chapter 9 of the Environmental Code for the development and operation of a new nuclear power plant with two or more nuclear reactors with a combined electrical output of up to 2,800 MWe The permit application will cover only the development and operation of the facility, not the future decommissioning of the new nuclear power reactors.

The operation of a nuclear power plant generates conventional waste (non-hazardous and hazardous waste) and nuclear waste, see also Section 3.3.4. Nuclear waste will be managed and temporarily stored within the operational area in preparation for, or pending, continued management and final disposal elsewhere. The final disposal of such nuclear waste is not covered by the planned operations.

Spent nuclear fuel will be managed and stored in fuel ponds within the operational area before being transported to a dedicated interim storage site. Such interim storage of nuclear fuel, as well as the final disposal thereof, is not covered by the planned operations.

The planned operations are considered to be mainly covered by the following provisions in the Environmental Assessment Regulations (2013:251):

- **Chapter 21 Article 7** Permit requirement A and activity code **40.30** apply to nuclear power reactors or other nuclear reactors.
- **Chapter 21 Article 9** Permit requirement B and activity code **40.50-i** apply to combustion plants with a total rated heat input of 50 megawatts or more but not more than 300 megawatts.
- **Chapter 12 Article 32,** Permit requirement B and activity code **24.32-i** apply to facilities for the production of non-metals, metal oxides or other inorganic compounds by chemical or biological reaction on an industrial scale up to 20 000 tonnes per calendar year.

- **Chapter 29 Article 58** Permit requirement A and activity code **90.460** apply to the treatment of high-level radioactive waste, final disposal of radioactive waste or storage of radioactive waste.

- **Chapter 29 Article 59** Permit requirement A and activity code **90.470** apply to the processing, storage, final disposal or any other management of spent nuclear fuel, nuclear waste or other radioactive waste in accordance with the Act (1984:3) on Nuclear Activities (Nuclear Activities Act) or the Radiation Protection Act (2018:396), if the management is not subject to permit under Article 58.

Vattenfall also plans to apply for a permit under Chapter 11 of the Environmental Code for the water operations that will be required for the development and operation of the facility, including seawater abstraction for cooling water purposes, the construction of facilities in water areas, groundwater abstraction, the filling of ponds and water bodies in the area, re-infiltration and more.

This activity may require a permit under Chapter 7. Article 28 a of the Environmental Code (referred to as “Natura 2000 permit”). Such a permit will be granted provided that the activity is deemed to have a significant impact on the nearby Natura 2000 site. Vattenfall will investigate the impact of the operations on the nearby Natura 2000 site and the need for a Natura 2000 permit as part of the application process. An application for a permit under the Cultural Environment Act (1988:950) and an exemption from the Species Protection Regulations (2007:845) are also expected to be required.

The Nuclear Activities Act requires a permit for the development, possession and operation of a nuclear facility and for the management of nuclear material and nuclear waste. A separate permit application under the Nuclear Activities Act will be submitted to the Swedish Radiation Safety Authority and processed alongside the Environmental Code review. The Nuclear Activities Act also lays down requirements for the performance of a specific environmental assessment under Chapter 6 of the Environmental Code. Vattenfall plans to produce a joint environmental impact assessment for the reviews under both the Environmental Code and the Nuclear Activities Act. This scoping consultation is a combined consultation for the two reviews.

2.3. Related questions

A preliminary assessment shows that the planned operations are covered by the Act (1999:381) on Measures to Prevent and Limit the Consequences of Major Chemical Accidents and related delegated legislation (the Seveso legislation) in view of the chemicals planned to be managed in the operations, see also Chapter 7.13.

The total rated output of the planned auxiliary power units means that the operations are deemed to be subject to a permit requirement under Chapter 21, Article 9 of the Environmental Assessment Regulations (activity code 40.50-i). Planned production of sodium hypochlorite is also subject to a permit according to Chapter 12, Section 32 of the Environmental Assessment Ordinance (activity code 24.32-i). This also means that the operations constitute an industrial emissions activity under Chapter 1, Article 2 of the Industrial Emissions Regulations (2013:250), and that they are covered by said Regulations. Since the

operations are covered by the Industrial Emissions Directive, a status report must be prepared and included in the application.

The planned auxiliary power units will each have an installed output of less than 15 MW, which means that the activity is not covered by the Large Combustion Plants Regulations (2013:252) (cf. Articles 6 and 36 of the Regulations, stating that installations below 15 MW should not be aggregated). Instead, in view of the planned auxiliary power units, the activity is covered by the Medium Combustion Plants Regulations (2018:471)

The operations will also be subject to the Radiation Protection Act (2018:396) and the Accident Prevention Act (2003:778) and related regulations.

Large sections of the planned operational area are subject to zoning. As a result of the planned operations, existing zoning plans will need to be revised and/or replaced by one or more new zoning plans. The process of revising and/or replacing existing zoning plans will take place separately and alongside the forthcoming permitting process. In addition, a building permit is required for the development of the operations under the Planning and Building Act (2010:900).

Areas in the Biskopshagen Nature Reserve will also be utilised for the operations and will therefore need to be occupied.

3. Planned operations

This section provides preliminary and summary information on the planned operations. Work is currently underway to investigate the technical and financial conditions for the planned operations, which will form the basis for the detailed design of the operations. Vattenfall intends to report further information about the design of the operations, and prepare preliminary assessments of the impact of the operations on human health and the environment, at a later stage of the permit process.

The following section describes initially the development and erection phase, followed by the characteristics of the nuclear reactors, how cooling water will be supplied, the need for backup power, and the management of waste and spent fuel. It also describes how control, monitoring and supervision of the planned operations will be carried out.

3.1. Development

The development of the planned operations will start with ground preparation measures to create a level and stable foundation with the correct height. This work is estimated to take approximately two years and will involve blasting the bedrock, building cooling water structures, filling and levelling the area, etc. The ground level varies relatively widely across the area, from approximately 4–30 metres above sea level. The levelled ground level on which the plant will be situated takes into account normal water level variations resulting from prevailing weather patterns and expected sea level rises caused by climate change. It is likely that the ground level for the plant will be somewhere between four and six metres above sea level.

The soil and rock masses generated during the construction phase will primarily be utilised within the project, or transported to nearby reception facilities where the masses will primarily be reused, then recycled and, as a last resort, disposed of. Rock crushing may take place on site. After ground preparation, connections to water and electricity will be provided in the construction area.

Construction work, consisting of laying the foundations and erecting buildings such as reactor buildings and turbine buildings will then begin. Finally, system components will be supplied. The erection and installation work for each nuclear reactor is estimated to take approximately four to six years. The small modular reactors, described in section 3.2, each take a shorter time to build and commission than the large reactors.

Vattenfall will also build its own workshops for maintenance and servicing, new storage and warehouse buildings, and premises for other support activities that may be needed, such as emergency services and security. Coordination with Ringhals AB regarding emergency preparedness may take place in cases where it is possible and considered appropriate.

Construction materials and components will be transported to the site by lorry or by ship. During the construction period, temporary storage and assembly areas will be needed within and adjacent to the construction site. The exact location of the temporary storage and assembly areas has not yet been decided, but these areas may need to be located in neighbouring local authority areas. Roads and storage areas will be paved or otherwise hardened.

Additional space in the immediate area is needed for, for example, parking spaces, crew sheds and temporary accommodation for the contractors hired during construction. Up to 10,000–12,000 people may be employed during the construction phase if large reactors are built.

Intake and discharge of cooling water will take place via existing or newly constructed infrastructure. Work in and adjacent to the water will, depending on needs and conditions, be carried out through blasting, excavation, dredging, filling and/or casting or similar measures.

Construction work will continue every day, around the clock. The construction site will be fenced and floodlit.

The construction, installation and commissioning of the planned operations are estimated to take approximately 10 years. Construction for ground preparation work is expected to begin in the second half of the 2020s, provided that the necessary permits have been issued and investment decisions made.

Construction work will be carried out in accordance with current legislation, and Vattenfall will work to minimise disruption.

3.2. Nuclear reactors

Nuclear reactors constitute the central part of the planned operations. Vattenfall plans to build and operate two large nuclear reactors, or three to five small modular nuclear reactors, with a combined electrical output of up to 2,800 MWe (equivalent to no more than 8,400 MW heat output).

Each nuclear reactor will consist of a reactor and a turbine section. The nuclear reactors will also be independent of each other, but will share services such as seawater intake, maintenance workshops, waste management, etc. The operation of the nuclear reactors will be managed by an on-site operating organisation. Operation includes recurring fuel replacement. .

3.2.1. Evaluated reactor types

The nuclear reactors will be based on proven light water technology and will incorporate the latest developments in terms of safety and performance. Light water technology is available today as large reactors and small modular reactors. Vattenfall has evaluated both of these designs and is continuing to investigate which type of reactor and how many reactors will be built as part of the planned operations.

The suppliers of light water technology that Vattenfall has deemed suitable for the planned operations offer large reactors, in the form of pressurised water reactors, with an approximate electrical output of 1,200–1,400 MWe and small modular reactors, in the form of boiling and pressurised water reactors, with an approximate output of 300–500 MWe. Unlike small modular reactors, large reactors are in operation around the world today, and there is experience of how these are designed and built. In addition to the lower power, small modular reactors are characterised by being designed with a focus on modularity, scalability and simplicity, which allows them to be mass-produced and be more cost-effective than traditional large reactors.

What the evaluated reactor types have in common is that they, regardless of size, are based on reliable, proven technology but with further modernisations. Modern reactors feature simplified but robust and reliable design solutions and utilise standardised components to a greater extent compared to existing nuclear power reactors. Operating characteristics have also been improved through, in particular, longer estimated operating time, higher availability and the possibility of flexible operating cycles. Further innovations that occur among the evaluated reactor types include, for example, the possibility of placing reactor buildings partially underground, which increases resistance to natural phenomena. The evaluated reactor types also use passive safety systems, to varying degrees, for emergency cooling of the reactor and containment, reducing the need for separate motive power, such as electricity, to operate.

3.2.2. Function and technical characteristics

The nuclear reactors considered for the planned operations will be based on light water technology, meaning that enriched uranium is used as fuel and that normal water is used as coolant and moderator.

Light water technology comes in two designs: boiling water or pressurised water reactors. The basic principle is the same for both. Nuclear fission takes place in the reactor. A neutron is sent towards a uranium atom whose nucleus splits and new neutrons are released. These can in turn split more uranium nuclei and a chain reaction occurs. Nuclear fission releases energy that is used to evaporate water. The steam generated can be used in a turbine plant to generate electricity.

In a boiling water reactor (BWR), the uranium fuel is split in the reactor vessel, which generates heat. The control rods regulate the power depending on the position and water flow. The heat generated from nuclear fission causes water to

boil and steam to form. The steam is directed to the turbine plant, which causes the turbine to rotate. A generator is connected to the turbine shaft and electrical energy is generated during rotation. Using cooling water from the sea, the steam is cooled down and converted into water in the condenser. The water is pumped back into the reactor to cool the fuel. Cooling water from the sea is released via a tunnel back into the sea. The process is illustrated in Figure 3.

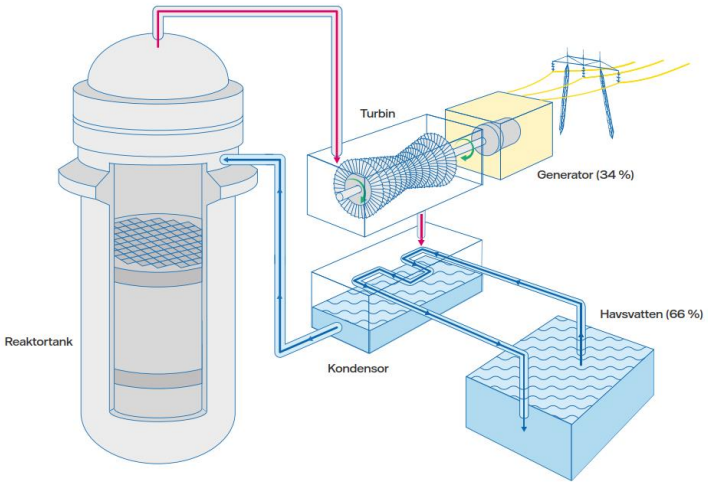


Figure 3. Schematic diagram of a boiling water reactor. (Ringhals AB).
Reaktortank – Reactor tank
Turbin – Turbine
Generator – Generator
Havsvatten – Seawater
Kondensor – Condenser

In a pressurised water reactor (PWR) there are two cooling water circuits; a primary circuit and a secondary circuit. The control rods regulate the power depending on the position and water flow. The water in the primary circuit is heated by nuclear fission in the reactor vessel but is prevented from boiling by keeping the pressure high. The water from the primary circuit heats the water in the secondary circuit in a heat exchanger, also called a steam generator. The water in the secondary circuit boils and the steam formed is directed to one or more turbines. Low-pressure steam from the turbine is then fed to the condenser for cooling using cooling water from the sea, after which the condensate formed is pumped back to the steam generator. The water in the primary circuit is pumped back to cool the core. Cooling water from the sea is released via a discharge tunnel back into the sea. The process is illustrated in Figure 4.

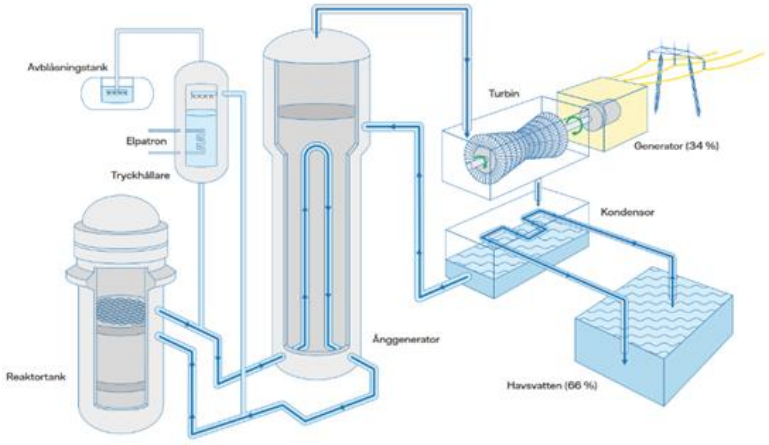


Figure 4. Schematic diagram of a pressurised water reactor. (Ringhals AB).

Vattenfall is investigating possible reactor types, i.e. both large reactors and small modular ones. Table 1 shows the overall technical characteristics of the planned operations based on the reactor types being investigated.

Table 1. Summary of overall technical characteristics

Technical characteristics	
Electrical power:	Approximately 1,500–2,800 MW
Annual energy output:	Approximately 12–23 TWh
Fuel quantity (uranium oxide):	Approximately 250–500 tonnes
Fuel consumption:	Approximately 35–70 tonnes/year
Heat output:	Approximately 4,000–8,400 MW
Backup power demand:	Approximately 20 MWe–110 MWe
Cooling water demand	Approximately 80–120 m^3/s

3.2.3. Nuclear safety and radiation protection

Regardless of which type of nuclear power reactor Vattenfall chooses, the planned operations will be conducted in such a way as to ensure a high level of safety and compliance with legal requirements.

The safety of a nuclear reactor is based on what is known as the defence-in-depth principle, which aims to eliminate the harmful effects of ionising radiation. These issues are governed by the Nuclear Activities Act and the Radiation Protection Act, as well as regulations issued by the Swedish Radiation Safety Authority. The defence-in-depth principle applies several successive technical, organisational and manual measures to minimise the discharge of radioactive effluents into the environment and the harmful effects of radiation.

Defence in depth, as defined by the Swedish Radiation Safety Authority (SSM), is divided into five levels for the purposes of:

- Preventing operational disruptions and other errors through quality design, stable operation and adapted maintenance.
- Detecting and monitoring operational disturbances to ensure they do not result in accidents and that the nuclear reactor can be restored to normal operation.
- Minimising the effects of accidents and preventing extensive fuel damage.
- Ensuring that radioactive releases caused by accidents involving extensive fuel damage are as low as reasonably achievable.
- Mitigating the effects of radioactive discharges.

The design of the nuclear reactor and the organisation of its operations help to build defence-in-depth and combine to maintain radiological safety and radiation protection.

The nuclear reactor is designed with several physical barriers, which are included as part of defence in depth to prevent or delay the discharge of radioactive effluents into the environment. The multi-barrier principle means that if one barrier fails, the next one will come into play. There are four physical barriers around the nuclear fuel in the core:

- The fuel (which binds most of the radioactive effluents).
- The fuel cladding tube.
- The reactor vessel with associated piping system.

- The reactor containment

The effectiveness of the physical barriers is ensured by the safety features of the nuclear reactor, which include : reactivity checks (e.g., the ability to quickly shut down the reactor), removal of heat from the reactor and fuel storage, and containment of radioactive material (checks of planned radioactive discharges and limitations of accidental radioactive releases).

The safety features are present to varying degrees in the defence-in-depth level They are ensured, in particular, by systems and components manufactured and tested against strict quality standards.

The capacity of the nuclear reactor's barriers and safety features is verified by means of a safety analysis and is reported by the permit holder in a radiation safety report. Said report also details effects in the form of discharges into the environment during normal operation, operational disruptions and accidents.

In addition to the barriers above, there are other design safeguards that prevent and limit exposure to ionising radiation. This is achieved by the building being equipped with thick radiation shields made of concrete or lead. In addition, physical protection is installed to protect against theft and other unauthorised handling of nuclear material and other radioactive effluents. The physical protection also prevents access to the facility by unauthorised persons.

The operations will be designed based on current requirements. Any effects regarding ionising radiation during normal operation and unexpected events will be described and assessed in a future environmental impact assessment.

3.3. Support activities

3.3.1. Water activities

The plant will require a cooling water intake of no more than 120 m^3 of seawater per second. Plans are to deploy the intake in the northern section of the planned operational area.

Cooling water intake will be made possible through surface water intake, deep water intake or a combination of surface and deep water intake. To prevent large objects such as driftwood and ice from being brought in from the sea through surface water intake, a foam barrier extending a little below the surface of the water or another solution with the same function will be built at the intake point. At a surface water intake, the water temperature varies over the year from approximately 0ºC to 25ºC, which affects the efficiency of the plant. At a deep water intake, the water temperature is relatively stable throughout the year. For a deep water intake, either a blasted/drilled tunnel or bottom-laid pipes are required. The intake will be supported by equipment that allows water to be supplied from the bottom via an intake caisson.

Regardless of the type of water intake, the cooling water will be channelled into a basin and then filtered in several stages to separate unwanted material such as seaweed, fish, jellyfish, etc. Large material will be separated using a cleaning screen or similar, while smaller particles will be separated using a fine screen followed by a screening machine. The water will then be channelled via an underground tunnel or via an open cooling water channel to the turbine building

used to condense steam. The waste that accumulates in grids and screening machines will be collected in chutes and flushed out with seawater. As far as possible, the flushing water will be returned to the sea. However, large amounts of sewage tend to accumulate periodically, mainly during summer/autumn or during storms. To prevent it from reinfiltrating the intake building, it may be necessary to drain the sewage into special basins. Chlorine or an equivalent agent will also be added to reduce the growth of marine organisms in the cooling water.

Used cooling water will be returned to the recipient using existing infrastructure in the area or newly built tunnels. Cooling water can be distributed via open channels or blasted tunnels. The exact location and design of the discharge system is currently being investigated.

Groundwater will be drained during the construction and operational phases. The extent to which groundwater will be diverted is currently being investigated. Small areas of water within the operational area will be filled in. Work in water areas will also be required for the development of the operations, including for any new plant components required for water extraction and discharge. Groundwater and stormwater, for example, will be reinfiltrated.

3.3.2. Backup power

To ensure electrical power to the reactors and other prioritised systems if the power supply is cut off, backup power systems in the form of, for example, batteries, diesel/gasoline/HVO generators or gas turbines will be installed. The backup power systems will be tested regularly. They will have an output of up to approximately 10 MWe each and a total rated input power of approximately 20–110 MW.

3.3.3. Sodium hypochlorite production

Hypochlorite is a possible operating chemical that could be produced at the plant through seawater electrolysis.

Hypochlorite can be used to reduce the growth of marine organisms in cooling water systems to ensure a continuous and adequate supply of cooling water and thereby prevent disruptions to the process.

3.3.4. Waste management

Waste management in planned operations will be based on the EU’s waste hierarchy, which has been transposed mainly through Chapter 15 of the Environmental Code. In line with the order of priority laid down by EU waste legislation, waste should initially be prevented, secondly reused, thirdly recycled, fourthly used to recover energy and finally landfilled. Any waste that continues to be generated by the operations after preventive measures have been put in place will be managed and classified based on established procedures.

Construction is expected to generate large quantities of packaging waste, etc., which will be sorted for further processing by authorised recipients. For

management of soil and rock masses, see chapter 3.1. A mass management plan will be developed.

Both hazardous and non-hazardous waste that is not radioactive will be managed and temporarily stored in buildings or on adapted areas within the operational area. Waste will then be disposed of by an approved transporter and recipient.

During the operation of the nuclear power plant, radioactive waste will be generated in addition to conventional waste. A nuclear power plant is divided into different zones based on the risk of ionising radiation. Areas where there is a risk of ionising radiation are called *controlled areas*. Any waste that is generated outside a controlled area constitutes conventional waste. Conventional waste may be both non-hazardous and hazardous waste and will be managed in accordance with current regulations and delivered to transporters and recipients who hold the necessary permits.

All waste generated within a controlled area is classified as radioactive waste and is managed as if it were contaminated. Measurements are made of the waste's radioactivity, which forms the basis for its classification. Radioactive waste is classified based on two criteria: dose rate and half-life. Waste that is deemed to be reclassifiable is sorted out, decontaminated, if necessary, and measured for inspection purposes. Clearance means that the rules stemming from the Radiation Protection Act do not need to be applied, since the risks of radioactive contamination are so small that they can be considered negligible. If the contamination level post-measurement is below the limit values defined by the Swedish Radiation Safety Authority, the material may be cleared and then managed as conventional waste. For cleared conventional waste from operations, the focus is on waste being primarily prevented, secondarily reused, thirdly recycled, fourthly used for energy recovery and finally landfilled.

Radioactive waste is categorised based on its activity content and can be roughly divided into four groups: very low-level short-lived waste, short-lived low- and intermediate-level waste, long-lived low- and intermediate-level waste and high-level waste. High-level waste consists of spent nuclear fuel only when it has been placed in a repository.[3] why this is not covered by planned operations.

3.3.4.1. Very low-level short-lived waste

The radiation intensity in this waste is so low that after sorting it can be deposited in an external landfill, or alternatively managed by, for example, melting or combustion at another facility. The waste in this group consists, for example, of compactable waste (paper, wood, plastic, fabric, etc.) , non-compactable waste (concrete, construction waste, pipes, sheet metal, scrap iron, cables, etc.) and ion exchange resins and sludge.

3.3.4.2. Short-lived low- and intermediate-level waste

Short-lived low- and intermediate-level solid waste consists primarily of waste from maintenance work and replaced components as well as rags, gloves, protective equipment and disposable items. These types of waste are currently handled at existing nuclear power plants primarily through compaction or

[3] see Article 2, point 3 of the Nuclear Engineering Act

segmentation to reduce volume and then packaged in approved packaging. A certain portion of the short-lived low-level waste can also be handled by melting or combustion at another facility before being packed in suitable packaging. For short-lived intermediate-level waste, there are requirements that the waste must be encapsulated.

The waste is temporarily stored after being packed in suitable packaging for a period of time before being sent in special transport canisters to a repository for short-lived radioactive waste.

Liquid-borne short-lived low- and intermediate-level waste that may result from the purification of process water consists primarily of ion-exchange resins, evaporator concentrates and sludge. Ion-exchange resins and sludge are pumped into tanks where they are stored pending further processing. Wastewater is evaporated and the concentrate collected in tanks pending further processing, but other alternative methods of concentrating liquid waste may also become relevant. The waste is then stabilised in designated packaging to enable final disposal at another facility.

3.3.4.3. Long-lived low- and intermediate-level waste

Some long-lived low- and intermediate-level waste is generated, mainly during decommissioning, but components close to the reactor may also become neutron-induced and need to be managed as long-lived waste during a replacement, for example.

The waste will temporarily be stored within the operational area pending further processing and final disposal.

3.4. Checks and monitoring

3.4.1. Checks pursuant to the Environmental Code and Seveso legislation

Under the Environmental Code, the responsibility for protecting human health and the environment from damage and inconvenience caused by an environmentally hazardous activity lies with the party conducting the activity. This means that the operator must carry out specified checks and that a regulatory authority must supervise such checks. In addition, an activity that is subject to a permit under Chapter 9 or Chapter 11 of the Environmental Code is covered by the Operators (Self-Monitoring) Regulations (1998:901).

Activities covered by the Seveso legislation must, in accordance with Article 10 of the Seveso Act, prepare a safety report with related documents in accordance with Article 9 of the Seveso Regulations.

The County Administrative Board will be the regulatory authority for environmentally hazardous activities, Seveso activities and water activities.

Vattenfall will draw up a proposal for a self-monitoring programme for the external environment. The programme will describe how the environmental impact of the

activity, and the conditions imposed by the Property and Environmental Affairs Chamber (PEAC), will be monitored. Checks cover both the construction period and the operational period and must be communicated to the regulatory authority (the County Administrative Board of Halland) before they are performed.

3.4.2. Checks pursuant to the Nuclear Activities Act and the Radiation Protection Act

Anyone who conducts nuclear activities is responsible for safety and radiation protection and must carry out specified checks. The Swedish Radiation Safety Authority monitors this process.

Vattenfall will draw up a programme for local environmental monitoring that will include, in particular, procedures for monitoring discharges of radioactive effluents into air and water and the monitoring of radioactive effluents in the environment. Radiological consequences for the environment and people in the vicinity of the nuclear power plant as a result of these discharges will be evaluated.

Sub-programmes that concern monitoring of radioactive effluents in the environment must be approved by the Swedish Radiation Safety Authority before being applied. The Swedish Radiation Safety Authority also conducts its own random sample examinations and monitors the results.

4. Related activities

The following section describes activities that relate to the planned operations, but are not covered by it.

4.1. Electrical system

The planned operations will produce electricity for the Swedish national grid. The connection points to the existing 400 kV switchyard are located approximately 1.5 km east of the planned operational area.

Additional switchgear will be required to connect the operations to the national grid. Switchgear will be built near the plant and connected to outgoing lines that in turn connect to the main grid at the existing 400 kV switchgear facility east of the Ringhals Nuclear Power Plant. The facility is connected to the main grid through underground cables, overhead lines or a combination of these.

In addition to connection to the 400 kV grid for the output of electrical power, the facility may require connection to the 132 kV grid for independent input. The line will be laid underground or via overhead lines from nearby 132 kV switchyards.

Switchgear and connecting lines are facilities subject to a concession under the Electricity Act (1997:857).

4.2. External management of spent nuclear fuel and nuclear waste

Spent nuclear fuel will temporarily be stored in the facility's fuel pools, while low- and intermediate-level nuclear waste will be stored in planned operations on an interim basis, in accordance with the criteria set out in section 3.3.4. Subsequent management of nuclear waste and spent nuclear fuel, such as interim storage by an external party and final disposal, is not covered by the planned operations and will therefore not be subject to impact assessment as part of the permit applications. However, the principles for interim storage and final disposal will be described in brief in the application documents.

Under the Nuclear Activities Act and the Radiation Protection Act, Swedish nuclear power companies are required to manage their radioactive waste. Today, this is done by Svensk Kärnbränslehantering AB (SKB), a company owned by Sweden's nuclear power companies. Vattenfall will follow the rules in place to ensure that resources are allocated for the disposal of radioactive waste generated. Holders of permits for nuclear reactors are required to pay a fee to the Nuclear Waste Fund, which is managed by the Swedish National Debt Office. The funds in this fund will cover the cost of nuclear waste disposal, among other costs. In addition, companies provide financial collateral to manage a possible situation where the fund's funds are not sufficient. In the autumn of 2023, the government appointed an inquiry group to analyse, in particular, the need for any changes to the system used to manage nuclear waste and spent nuclear fuel from new nuclear power (Dir. 2023:155). The inquiry group will present proposals in that regard on August 29, 2025. The government has also commissioned the Swedish National Debt Office in the spring of 2024 to investigate the need for any changes to regulations governing the financing of the disposal of nuclear waste when new nuclear reactors are being developed. Particular importance should be placed on ensuring that the regulations do not prevent reactors on new sites, new actors or actors with waste from new reactor types from establishing themselves. The group has been tasked with preparing a report and submitting it by 31 August 2025 at the latest. Vattenfall will follow the inquiry group's work.

Currently, the existing system for the disposal of radioactive waste and spent nuclear fuel consists of the Central Interim Storage Facility for Spent Nuclear Fuel (Clab) in Oskarshamn, the Repository for Short-Lived Radioactive Waste (SFR) in Forsmark and related transport systems. There are plans to add more facilities to the current system, including a facility for final repository of spent nuclear fuel and a repository for long-lived waste (SFL). In addition, a new encapsulation facility will be built in the vicinity of Clab. Clab, along with the encapsulation facility, will constitute Clink. The existing system for managing radioactive waste and spent nuclear fuel, as well as planned facilities, is shown in Figure 5.

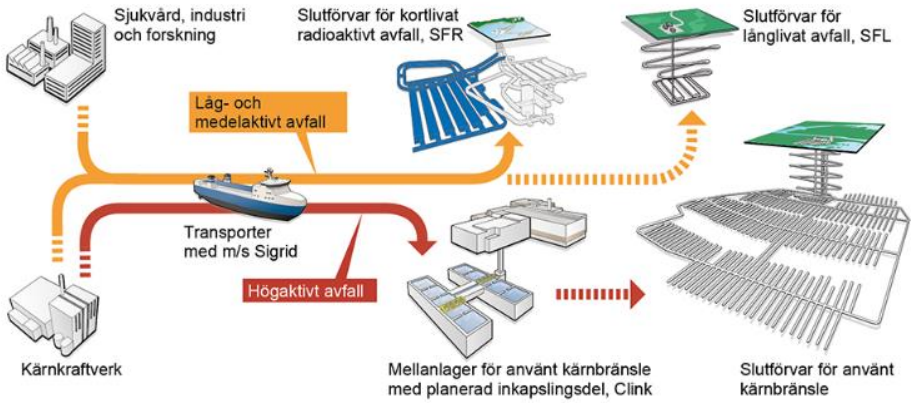


Figure 5. The existing system for managing radioactive waste and spent nuclear fuel. The blue rock chambers in SFR, the encapsulation facility adjacent to Clab and SFL, and the final repository for spent nuclear fuel are facilities that have yet to be built (Svensk Kärnbränslehantering AB).

The planned operations will be aligned with the existing system for managing radioactive waste and spent nuclear fuel, but new facilities with their own permits will need to be established. However, this is not included in the planned operations.

4.3. Decommissioning

The lifespan of planned reactors is estimated at 60–80 years. When electricity generation ceases, decommissioning work begins. Decommissioning refers to everything from permanently shutting down the reactor, removal of spent fuel, phased demolition, cleaning, storage and removal of demolition materials and radioactive waste to restoration of the area. The operator is required to have a preliminary plan for decommissioning, and such a plan will be developed by Vattenfall. The purpose of the plan is to ensure that radiation protection aspects such as radiation doses, discharges of radioactive effluents and waste quantities are taken into account during decommissioning.

Decommissioning a nuclear reactor is an activity that in itself requires a permit under the Environmental Code. This means that the operations sought do not include future decommisioningclosure. When relevant, this matter will be managed separately. Decommissioning will therefore not be included in impact assessments for the planned operations, but will be described in brief in the application documents.

5. Alternative

5.1. Zero alternative

An environmental impact assessment must, among other things, include a description of how the current state of the environment is expected to change in the future if the intended activity does not take place, a so-called *zero alternative*. The purpose of reporting the zero alternative is to provide a basis for evaluating what change the activity or measure entails from an environmental point of view.

The zero alternative in this case consists of the planned operations not being established at the site.

One consequence of the operation not coming to fruition is that the planned addition of predictable and fossil-free electricity production from the operation in the mid-2030s will not occur. This means an increased risk that the production of electricity in Sweden will not be sufficient to meet the increased demand that is expected to occur in the coming decades as a result of, among other things, electrification and the green transition of industry.

5.2. Alternative localisation

Under the Environmental Code's localisation principle (Chapter 2) Article 6 states that for an activity or measure that uses a land or water area, a location must be chosen that is suitable with a view to achieving the purpose with the least interference and inconvenience to human health and the environment. Under Article 17 of the Environmental Assessment Regulations, the environmental impact assessment must, among other things, contain information about possible alternative locations and the reasons why the selected location has been chosen over other alternatives.

A location investigation has been carried out at an early stage to identify a suitable location for the facility, taking into account that the purpose of the operation can be achieved with the least interference and inconvenience to human health and the environment, in accordance with the general rules of consideration in the Environmental Code. Balances have also been made between conflicting interests in accordance with the Planning and Building Act (2010:900).

The location study investigated possible locations for the planned operations based on several criteria, including space requirements, access to infrastructure and electricity grids, and proximity to the coast. The location alternatives that met the basic criteria were further evaluated in an in-depth investigation.

In the in-depth investigation, the location alternatives were evaluated based on, among other things, how much untouched land would need to be used by the operation, the impact on national interests and other protected natural areas, distance to housing, and more. Based on a balanced assessment of all relevant aspects, a location on the Värö Peninsula, directly west and southwest of the Ringhals Nuclear Power Plant, was deemed to be the most suitable, taking into account that the purpose should be achieved with the least interference and inconvenience to human health and the environment.

The completed location investigation will be described in more detail in the upcoming environmental impact assessment.

5.3. Alternative design

Under Chapter 2, Article 3 of the Environmental Code, the best possible technology must be used to prevent an activity from causing damage or inconvenience to human health and the environment. Evaluation of various suppliers for the nuclear facility is underway and the upcoming environmental

impact assessment will contain a report on alternative technologies for and designs of the planned operations. The presentation of alternative technologies will focus on the design of necessary facilities and measures that are relevant based on environmental impact.

The planned operations are considered to be covered by Chapter 21, Article 9 of the Environmental Assessment Regulations (activity code 40.50-i). The operation is therefore also considered to be covered by the Industrial Emissions Regulations (2013:250). For combustion plants to be covered by the conclusions on best available techniques for large combustion plants (BAT-LCP), the criterion stated is that the total rated input power must be at least 50 MW. When assessing the total power, a total of installed input power shall be calculated for all combustion units that have an installed input power of at least 15 MW. Planned reserve power units will each have an installed input power of less than 15 MW, which means that the operation is not considered to be covered by BAT-LCP . Instead, the planned operations are covered by the Regulations (2018:471) on Medium Combustion Plants (FMF), which implement Directive 2015/2193/EU on the limitation of emissions of certain pollutants into the air from medium combustion plants (MCP Directive).

The activity is also considered to be covered by BREF[4] -documents Energy Efficiency and Industrial Cooling Systems. The BREF document Energy Efficiency was adopted by the European Commission in February 2009. The document is a cross-cutting document that covers energy efficiency in several different industrial sectors. The aim is to provide general indications on energy efficiency technologies that can be considered as a suitable reference point. The BREF document Industrial Cooling Systems was adopted by the European Commission in December 2001. The document is a cross-cutting document that covers the use of cooling systems in several different industrial sectors. The document only covers cooling systems that use air and/or water for heat exchange.

Any applicable and relevant parts of the conclusions on best available techniques under the Industrial Emissions Directive (2010/75/EU) will be reported in the upcoming application and environmental impact assessment.

6. Environmental conditions

6.1. Environment

The operations are planned to be located within about ten properties, directly west and southwest of the Ringhals Nuclear Power Plant, on the Värö Peninsula in the Varberg Local Authority Area. The properties currently include permanent residences, holiday homes and agricultural properties. The majority of the properties are owned by Vattenfall and are rented or leased to private individuals and the Swedish University of Agricultural Sciences (SLU). The planned operational area and its surroundings are shown in Figure 6. The operational area is assessed to be larger than the area required for future operation of nuclear activities. In addition, temporary storage and assembly sites outside the operating area may be needed during the construction period.

[4] BREF = best available techniques reference document

Bua and Väröbacka are the closest urban areas located just over 1 km and approximately 4.5 km from the planned location, respectively. The towns of Skällåkra and Gloppe are located approximately 1-1.5 km from the planned location.

On the other side of Båtafjorden in Bua, about 2 km south, there is a preschool and school. There is also a landscaped playground and sports field. In Limabacka, about 5 km to the southeast, there is a retirement home.

In Båtafjorden is Videbergshamn, which consists of a recreational harbour and a harbour belonging to Ringhals AB. The part of the port that belongs to Ringhals AB is used primarily for the importation of fuel and the exportation of radioactive waste, but is also used for other types of goods and by other companies. There is a public road between the Ringhals Nuclear Power Plant and the harbour.

Traffic in the local area consists mostly of transport to and from the Ringhals Nuclear Power Plant and the neighbouring community of Bua. The nearest major road is the E6 between Malmö and Gothenburg, located approximately 6 km east of the planned operation. Road 848, as well as road 850 and road 847, run from road E6 to the planned operational area.

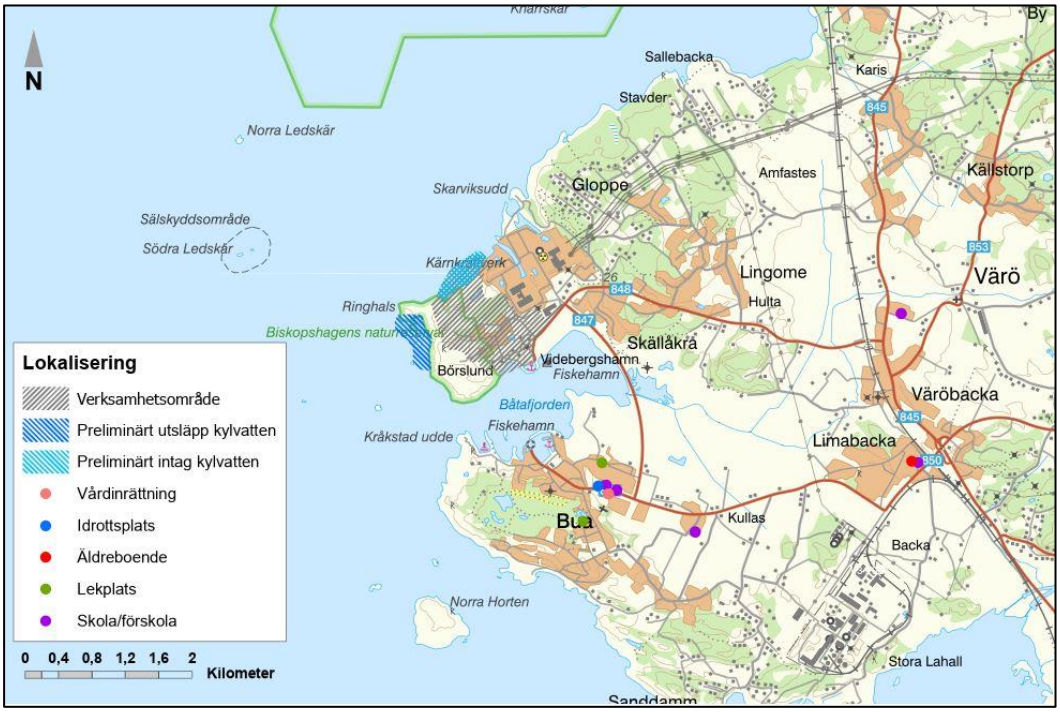


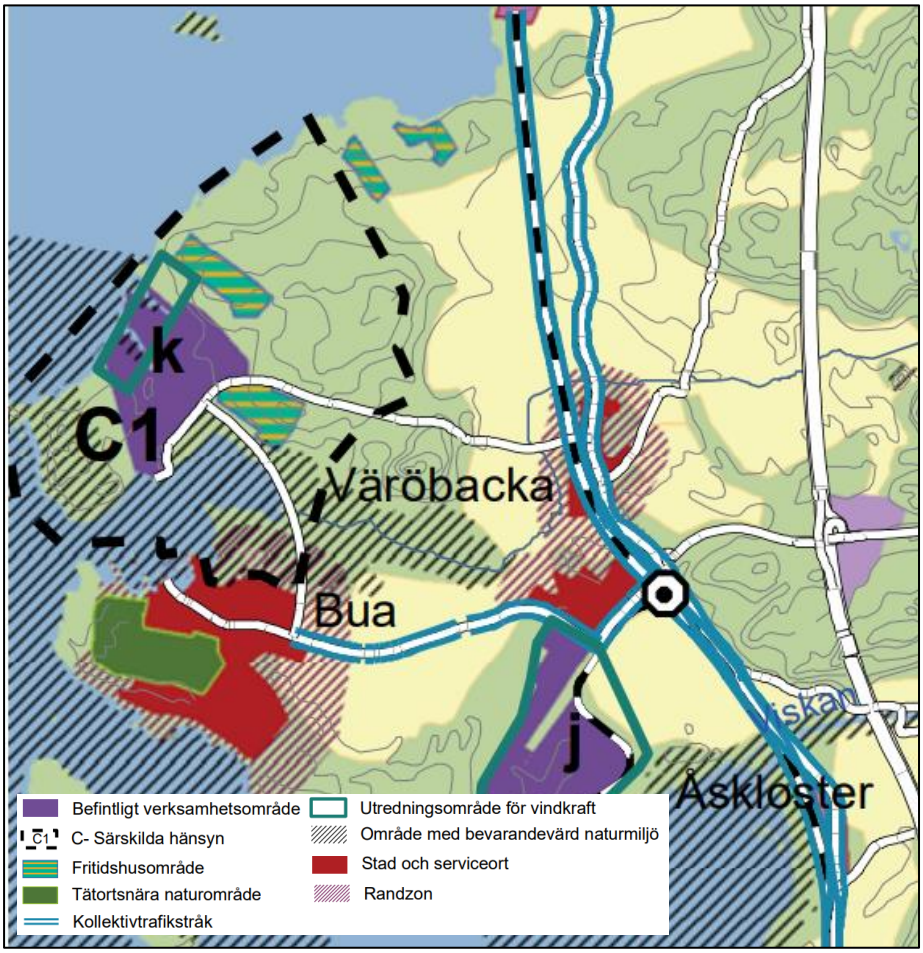
Figure 6. Map of the operational area and surroundings (Lantmäteriet).
Lokalisering – Localisation
Verskamhetsområde – Area of operation
Preliminärt utslapp kylvatten - Preliminary cooling water discharge
Preliminärt intag kylvatten - Preliminary intake of cooling water -
Vårdinretning - Care facility
Idrotsplats - Sports centre
Äldreboende - Retirement home

Lekplats - Playground
Skola/Förskola - School/Preschool

6.2. Planning document

6.2.1. Comprehensive plan

The planned area of operation is located within an area that in the Comprehensive Plan for the Varberg Local Authority (adopted on 15.06.2010), is designated as "*Ringhals Nuclear Power Plant and Its Surroundings*"[5] . According to the master plan, in the surrounding areas of Lingome, western Båtafjorden and northern Biskopshagen, very strict restrictions must be observed when examining buildings and other measures with regard to the nearby nuclear power plant. The County Administrative Board shall therefore, taking into account the protection area around the Ringhals Nuclear Power Plant and the health and safety of the residents, specifically examine issues regarding building permits and prior approvals in these areas. Figure 7 shows part of the land and water use map for the current comprehensive plan.



5 Comprehensive Plan for Varberg Local Authority, adopted by the City Council on 15.06.2010.

Figure 7. Land and water use map (Comprehensive Plan for Varberg Local Authority, revised by WSP).

Befintligt verksamhetsområde	Existing activity area
C- Särskilda hänsyn	C- Special considerations
Fritidshusområde	Holiday home area
Tätortsnära naturområde	Nature area close to the city centre
Kollektivtrafikstråk	Public transport route
Utredningsområde för vindkraft	Study area for wind power
Område med bevarandevärd naturmiljö	Area with a natural environment worth preserving
Stad och serviceort	Town and service centre
Randzon	Peripheral zone

Varberg Local Authority adopted an in-depth master plan for the Northern Coast on 14.02..[6] which covers the area of the planned operations. The goal of the detailed master plan is long-term sustainable development and to enable a good living environment, a good business environment, and to protect and make accessible natural and recreational areas. The detailed master plan includes a plan proposal with specifically identified development areas. The closest designated development area from the planned area of operation is Bua.

Work is underway to develop a new master plan for Varberg Local Authority that will extend until 2050.

6.2.2. Zoning plans

Large parts of the planned operational area are covered by the current zoning plan for Ringhals (VÄ56). Parts of the coastal area covered by VÄ56 were updated with a new zoning plan in 2010 to enable the establishment of wind power (VÄ94). The zoning plans are presented in Figure 8 below.

6Comprehensive Plan for Varberg Local Authority – An In-Depth Comprehensive Plan for the Northern Coast, adopted by the City Council on 14.02.2017.

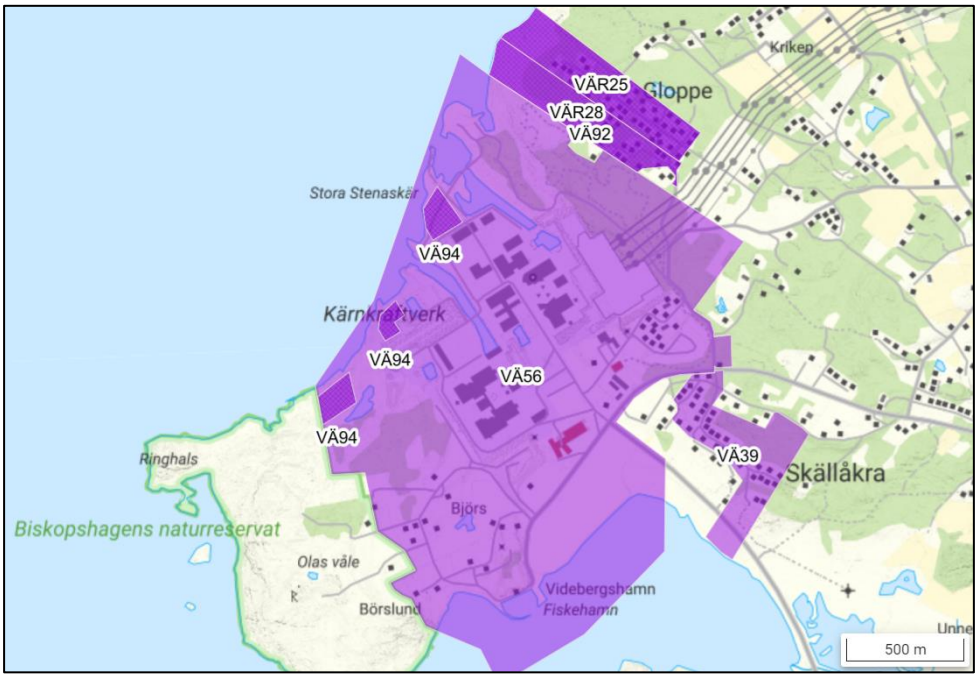


Figure 8. Existing zoned areas (Varberg Local Authority Area).

A detailed planning process has been initiated in parallel with the environmental assessment process to amend existing zoning plans and/or prepare one or more new detailed plans to enable the planned operations.

6.3. National interests

The Environmental Code contains provisions on how land and water should be protected and used. Certain areas are classified as being of national interest, either to protect the areas from exploitation or to ensure that they can be used for a specific, important purpose. Within and in the immediate area surrounding the planned area of operation, there are national interests covered by Chapters 3 and 4 of the Environmental Code, see Figure 9 and Table 2.

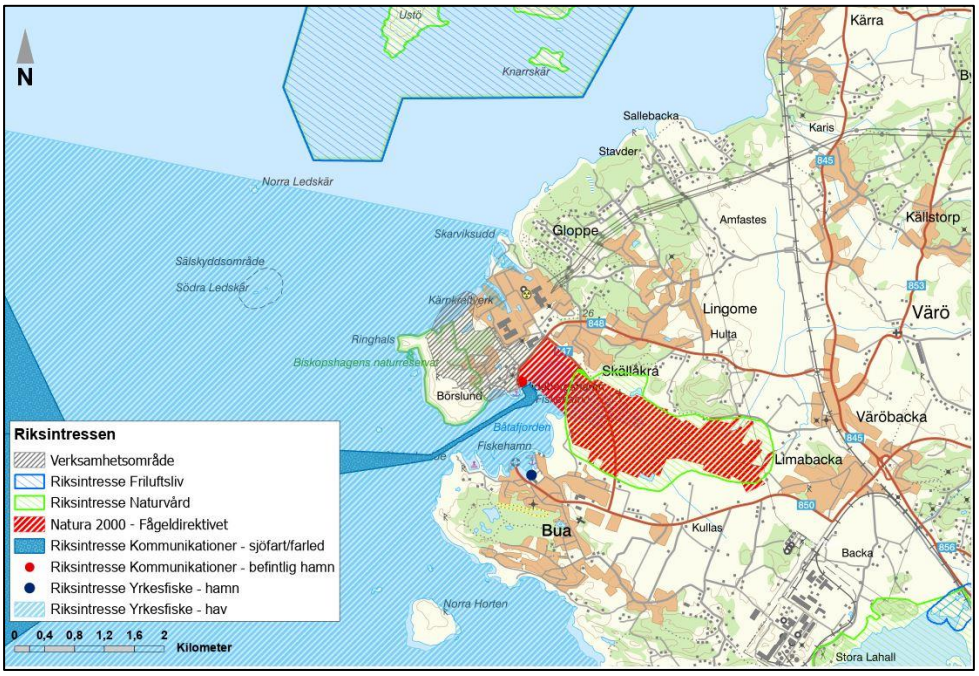


Figure 9. Identified national interests within and in the immediate area surrounding planned operations. National interests covering the entire area shown have been excluded from the map. National interest in active outdoor recreation and highly exploited coasts is therefore not visible in the figure. Areas of national interest for energy production and energy distribution are classified and the extent of these areas is therefore not shown in the figure. (Lantmäteriet, County Administrative Board's geodatabase).

Riksintressen	**National interests**
Verksamhetsområde	Field of activity
Riksintresse Friluftsliv	National interest Outdoor life
Riksintresse Naturvård	National interest Nature conservation
Natura 2000 - Fågeldirektlvet	Natura 2000 - Birds Directive
Riksintresse Kommunikationer – sjöfart/farled	National interest Communications - shipping / waterway
Riksintresse Kommunikationer - befintlig hamn	National interest Communications - existing harbour
Riksintresse Yrkesfiske - hamn	National interest Commercial fishing - harbour
Riksintresse Yrkesfiske - hav	National interest Commercial fishing - sea

Table 2. A general description of national interests in and around the area directly surrounding the planned activity.

National interest	Title	Distance from the planned operations	Description of the protection value
Energy production (Chapter 3 of the Environmental Code)	Ringhals-Värö Peninsula, Varberg	Overlapping	Ringhals/Värö Peninsula consists of a land and water area that enables large energy and power supplies, has a strategic location for energy conversion and is of great importance for security of supply. The area's strategic location and access to infrastructure also make it possible to contribute important balance and regulatory power to the system.
Energy distribution (Chapter 3 of the Environmental Code)	Ringhals	Overlapping	Connection lines from areas of national interest for energy production to the national grid.
Active outdoor life (Chapter 4 of the Environmental Code)	Halland's coastal area	Overlapping	Area with particularly high values for tourism and active outdoor activities.
Highly exploited coast (Chapter 4 of the Environmental Code)	Halland's coastal area	Overlapping	Coastal and archipelago area with great conservation value. Establishment of environmentally disruptive facilities may take place in places where similar operations already exist.
Commercial fishing (Chapter 3 of the Environmental Code)	South Nidingen	Overlapping	Fishing area for lobster and herring/European sprat.
Natura 2000 (Chapter 4 of the Environmental Code)	The Boat Fjord	Adjacent	Coastal beach meadow with rich bird life.
Communications – Shipping/Fairway (Chapter 3 of the Environmental Code)	The entrance to Ringhals	Adjacent	Public waterway.
Communications – Port (Chapter 3 of the	Ringhals harbour	Adjacent	Port of central importance.

Environmental Code)			
Commercial fishing (Chapter 3 of the Environmental Code)	Bua	Approximately 800 m	Fishing port.
Nature conservation (Chapter 3 of the Environmental Code)	Klosterfjorden – Getterön	Approximately 800 m	Outstanding examples of coastal landscapes that particularly well demonstrate the development of the landscape. Threatened or vulnerable biotopes and species. Very rich plant and animal life.
Outdoor life (Chapter 3 of the Environmental Code)	Onsalalandet-Kungsbackafjorden-Tjolöholm	Approximately 2.5 km	Enriching experiences in natural and/or cultural environments. Outdoor activities and thus enriching experiences. Water-related outdoor activities and thus enriching experiences.
Nature conservation (Chapter 3 of the Environmental Code)	Vendel Islands Archipelago	Approximately 3.5 km	An area that particularly well demonstrates the development of both the natural and cultural landscape.

6.4. Geology and soil conditions

The bedrock in and around the planned operational area consists mainly of gneisses with a dominant granitic to granodiorite composition. The rock quality is classified as consistently good.[7] . The soil depth within the area varies between 0–15 metres with the deepest soil depths in the southern part of the area. The soils consist of both clay and organic soils as well as friction soils of sand and moraine.

The planned area of operation is not located within any designated risk area for landslides, rock falls or erosion.[8] . A number of minor landslide caution areas along certain stretches of coast in the immediate vicinity of the planned operational area are identified in the Geological Survey of Sweden (SGU) map service. A smaller such area also fits on the coast within the northern part of the planned operational area. These are areas where there may be conditions for landslides in clay and silt soil.[9] . The stability of the soil will be further investigated

[7] Project Svea – Soil investigations. Final report, feasibility study, COWI, 30.03.2015.

[8] Guidance on landslides, erosion (ver. 2023_1.4.5) (swedgeo.se) Visited on 28.09.2023.

[9] SGU's map viewer, layer for “Conditions for landslides in fine-grained soil” Visited on 28.09.2023.

as part of the process of preparing application documents and any risks associated with this will be managed during construction of the facility.

Historical photographs show that agricultural activities have primarily been carried out within the planned area of operation. The County Administrative Board's map of suspected and confirmed contaminated areas (EBH map) shows that in connection with the planned operational area there are two areas classified in risk class 3 (moderate risk), see Figure 10. These areas are called “Industrial landfills” and “Harbours – recreational marinas, boat parking areas”, respectively. In addition, there is an unexplored area called "Wastewater Treatment Plant"[10] .

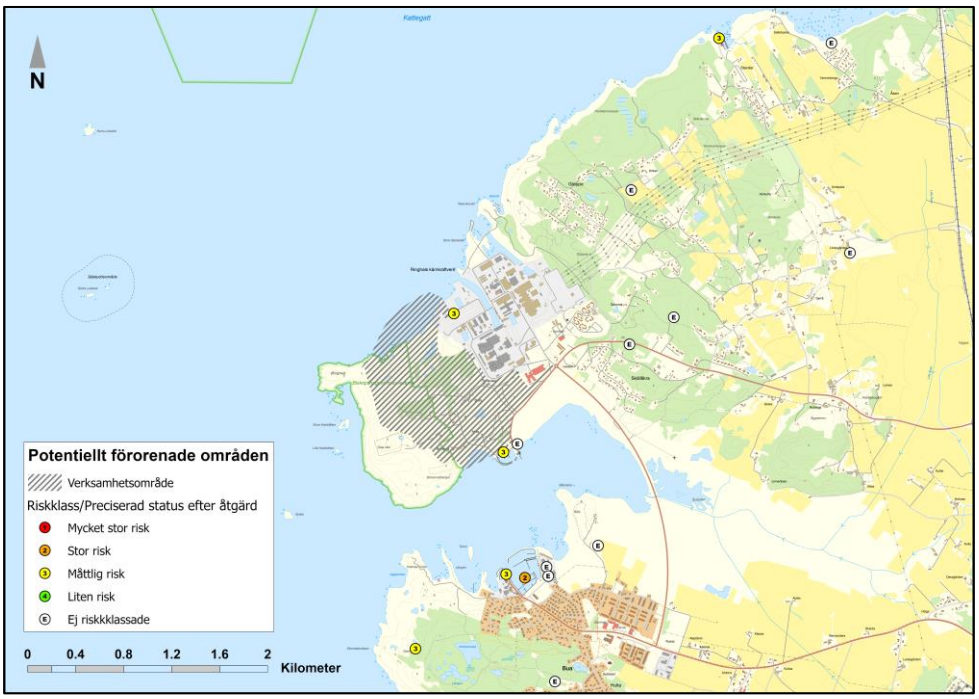


Figure 10. Map of potentially contaminated areas, EBH map (Lantmäteriet, Halland County Administrative Board).

Potentiellt förorenade områden	**Potentially contaminated sites**
Verksamhetsområde	Area of activity
Riskklass/Preciserad status efter åtgärd	Risk class/specified status after action
Mycket stor risk	Very high risk
Stor risk	High risk
Måttlig risk	Moderate risk
Liten risk	Low risk
Ej riskklassade	Not classified as risk

6.5. Hydrology

The Värö Peninsula borders two surface water bodies, *the Vändelsö Archipelago* (SE571720-120640) and *the North Central Halland Coastal Waters* (SE570000-120701). Both water bodies are classified as having a moderate ecological status,

[10] The County Administrative Board's geoportal. EBH map. Visited on 29.11.2023.

and they do not have a good chemical status. The impact on relevant quality factors for the status classification will be reported in the application.

Within the planned operational area there are a number of smaller water bodies and wetlands. In Varberg Local Authority's Nature Conservation Programme, which is used as a basis for community planning and nature conservation work, a wetland area situated northeast of Biskopshagen Nature Reserve is mentioned.[11] The wetland area overlaps the planned operational area.

There is no identified groundwater body within the planned operational area. According to SGU's mapping service, the nearest reported well/individual water source in Skällåkra is approximately 1 km from the planned operational area.[12] .

6.6. Natural values

There are a number of designated areas of nature worthy of protection in the vicinity of the planned operational area, see Figure 11 and Table 3.

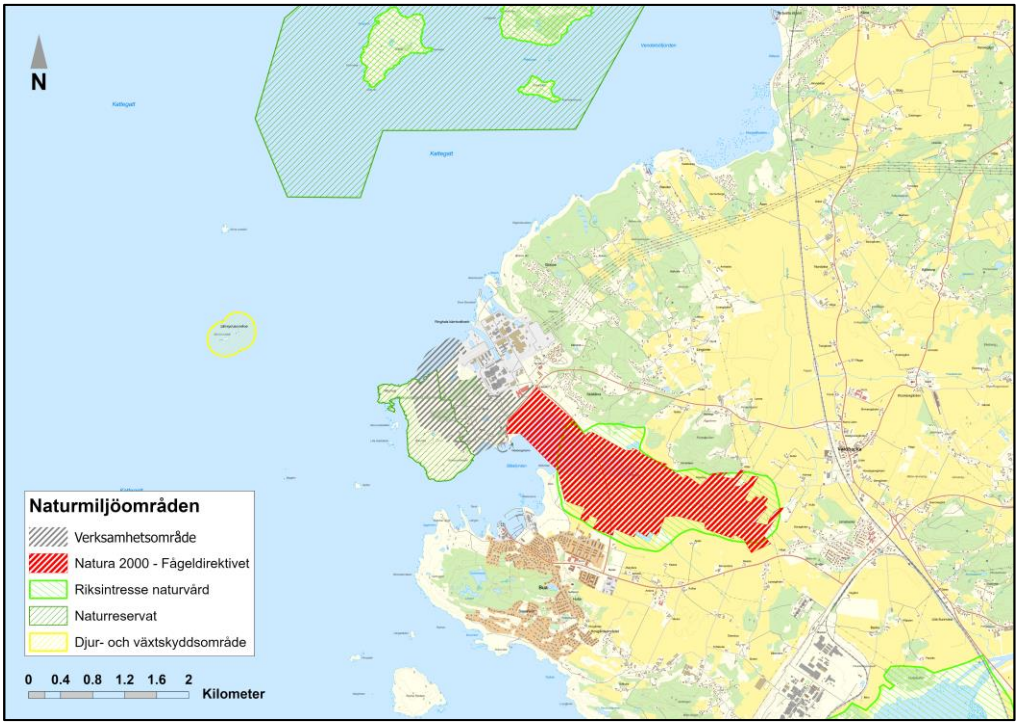


Figure 11. Natural areas worthy of protection within or in the immediate vicinity of planned operations (Lantmäteriet, County Administrative Board's geodatabase).

Naturmiljöområden	**Natural environment areas**
Verksamhetsområde	Area of activity
Natura 2000 - Fågeldirektivet	Natura 2000 - Birds Directive
Riksintresse naturvård	National interest in nature conservation
Naturreservat	Nature reserve
Djur- och växtskyddsområde	Animal and plant protection area

[11] Nature Conservation Programme for Varberg Local Authority (revised edition, 2007).
[12] SGU's map viewer, warehouse for "wells" Visited on 13.10.2023.

Table 3. General description of areas with protected nature in the immediate area or within the area of the planned operations.

Type of area protection	Title	Distance from the planned operations	Description of the protection value
Nature reserve	Bishop's Garden	Overlapping	The area is approximately 83 hectares in size and aims to preserve biodiversity (vascular flora), meet the need for an area for outdoor recreation, and to care for and preserve valuable natural environments.
Natura 2000 site (bird directive SPA)	The Boat Fjord	Adjacent	The area is approximately 255 hectares in size and aims to preserve or restore a favourable condition for the species that formed the basis for the designation of the area. The priority conservation values are coastal meadows with rich bird life. Priority birds are waders and terns.
National interest in nature conservation	Klosterfjorden-Getterön	Approximately 800 m	The area contains a well-preserved, varied and open cultural landscape of great value. The area includes representative natural pastures such as coastal meadows, heather heath, bushy outback and open pastureland. Here, plant communities with traditionally favoured species are found, some of which are rich in species and individuals.
Nature reserve	Vendel Islands	Approximately 2.5 km	The area includes valuable grazing landscapes and geology with terrace-like rock and rauk formations built up of charnockite, a weathered gneiss variety that is unique to Halland, as well as high marine values in the form of eelgrass meadows.
Animal and plant protection area	South Ledskär	Approximately 2.5 km	Seal protection area.

National interest in nature conservation	Vendelsö Archipelago	Approximately 3.5 km	An area that particularly well demonstrates the development of both the natural and cultural landscape.

6.7. Protected species

On the Värö Peninsula, species that are protected under the Species Protection Regulations have been observed. Including vascular plants, amphibians, mammals, reptiles, birds and insects.

Vattenfall will conduct a number of species inventories and carry out in-depth investigations, see section 8.3, to assess the potential impact of operations on these (and other) species and whether the operations require an exemption from the Species Protection Regulations. The investigations will be included in the application documents.

6.8. Cultural heritage

Within the planned area of operation, a number of ancient ruins and other cultural artefacts, including stone settings and settlements, that may be affected have been identified, see Figure 12. There are also several ancient ruins and other cultural artefacts within the Biskopshagen Nature Reserve.[13] .

Ancient ruins are traces of abandoned human activity that occurred before the year 1850. All ancient ruins, even those that are not known, are protected under the Cultural Environment Act. Cultural historical artefacts also include traces of human activity that occurred during and after 1850. Other cultural and historical artefacts do not have the same protection as an ancient monument, but consideration and care must be shown.

[13] The National Antiquities Authority's search service Fornsök. Visited on 19.09.2023.

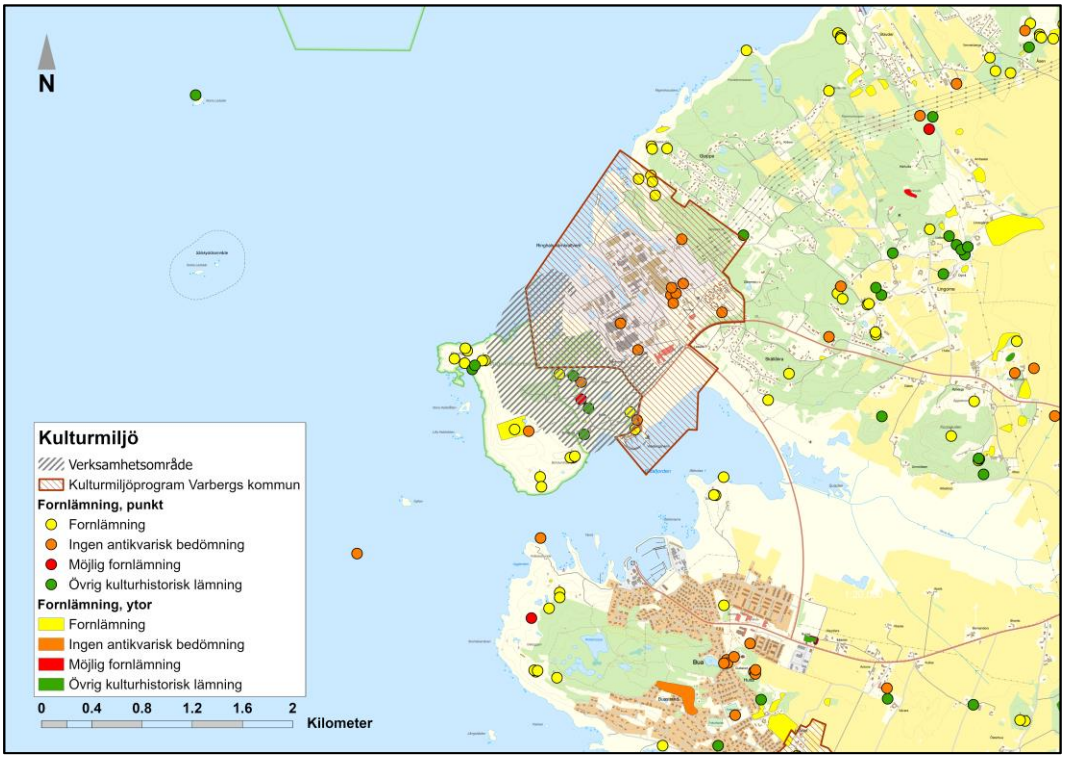


Figure 12. Identified cultural values within and in the immediate surroundings of the planned operations (Swedish National Land Survey, Varberg Local Authority, Swedish National Antiquities Authority).

Kulturmiljö	Cultural environment
Verksamhetsområde	Area of activity
Kulturmiljöprogram Varbergs kommun	Cultural environment programme Varberg municipality
Fornlämning, punkt	Ancient monument, point
Fornlämning	Ancient monument
Ingen antikvarisk bedömning	No antiquarian assessment
Möjlig fornlämning	Possible ancient remains
Övrig kullurhlslorisk lämning	Other cultural-historical remains
Fornlämning, ytor	Ancient monument, surfaces
Fornlämning	Ancient monument
Ingen antikvarisk bedömning	No antiquarian assessment
Möjlig fornlämning	Possible ancient monument
Övrig kulturhistorisk lämning	Other cultural-historical remains

Varberg Local Authority's Cultural Environment Programme from 2016 identifies important cultural environments within the local authority's area. The cultural environment programme shows that the Ringhals area has cultural and historical values from a social, industrial and architectural historical perspective, among other things. Bua village and the Vendel Islands are also designated as important cultural environments.[14] .

[14] Cultural Environment Programme for Varberg Local Authority (2017).

There is no national interest in cultural environment protection in the vicinity of the planned operations. The nearest, Nidingens Fyrplats, is over a mile north of the business.

6.9. Landscape, outdoor life and recreation

The planned operations will use land areas that were previously partially undeveloped. The area for planned operations consists of open land, with mountains in the northern part of the area and a more open agricultural landscape with housing in the southern part. There are also areas of deciduous and pine forests, often in mountainous terrain, in the landscape. The height above sea level varies greatly within the area. The areas with agricultural land are located at approximately 2–20 meters above sea level, while the mountain peaks reach 30 metres above sea level in some places.

West of the planned operational area lies Biskopshagen Nature Reserve. The nature reserve has natural pastures in the southern part and drier and nutrient-poor rocky areas (heather landscapes) in the northern parts. In the depressions, there are wetlands, and in areas close to the shore, there are shingle fields, rocky outcrops of shale gneiss and various smaller water-filled depressions, so-called rock pools.

Directly east of the planned operational area has been the Ringhals Nuclear Power Plant since the 1970s. The power plant area is around 100 hectares in size with buildings of varying heights.

The coastal area of North Halland is a recreational area for residents and tourists. There are good opportunities for swimming, fishing, outdoor activities and nature experiences. The entire area of operation is within the National Interest for Outdoor Recreation. The national interest extends from the border with Skåne in the south to Gothenburg in the north.

7. Expected environmental impacts

Chapter 6 of the Environmental Code states that environmental impacts mean direct or indirect effects that are positive or negative, temporary or permanent, cumulative or non-cumulative and that arise in the short, medium or long term on the environment or human health. Environmental impacts are not limited geographically; they can occur both in the immediate area and far away, and within and outside Sweden's borders.

The following chapter presents preliminary environmental impacts resulting from the construction and operation of the planned operations. The descriptions are based on the different alternatives being considered and preliminary environmental effects are described for the alternative that generates the greatest need for space or the greatest environmental impact. Estimates for transports given in section 7.6 below are based on rough estimates and may be adjusted when more information is obtained.

7.1. Land use

7.1.1. During construction

Planned operations require a larger land area during construction than the land area required for the operation of the facility. In addition, temporary storage and assembly sites outside the operational area may be utilised during the construction period. These may be located in the immediate area or in neighbouring local authorities. Most of the temporary storage and assembly areas will be restored after the construction period.

During all earthworks, special precautions will be taken in the event that contaminated materials are encountered. Contaminated materials will be handled appropriately in collaboration with the regulatory authority in accordance with the Environmental Code.

7.1.2. During operation

The operation is estimated to have a lifespan of 60–80 years. Neither during this time nor during the subsequent decommissioning will the land be able to be used for other purposes.

7.2. Natural and cultural environment

7.2.1. During construction

The planned operations will take place in part of the Biskopshagen Nature Reserve. A natural value inventory covering the current land area will be carried out, and the issue of utilising the nature reserve will be investigated further. A process to revoke the nature reserve has been initiated at the County Administrative Board. Vattenfall will strive to minimise the impact on biodiversity and is investigating the possibility of compensation.

Possible disturbances during the construction period include noise, dust, vibrations and light. If the activity is assessed to have a significant impact on the environment in the nearby Natura 2000 site Båtafjorden, a permit is required in accordance with Chapter 7. Article 28 a of the Environmental Code. This will be investigated further and if it is assessed that there is a risk of significant impact, a Natura 2000 permit will be sought.

Several inventories, including bird inventories and bat inventories, will be carried out and the results will be attached to the upcoming application.

The marine environment will also be affected in connection with the construction of a new cooling water intake and the possible construction of a new discharge tunnel, for which reason marine inventories will be carried out.

There are known ancient ruins and other cultural and historical artefacts in the area that may be affected by the establishment. The presence of ancient monuments and any impact on them will be investigated further as part of the process of preparing application documents. Vattenfall will seek the permits

required under the Cultural Environment Act in cases where the ruins are at risk of being affected by the construction. If additional ancient ruins are found during excavation, this will be handled in accordance with the provisions of the Cultural Environment Act.

7.2.2. During operation

It will be investigated whether operating the planned operations may have a significant impact on the environment in the Natura 2000 area Båtafjorden and how the Biskopshagen Nature Reserve will be affected by the activity, as well as species worthy of protection in the surrounding area. How intake and discharge of cooling water, among other things, may affect the marine environment will also be investigated as part of the application.

After the facility is built, no further impact on the cultural environment is expected.

7.3. Outdoor life, recreation and landscape

7.3.1. During construction

During construction, the landscape will gradually be transformed through earthworks and civil engineering works. The project will take place in a landscape that is currently home to large and tall buildings and power lines at the Ringhals Nuclear Power Plant.

Accessibility to the Värö Peninsula will be limited and possibly cease during the construction period, which may affect the possibility of outdoor activities in the area for certain periods.

7.3.2. During operation

The visual impact of the completed facility on the landscape depends on the supplier and technology choice. Some designs involve the reactors being blasted into the rock while others involve placement above ground. The maximum height of the facility may be on par with the Ringhals Nuclear Power Plant’s existing installations/buildings. A landscape image analysis will be produced as part of the application.

While the operation is ongoing and under closure, the land within the operation area will not be able to be used for outdoor activities and recreation. Accessibility to unoccupied parts of the Värö Peninsula may become more difficult or cease during the operation of the facility. In the parts of the nature reserve that will need to be used for the operation, it will not be possible to practice outdoor activities.

7.4. Resource usage

7.4.1. During construction

Resource use during construction will be based on circular principles, which aim to reduce resource use and utilise resources in a sustainable manner.

During construction of the facility, large amounts of building materials such as steel, concrete, cement, aggregates/sand/gravel and certain metals such as copper and aluminium will be used. The use of primary raw materials and resources will be minimised and, where possible, supplemented with reused or recycled resources.

During construction, a large number of chemical products will also be used. In addition to pure building materials, there will be explosives, paints, welding gases and maintenance chemicals, for example. Routines for storage, handling of chemicals and disposal of chemical residues will be developed and will be in effect during the construction and operation phases.

Fuels, mainly in the form of diesel, for work vehicles will be available. The possibility of using electric transport and more sustainable fuels, with the aim of minimising greenhouse gas emissions, will be investigated.

Electricity will be consumed for lighting, among other things. Parts of the electricity requirement may be produced with electricity generators if it is not possible to ensure electricity supply in another way.

Municipal water will be used for work such as concrete pouring, flushing, cleaning and the like. Furthermore, municipal water will be used for sanitary purposes in construction sheds, offices and residences.

7.4.2. During operation

Uranium dioxide is used as fuel in reactor tank(s). Fuel consumption is estimated to be a maximum of 70 tonnes of uranium dioxide per year for the entire operation.

Operation and maintenance of the facility will require several different chemical products, but which products these will be has not yet been studied in detail. When it comes to operating chemicals, these depend partly on the choice of reactor technology and supplier. Examples of operating chemicals that may be relevant are boric acid, hydrazine, hydrogen gas and lithium hydroxide. To regenerate the filters used to completely desalinate process water, sodium hydroxide and sulfuric acid are also required. Chlorine or hypochlorite, which may be added to the cooling water to reduce the growth of marine organisms, are further examples of possible operating chemicals. The maintenance chemicals will include various lubricating oils, greases, solvents, cleaning agents and the like. Vehicle service and fuel management will take place. All handling of chemical products will comply with applicable legal requirements and all liquid chemicals will be stored safely using embankments or equivalent. Collection materials will be available for handling spills. Substitution of chemical products to

chemicals that are less environmentally and health hazardous will be implemented whenever possible.

Internal and external transport will consume fossil fuels or biofuels. The possibility of using electric transport or a larger proportion of sustainable fuels, with the aim of minimising emissions, will be investigated.

The operation of the facility will use electricity to operate pumps, ventilation, some heating, lighting, instrumentation and the like. Maximum electricity consumption for operating reactors with an output of 2,800 MWe is estimated at approximately 170 MW in installed power.

Municipal water will be used in the process to cool the core and allow continued nuclear reaction, as well as to produce steam for turbine operation. This takes place in a closed process where the water is circulated. An alternative to using municipal water is to use seawater for the process. Regardless of the origin of the water, it will need to be desalinated, via ion exchange and osmosis treatment, before it is used in the process. To reduce consumption, a large portion of the process water will be purified and reused during the operational phase. Municipal water will also be used for sanitary purposes.

Seawater will be used to cool the nuclear facility. Cooling water consumption, in the form of seawater, is estimated to amount to approximately 120 m^3 per second.

7.5. Waste

7.5.1. During construction

Waste management during construction will be based on circular principles, which aim to reduce resource use and waste, and promote the reuse and recycling of materials in a sustainable manner. Excavated materials that arise in the area will be utilised in the project to the extent possible. Construction waste will be managed with a focus on recycling and reuse, and in accordance with applicable regulations to minimise the impact on human health and the environment.

7.5.2. During operation

Waste generated outside the controlled area is conventional waste such as packaging materials, office supplies, plastic, wood, metal and household waste. The conventional waste can be both non-hazardous and hazardous waste and will be handled in accordance with the Waste Regulations (2020:614) and delivered to transporters and recipients who hold the necessary permits.

The waste that is expected to arise in the operation, after preventive measures, will be handled and classified based on established routines depending on the type of material and the amount of radioactivity. Radioactive waste will be managed with safety as the highest priority and in accordance with laws and regulations. The waste that will arise during operation is assessed to be of the same nature as the waste that arises at other nuclear power reactors in Sweden.

7.6. Transportation

7.6.1. During construction

During construction, transportation of, among other things, soil and rock materials, building materials and construction components to and from the operational area will be carried out. There are existing roads to and within the area, however, some roads may need to be strengthened to handle road transport to and from the area during construction. The main transport route is road 848 from Väröbacka, via exit 56 to road E6, see Figure 13. In addition, routes 850 and 847 can also be used. It should be taken into account that route 847 passes through the Natura 2000 area Båtafjorden.

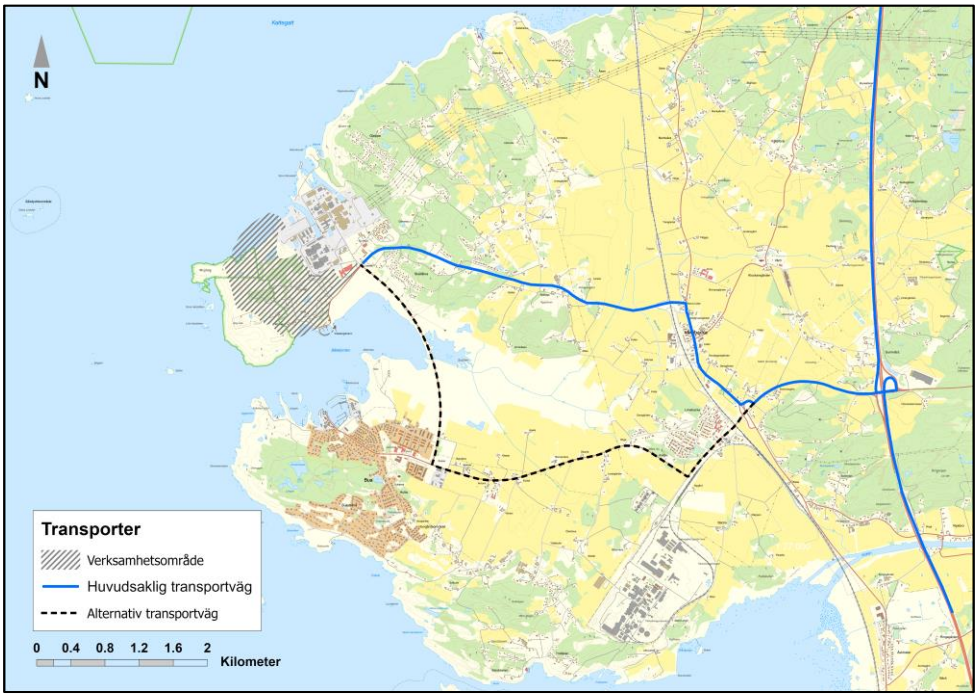


Figure 13. Overview map of possible transportation routes (Lantmäteriet, Vattenfall).

Transporter	Transport
Verksamhetsområde	Area of activity
Huvudsaklig transportväg	Main transport route
Alternativ transportväg	Alternative transport route

The proximity to suitable ports, such as Videbergshamn, the ports of Halland or the Port of Gothenburg, enables sea transport of bulky equipment and more. Videbergshamn has a permit for handling raw materials and materials connected to nuclear facilities. Other ports have permits for handling, among other things, containers, bulk, RoRo, steel and sheet metal products and liquid bulk.

The foundation and ground preparation phase is estimated to generate approximately 250–300 truck transports (500–600 vehicle movements) daily for

the transport of excavated materials and rock material. This is provided that all rock material that is brought up is transported away from the facility. However, some of the rock material will likely be used for backfilling and ground levelling at the construction site. During the subsequent construction phase of approximately eight years, approximately 60,000–120,000 truck transports are estimated to occur, which corresponds to 120,000–240,000 vehicle movements or approximately 40–80 vehicle movements per day. To keep the number of transports down, Vattenfall will, among other things, plan to ensure that the vehicles do not travel empty on any route and work towards a high fill rate in the vehicles.

In addition to truck transport, approximately one hundred sea transports are estimated for the transport of heavy components. Depending on the distribution between the respective modes of transport, the stated number of transports may vary. An increased number of sea transports reduces the need for truck transport and vice versa. Transportation to and from the facility for personnel is not included in the figures given above.

7.6.2. During operation

During the operational phase, goods transport will mainly take place via truck. Exceptionally, sea transport will take place. Transport will consist of internal transport, external freight transport and staff travel to and from work. The number of vehicle movements per day is estimated to be approximately 2,300, of which approximately 150 vehicle movements will consist of heavy transport. The main transportation route will be the same as during the construction phase.

7.7. Noise, light and vibrations

7.7.1. During construction

Noise disturbances will occur in the immediate vicinity during the construction period. Work at the beginning of the construction phase will, among other things, give rise to vibrations and a higher noise level, especially during blasting and handling of explosives. Crushing of materials may also occur. Increased transportation in the area will generate noise.

A noise investigation will be prepared as a basis for assessing the noise levels caused by the operation and any need for measures to ensure that the Swedish Environmental Protection Agency's current guideline values for noise from construction sites are met. Noise from traffic to and from the construction site will be assessed based on the guideline values that apply to traffic noise.

Other possible disturbances during the construction period include vibrations and light, as the construction area will be illuminated in the evening and at night.

7.7.2. During operation

Noise sources in the form of transportation, ventilation systems, testing of safety valves and similar activities will give rise to some noise in the surrounding area. The noise investigation to be carried out will assess how the planned operations

relates to the guideline values stated in the Swedish Environmental Protection Agency's guidance for industrial noise and the possible need for protective measures.

7.8. Groundwater

7.8.1. During construction

In connection with the construction of the facility and associated infrastructure, it will likely be necessary to drain groundwater through pumping. Vattenfall will carry out additional surveys and investigations regarding groundwater and geotechnical engineering. The results of the investigations will, among other things, report the area of impact from the groundwater diversion and whether protective measures will be needed, in the form of, for example, retaining walls or foundation walls to ensure that ground levels and groundwater levels on surrounding land are not negatively affected.

Vibrations from blasting work can also activate cracks with the risk of surface water moving downwards and with the risk of affecting the groundwater level. If there are remaining wells in the area, a well inventory may be necessary, which includes level measurement and water quality control in nearby wells to determine the current situation for future checks.

7.8.2. During operation

As the facility may be lowered into the bedrock, below the groundwater level, groundwater infiltration cannot be ruled out. The amount of groundwater leaking in depends on the presence of cracks in the rock and the degree of sealing. The penetrating water must be removed to avoid compromising the safety of the facility. This will be done with pumps and the water will be led up to ground level and then diverted via the storm water system. Regular monitoring of groundwater levels will be included as part of the future environmental monitoring program.

7.9. Emissions into water

7.9.1. During construction

The seawater in the immediate area will be turbid during blasting, dredging and construction of a new cooling water intake and a possible new cooling water outlet. The impact and the need for any measures to minimise the impact on benthic flora and fauna and the marine environment will be investigated as part of the application.

7.9.2. During operation

Seawater for cooling will be filtered from fish, clams, jellyfish and seaweed. Water containing separated cleaning material will be removed using flushing pumps. The water will contain varying amounts of cleaning agent. During periods of low sewage levels, this water is returned directly to the sea. In the case of large

amounts of cleaning, the cleaning water will instead be drained. This is done to avoid large amounts of cleaning agent being returned to the cooling water which is then reinfiltrated into the plant. After dewatering, the sludge can be used as a resource, depending on its content. To reduce fouling in the cooling water system, chlorination of the cooling water tunnels may be carried out through environmentally adapted dosing of hypochlorite, which is included with the cooling water. The concentration that comes with the cooling water should be kept as low as possible. Alternatively, mechanical cleaning of the tunnels will be carried out. Mechanical cleaning is carried out by adding so-called cleaning balls to the cooling water.

The cooling water circulating within the plant will, when released back into the sea, have a temperature of around 10 degrees warmer than when the water was taken in. In the sea, the heated cooling water will be mixed with the surrounding seawater, which means that the heat output of the discharge will decrease.

When the plant is in operation, process water also occurs in the form of leakage water, drainage water, flushing water when replacing ion exchangers and in connection with cleaning. The process water is purified through filtration and ion exchange, and most of the water can be reused in the process. However, smaller amounts of purified process water need to be discharged from the plant via the cooling water outlet. Small amounts of radioactive effluents will accompany the purified process water into the sea. These substances can give rise to a limited concentration of radioactive effluents in water recipients and in sediments and a limited radiation dose to humans via the ingestion of fish and shellfish. For nuclear activities, strict requirements apply to limiting radiation doses to the public and discharge of radioactive effluents into the environment, including through regulations on so-called dose restrictions and radiological acceptance criteria. Current and possible future regulations in the area will be taken into account. An assessment of exposure in the environment, including calculation of dose rates in biota and radiation dose to humans, will be carried out, see also section 7.13.2. Small amounts of process and maintenance chemicals such as boric acid, lye and sulfuric acid may also be carried with the process water/cooling water into the sea.

Storm water from paved surfaces will be diverted to the recipient at the inlet and outlet channels. Storm water that is at risk of being contaminated by oil must pass through oil separators before being discharged. The need for retention dams is being investigated. A storm water investigation will be carried out as part of the application.

The discharge of water from the operation will either take place to *the Vändelsö Archipelago* water body (SE571720-120640) or to *the coastal waters of North Central Halland* (SE570000-120701). Both water bodies have moderate ecological status and they do not have good chemical status. The impact on relevant quality factors for the status classification will be reported in the application.

7.10. Emissions to air

7.10.1. During construction

During construction, work machinery and transport will cause emissions of, particles, carbon dioxide, nitrogen oxides, sulphur dioxide and particles into the air during construction. The possibility of using electric transport and more sustainable fuels, with the aim of minimising emissions, will be investigated.

Smaller amounts of solvents will be released from building materials, degreasing, paints and more.

Construction-related dust can periodically cause disturbances in the immediate surroundings. Dust generation is expected primarily during the initial construction work, for example during blasting and handling of rock masses. Construction-related dust may have negative effects on the area's flora but is primarily a work environment issue. To reduce dust, several different protective measures can be taken if necessary. Examples of measures include watering or salting gravel roads and areas, watering storage areas, vehicle beds, and connecting water to nozzles on crushing machines and conveyor belts if these are used.

7.10.2. During operation

The operation of the reactors will result in small amounts of radioactive substances being discharged into the atmosphere. These substances are diluted in the air and only cause limited impact on the environment. An assessment of environmental exposure, including calculation of dose rates in biota and radiation dose to humans, will be performed. See also section 7.13.2.

Recurrent test operation of backup power units will result in emissions of primarily carbon dioxide, nitrogen oxides, sulphur dioxide and particulate matter. In addition, transport to, from and within the operating area generates similar emissions into air.

7.11. The climate impact of the operation

7.11.1. During construction

The construction of planned operations will require materials such as steel, concrete and other energy-intensive construction materials and inputs. Transport and construction equipment will consume diesel and other fuels. To minimise the impact on the climate during construction, the project will focus on resource conservation. The use of resources with a lower climate footprint, such as recycled materials, as well as electric transportation and more sustainable fuels, will be investigated and implemented where possible.

7.11.2. During operation

Electricity production at a nuclear power plant is fossil-free. From a life cycle perspective, the climate impact of a nuclear power plant is low and carbon dioxide

emissions amount to approximately 5.71 grams per kWh [18] for existing nuclear power, which is lower than the corresponding figure for both wind and hydropower.[15][16] . The majority of greenhouse gas emissions are linked to upstream and downstream processes such as the production of nuclear fuel and materials for the infrastructure required for the distribution of electrical energy.[17] . The operation of the nuclear power plant itself accounts for a smaller portion of carbon dioxide emissions. Emissions of substances during the operation of the plant that contribute to the greenhouse effect, eutrophication and acidification in the form of nitrogen dioxides, carbon dioxide and sulphur dioxide are generated primarily during transport to and from the plant and during test runs of backup power plants.

To minimise the impact on the climate during operations, the business will work actively to conserve resources. Resources with a lower climate footprint, such as recycled materials, electric transportation and more sustainable fuels, will be used where possible.

7.12. Vulnerability to climate change and external environmental events

7.12.1. During construction

The construction work will take place over a shorter period and may be affected by temporary weather phenomena but will not be affected by climate change in the longer term.

7.12.2. During operation

Nordic nuclear power is generally considered to be well-equipped against consequences linked to climate change as nuclear power production is affected by few weather and climate-related factors compared to the production of other types of energy. However, weather-related events can affect operations and delivery reliability and have financial consequences. Examples of such weather-related events are lightning strikes, which can generate disruptions to the network [18] .

Climate change in the form of increased sea temperature can lead to an increased occurrence of marine organisms that cause clogging of cooling water pipes. Increases in sea temperature can also lower heat output and thus lead to reduced production. Sea level rise is also a factor to consider. Based on the scenarios that the Intergovernmental Panel on Climate Change (IPCC) assesses as likely, it is estimated that the average water level in Varberg Local Authority in 2100 could rise by up to one metre compared to today. Estimated extreme sea level rise with a return period of 100 years is stated at 1.6 metres above mean

[15] Vattenfall AB (2021) EPD® of Electricity from Vattenfall's Nordic Hydropower. EPD® registration number: S-P-00088

[16] Vattenfall AB (2022) EPD® of Electricity from Vattenfall's Wind Farms. EPD Registration number: S-P-01435

[17] Vattenfall AB (2022) EPD® of Electricity from Vattenfall's Nuclear Power Plants. EPD® Registration number: S-P 00923

sea level. [18] Planned operations will be located at an altitude of approximately four to six meters above current sea level. Sea level rise is therefore not considered to result in a need for additional protective measures.

Other external events to be taken into account in the continued work include the risk of landslides, earthquakes, torrential rain, storms and fires during prolonged droughts.

7.13. Risk and safety

7.13.1. During construction

To reduce the risk of environmentally related accidents such as emissions to surrounding land and water environments during the construction phase, necessary risk assessments will be carried out, protective measures and routines will be implemented. Equipment for cleaning up chemical and fuel spills will be readily available.

Vattenfall plans to build several reactors and bring them into operation in stages. Construction work will then continue on the site while parts of the facility are in operation. Risks associated with this will be analysed. Risks linked to the nearby operations at the Ringhals Nuclear Power Plant will also be analysed.

7.13.2. During operation

7.13.2.1. Radiation safety and radiological risks

The operator's radiation safety work is a central part of the assessment under the Nuclear Activities Act. The Swedish Radiation Safety Authority sets requirements for radiation safety and monitors that those who operate the facilities comply with applicable regulations and requirements.

The concept of radiation safety encompasses radiation protection and safety. Radiation safety has the highest priority in nuclear operations. The purpose of all safety work is to prevent and mitigate the consequences of an accident, so that human health and the environment are protected against unwanted effects of radiation now and in the future. The operation's radiation safety work shall be maintained at as high a level as is practically possible and it shall be further developed based on operational experience and taking into account scientific and technical developments. In accordance with the principle of defence in depth, the safety of a nuclear facility shall be ensured through several successive protective mechanisms that are independent of each other. This principle covers both the functional and structural safety of the facility, see chapter 3.2.3. When designing a nuclear facility, possible operational disruptions and accidents must also be taken into account. In addition, all fissile material is recorded and checked in accordance with the international non-proliferation treaty in order to prevent unauthorised persons from gaining access to the material.

[18] Unger et al. (2021) The Impact of Climate Change on Nuclear Power. REPORT 2021:744. Energy research.

The operations are expected to result in low discharges of radioactive effluents into the air and water. These discharges are not considered to lead to any adverse effects, either in the local area or in another country. Radiological environmental consequences resulting from the planned operations, i.e. radiation doses to a representative member of the public, activity concentrations in the environment and dose rates to representative organisms, will be calculated and assessed.

In the event of an accident, the discharge of radioactive effluents under adverse weather conditions may affect a large area. However, the application of extensive preventive and mitigation measures means that no serious consequences are expected to arise either in the immediate vicinity or in another country. Radiological consequences in the surrounding area will be assessed and reported on with a view to the potential for accidents.

7.13.2.2. Risks covered by the Environmental Code

Planned operations also carry a risk of small-scale incidents and accidents. This could, for example, involve spills of chemicals, breakdowns of purification equipment, etc. These risks linked to the Environmental Code will be analysed so that adequate protective measures can be taken.

7.13.2.3. Seveso Act

A preliminary assessment indicates that the planned operations are covered by the Seveso Act. The Seveso Act governs activities where large quantities of specified hazardous substances or substances with specified hazardous properties are present. The law has two levels of requirements. If the quantity encountered exceeds the lower limit quantity, the operation is covered by the lower requirement level. If the amount of hazardous substances present exceeds the higher limit, the operation is subject to the higher level of requirements. It is currently being investigated whether the applied for activity will constitute a higher or lower level Seveso activity.

If the planned operations are covered by the higher level of requirements, a safety report with associated appendices will be prepared and included in the application in accordance with the Environmental Code. If the planned operations are covered by the lower level of requirements, an action plan and risk analysis will be developed and included in the application in accordance with the Environmental Code.

The present consultation also constitutes a so-called Seveso consultation in accordance with Chapter 6. Article 29(2) of the Environmental Code and below describe risks and possible measures to prevent and limit possible serious chemical accidents. The consultation also concerns factors in the environment that may affect the safety of the operation in accordance with Article 13 of the Seveso Act.

Risks and protective measures

During operations, substances with environmentally hazardous properties and substances that are considered to pose a physical hazard under the Seveso

legislation may be relevant. Examples of chemicals that may be handled in quantities for which the Seveso Act becomes applicable are hydrazine, hydrogen gas, sodium hypochlorite, acetylene, diesel and LPG. Based on the properties of the hazardous substances and experiences from the Ringhals Nuclear Power Plant[19] the following risks may be relevant:

- Hydrazine is a chemical substance used to prevent corrosion in piping systems. Hydrazine is corrosive, toxic, carcinogenic and very toxic to aquatic organisms. Leakage of hydrazine can produce toxic fumes. The extent to which spread can occur depends partly on prevailing weather conditions and the size of the leak. If hydrazine spills and crystallizes, a fire may occur upon contact with organic material.

  Examples of protective measures that may be taken include necessary embankments, continuous leakage monitoring, sprinkler systems and daily patrols.

- Hydrogen is a flammable gas. The biggest consequences linked to the handling of hydrogen gas are an explosion or a jet flame from an ignited gas cylinder leading to damage to personnel and the facility.

  Examples of protective measures to minimise the risks associated with hydrogen handling include hydrogen detection and daily patrols.

- Risks associated with handling acetylene and LPG are primarily linked to fire.

  Examples of protective measures include fire alarms and access to fire extinguishers.

- Leakage of diesel can lead to contamination of soil and water.

  Examples of protective measures that may be taken include the necessary embankment and access to a sump or equivalent for collection.

- When sodium hypochlorite and hydrochloric acid are mixed, chlorine gas is formed.

  Separated embankments and well-functioning alarm routines are examples of preventive measures.

In addition to those listed above, various protections are installed for conventional risks such as fire, leakage, explosions and turbine failures.

For fire protection, the facility will be divided into fire cells. The facility will be monitored with detectors connected to the central control room, which is staffed 24/7. Local fire services are available at the facility. Duplicate fire pumps will be installed to supply fire water networks and sprinklers at locations that are particularly important to protect from a reactor safety perspective.

[19] Information about Ringhals Nuclear Power Plant taken from the Swedish Rescue Service West website. Visited on 20.10.2023 and 02.12.2024.

For leaks from transformers with large amounts of oil and for diesel tanks, collection devices will be available in the form of embankments that will allow any leakage to be collected.

To prevent the occurrence of explosions, explosive equipment will be placed in areas with a low risk of ignition. Special procedures for working on these systems will be in place.

To prevent turbine failures, the systems are built with high quality requirements. Monitoring is extensive to identify errors early. The layout of the turbines is also done so that if parts should come loose, this will not negatively affect the safety of the facility.

Environmental factors

As part of the work of identifying and assessing risks, all Seveso operations must, in accordance with Article 13 of the Seveso Act, investigate which environmental factors may affect the safety of the operation. Environmental factors include both man-made circumstances and natural factors. Special consideration must be given to other Seveso activities in the vicinity. The nearest Seveso operation is the adjacent Ringhals Nuclear Power Plant. The risks at the Ringhals Nuclear Power Plant are assessed to be of the same nature as for planned operations since the same/similar hazardous substances are used there.

Other Seveso operations in the surrounding area consist of Södra Cell Värö and the Lahall power plant, located approximately 5 km from the planned location. At Södra Cell Värö, various hazardous substances are used for the production of paper pulp. The risk inventory conducted for the operation shows that there is no risk that an unwanted event within the factory area could have serious consequences for personal safety or the environment outside the operation area. Lahall's power plant is a backup power plant for Svenska kraftnät and Ringhals Nuclear Power Plant. The facility handles fuel in the form of diesel and the greatest risk identified is leakage of fuel into the surrounding environment. Otherwise, there are no Seveso operations or other industrial operations in the immediate area that are considered to constitute relevant environmental factors.

Accidents linked to the transport of dangerous goods could constitute an environmental factor. The nearest recommended route for dangerous goods is route E6/E20 approximately 6 km east of the planned location. The West Coast Railway extends approximately 4 km east of the planned location.

Natural environmental factors are described in more detail in section 7.12 and include, for example, floods and lightning strikes. In addition, intentional damage is also an environmental factor that will be taken into account.

8. Upcoming environmental impact assessment

8.1. Proposal for scoping

Scoping the content of the environmental impact assessment involves a focus on essential issues and aspects that are to be impact assessed. The scope of an environmental impact assessment should be adapted to the environmental impact

and other effects that the activity entails. The environmental impact assessment is therefore planned to focus on the subject areas of the natural environment, landscape, waste, water intake, impact on groundwater, transport, noise, discharges into water, and risk and safety. Land use, other area protection, raw materials and chemical products, emissions to air, vulnerability to climate change and external events will also be described and assessed. Consequences for environmental objectives and environmental quality standards are described throughout. The environmental impacts of the planned operations will be compared with a zero alternative, which means that the planned operations are not established on the site.

Geographically, the impact assessment will mainly be limited to the area directly affected by the planned operations. However, geographical scoping for each aspect may vary and is highlighted to the extent deemed necessary.

In terms of time, the environmental effects are assessed in the short, medium and long term.

- **The short term** consists of the construction phase, which corresponds to approximately 10 years.
- **Medium term** is up to between 25 and 30 years.
- **Long term** corresponds to the facility's lifespan until decommissioning.

8.2. Assessment criteria

The purpose of the environmental impact assessment is to report the consequences of the planned operations on human health and the environment. The environmental impact assessment is qualitative, but is mainly based on certain frameworks that are referred to here as *assessment bases*. By applying the assessment criteria, the environmental impact of the planned operations can be put in relation to the value of each aspect.

In the planned environmental impact assessment, the concepts of *impact*, *consequence* and *measure* will be used. Impact refers to the change in environmental and health aspects that the planned operations entails compared to a zero alternative. Consequence refers to the result of the impact and the degree of impact. The impact and/or consequence can be both *direct* and *indirect* and relate to the value of the aspect, but can also be related to national, regional and local environmental objectives, environmental quality standards, as well as national guideline values, limit values and current practices. To avoid or reduce negative consequences, various measures (*protective measures*) are proposed where necessary. The assessment is made by weighing the value of the aspect and the scope of the planned action. The assessment is made in relation to the zero alternative.

8.3. Suggested table of contents

Proposals for the design of the upcoming environmental impact assessment are presented in the table of contents below, Table 4. The description in the table below should be seen as an example of the description of the scoping that the environmental impact assessment will contain and not as an absolute design. The

table of contents is based on current provisions in Chapter 6 of the Environmental Code and the Environmental Assessment Regulations (2017:966), the Nuclear Activities Act and other provisions that are relevant to the current activity. In addition to an environmental impact assessment, the application will consist of a main submission including a report linked to the general rules of consideration, a technical description, an action plan/safety report and a status report, all with associated appendices.

Table 4. Proposal for the table of contents of the environmental impact assessment.

Summary	
A non-technical summary of the environmental impact assessment.	
Introduction	
Administrative information and background to the application.	
The planned operations	
Excerpt from the technical description.	
Overall area description	
Overall	Overall description of environmental conditions.
Planning conditions	Description of planning conditions with regard to the master plan, detailed master plan and zoning plans. Assessment regarding the operation's compatibility with applicable zoning plans.
Localisation and options	
Location	Description of the location.
Projected current position / zero alternative	Description of the zero alternative.
Alternative localisation	Alternative locations are reported.
Alternative design	Reporting on alternative techniques and designs for the planned operations. The presentation of alternative technologies will focus on the design of necessary facilities and measures that are relevant based on environmental impact. Reporting linked to the BREF documents Energy Efficiency and Industrial Cooling Systems.
Method for Environmental Impact Assessment	
Scoping	Explanation of the scoping of the environmental impact assessment.
Assessment criteria	Review of the assessment criteria used in the environmental impact assessment.
Basis for assessment	
National and regional environmental goals	Relevant goals are reported.
Municipal environmental goals and environmental programmes	Goals and other relevant documents are reported.
Environmental quality standards	Environmental quality standards for outdoor air and surface water are reported.
Impact assessment	
Land use and soil conditions	Reporting of available information about the properties and geotechnical conditions. Assessment of the impact of operations. Soil surveys and a status report pursuant to the Industrial Emissions Directive will be included in the application.
Landscape	Description of what the landscape looks like today and how this will change as a result of the planned operations. Assessment of the impact of the activity on the landscape. A landscape image analysis including the impact of lighting will be included in the application.
Natural environment	Description of affected natural environments in the vicinity of the operation. Assessment of the impact of the activity on these areas and assessment of whether the activity may significantly affect the environment in the nearby Natura 2000 site. A Natura 2000 study will be included in the application. A natural value inventory

	and a number of species inventories, including bird and bat inventories, will be included in the application.
Cultural heritage	Description of affected cultural environments in the vicinity of the operation. Assessment of the impact of the activity on these. A summary of the cultural environment inventory will be presented in the application.
Outdoor activities and recreation	Description of affected areas in the vicinity of the operation. Assessment of the impact of the activity on these.
Other area protections	Description of other area protection in the vicinity of the operation. Assessment of the impact of the activity on these.
Raw materials and chemical products	Accounting for existing raw materials and chemical products and their handling. Assessment of the impact of the handling on human health and the environment.
Energy use	Reporting on the energy demand of the planned operations for construction and operation, and assessing energy demand from a resource perspective.
Water use	Reporting on the water demand of the planned operations for construction and operation, and assessing water demand from a resource perspective.
Surface water intake	Reporting of surface water intake and the impact of the operation on the aquatic environment. Cumulative effects with respect to the Ringhals Nuclear Power Plant's intake of cooling water will be described. A cooling water investigation, as well as a mapping of marine environments with an associated assessment of the impact on the marine environments, will be included in the application. Sediment sampling will be carried out.
Groundwater	Reporting of the impact on groundwater. A hydrogeological assessment will be included in the application.
Emissions to water	Reporting of emissions to water from planned operations. Assessment of the impact of the discharge on human health and the environment in terms of impact on the recipient and environmental quality standards. Cumulative effects with regard to emissions from the Ringhals Nuclear Power Plant will be described.
Waste	Reporting on the types of waste generated in the operation. Assessment of how waste management affects human health and the environment.
Emissions to air	Reporting of emissions into the air from planned operations. Assessment of the impact of emissions on environmental quality standards and human health and the environment. Cumulative effects with regard to emissions from the Ringhals Nuclear Power Plant will be described.
Climate impact	Reporting and assessment of planned operations' climate-impacting emissions.
Transportation	Reporting the number of transports that planned operations generate during construction and operation, comparison with traffic measurements on affected transport routes and reporting the noise generated from transports. Assessment of the impact of transport on

	human health and the environment. Cumulative effects with respect to the Ringhals Nuclear Power Plant will be described. A transport investigation will be included in the application.
Noise, light and vibrations	Accounting and calculation of noise sources from the planned operations. Assessment of the possibility of including the Swedish Environmental Protection Agency's guidelines (report 6538) for industrial noise and general advice regarding noise from construction sites (NFS 2004:15). Assessment of the impact of light and vibrations on human health and the environment. Cumulative effects with respect to the Ringhals Nuclear Power Plant will be described. A noise investigation will be included in the application.
Vulnerability to climate change and external environmental events	Reporting of natural environmental factors that may affect the planned operations. Assessment of the impact of climate change and external events. A storm water/flooding investigation and geotechnical investigation will be included in the application.
Risk and safety	Reporting of risks linked to the Environmental Code, the Seveso Act and risks linked to the nuclear facility, i.e. radiological consequences during operation and accidents. Assessment of the risk profile of the operation and its potential impact on human health and the environment. Cumulative effects with respect to Ringhals' operations will be described. A risk and safety analysis linked to the Environmental Code and the Seveso Act will be included in the application.
Overall assessment	
Overall assessment of the environmental aspects listed above.	
Reporting of expertise	
Description of expertise under Article 15 of the Environmental Assessment Regulations.	
References	

The following investigations are planned to be produced/attached as supporting documentation for the upcoming application. These investigations may be supplemented by further investigations and surveys.

- Natural value inventory
- Natura 2000 investigation
- Species inventories and species protection studies
- Marine inventories
- Archaeological investigation
- Marine archaeological investigation
- Location investigation
- Rock/geotechnical investigation
- Hydrogeological investigation
- Storm water investigation
- Modelling water/cooling water investigation
- Landscape image analysis
- Noise investigation
- Radiological consequences resulting from normal operations and accidents
- Action plan or safety report including annexes (Seveso)
- Risk analyses Environmental Code and Seveso
- Status report
- Mass management plan

9. Continued consultation

9.1. The consultation process

Vattenfall intends to conduct the consultation on the planned operations in several stages. As a first and initial step, a consultation meeting was held with the County Administrative Board of Halland County, Varberg Local Authority and the Swedish Radiation Safety Authority. The purpose of the initial consultation meeting was to discuss the delimitation between the review procedures under the Environmental Code and the Nuclear Activities Act, the scope and definitions of the procedures, the location of the planned operations and the continued consultation process.

Vattenfall now intends to continue the consultation by inviting a larger circle of authorities, but also organisations, particularly those concerned, and the general public to the consultation, for which this document forms the basis. The authorities that are to be invited to the consultation are: County Administrative Board of Halland County, County Administrative Board of Västra Götaland County, Environmental Protection Agency, Radiation Safety Authority, Swedish Marine and Water Authority, Swedish Civil Contingencies Agency, Swedish Transport Administration, Chemicals Inspectorate, Swedish Power Networks, Swedish Energy Agency, Geological Survey of Sweden, Swedish Geotechnical Institute, Swedish Maritime Administration, Swedish Police Authority, State Administrative Board of the Swedish University of Agricultural Sciences, SLU (Institute for Aquatic Resources), National Debt Office, Swedish Board of Housing, Building and Planning, Swedish Armed Forces, local safety committee, Varberg Local Authority, Kungsbacka Local Authority, Mark Local Authority, Falkenberg Local Authority, West Rescue Service and Greater Gothenburg Rescue Service. More authorities may be invited to the consultation.

The consultation will take place both in writing and through several consultation meetings to be held during the first half of 2025.

Further consultation sessions are then intended to be held as the planning work progresses, and the planned operations can be described more precisely.

Invitations to each consultation event will be made via advertising and direct mailing to those particularly affected and to organisations that Vattenfall deems to be affected or have an interest in the planned operations. Affected organisations have been selected based on, among other things, experience from previous permit procedures for nearby or similar operations. Those particularly affected are currently assessed to consist of property owners, users, residents, business owners, well owners and other rights holders (for example, holders of rights of way and easements) within the area marked in Figure 14 below and adjacent to route 850 up to route E6. This group is considered to be particularly affected by the activities, including in the form of noise, air emissions, groundwater impact, transportation, visual impact and more. The group also includes owners of ongoing projects in the area that may be affected by the planned operations. In addition, Södra Cell Värö, Lahall power plant and Ringhals AB (Ringhals Nuclear Power Plant) are considered to be particularly affected based on the requirements of the Seveso legislation linked to environmental factors. The direct mail will contain a detailed description of why each recipient is considered to be particularly affected.

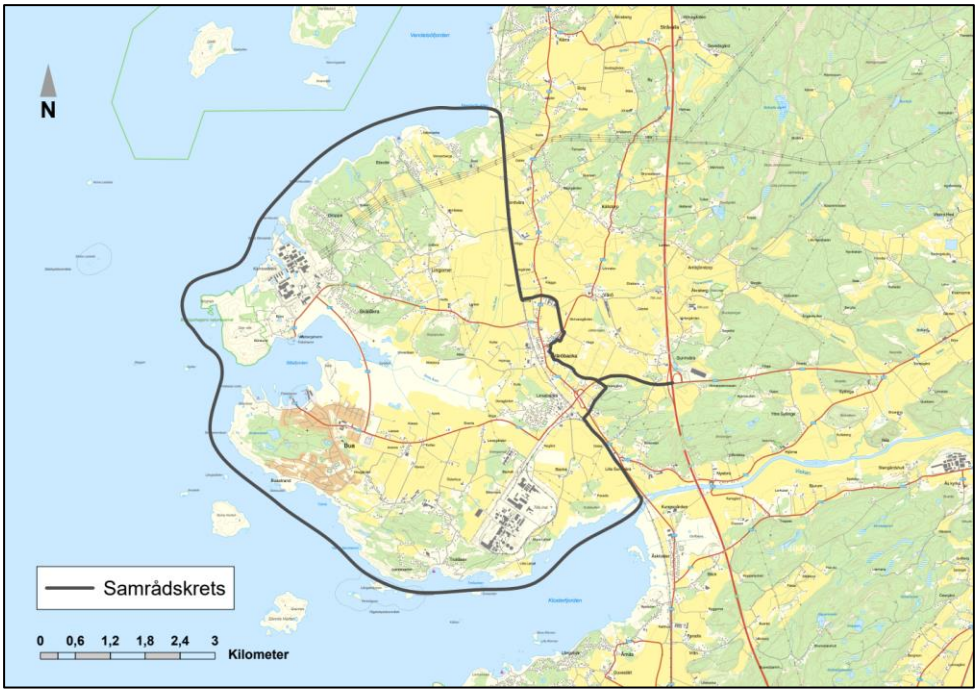


Figure 14. Consultation group for those particularly affected (Lantmäteriet, Vattenfall).

Information about the planned operations is also available at www.vattenfall.se/kraftdialog. This consultation document and information about dates for consultation meetings, etc. will be published there.

9.2. Handling of received comments

The results of the views expressed during the consultation will be taken into account and compiled and attached to the upcoming permit application in a consultation report.

9.3. Processing of personal data

Vattenfall AB with corporate registration number 556036-2138, Evenemangsgatan 13, Solna and 08-739 50 00, is the data controller for all personal data processing that takes place as part of this consultation and upcoming reviews of permit applications for the construction and operation of new nuclear power with associated activities on the Värö Peninsula in the Varberg Local Authority Area (hereinafter collectively referred to as “permit procedures”).

9.3.1. How Vattenfall collects personal data

The personal data that Vattenfall processes is collected directly from you when you provide information as part of the permit procedures. Personal data will also be collected from courts, authorities (for example, the National Land Survey of Sweden) and other public registers.

9.3.2. How Vattenfall processes personal data

Your personal data is processed in accordance with applicable data protection legislation. This means, among other things, that Vattenfall needs to have a legal basis to process personal data. Below is a description of (i) the types of personal data that are processed, (ii) for what purposes, (iii) the legal basis on which the processing is based and (iv) the storage period.

Categories of personal data	Purpose	Legal basis	Storage period
Contact information (e.g. name, address, email and phone number), property designation and others personal data that you provide in connection with submitting comments, alternatively as collected in accordance with the above, as part of the the state tests	Vattenfall processes your personal data for the purpose of fulfilling Vattenfall’s obligations to perform and document consultations and to conduct permit tests.	(i) Fulfilment of Vattenfall's legal obligations to perform and document consultation in accordance with Environmental Code and Law (1984:3) on nuclear operations. (ii) Vattenfall’s legitimate interest in conducting permit procedures and responding to comments as part of the permit procedures	Personal data is saved for as long as consent procedures are ongoing.

9.3.3. With whom does Vattenfall share personal data?

Your personal data will be shared with the competent court for relevant permit procedures as well as with authorities involved in the permit reviews when required by law, regulations, court or authority decision, all for the purpose of fulfilling Vattenfall's legal obligations.

Your personal data will also be shared with other companies within the Vattenfall Group and suppliers who perform services on Vattenfall's behalf in order for Vattenfall to be able to fulfil Vattenfall's legal obligations, such as IT suppliers, printers and external consultants, legal advisors, experts and specialists.

9.3.4. Your rights

You have several rights in relation to Vattenfall's processing of your personal data. Information about your rights and how you can exercise them is described below. Please note that your rights only apply to the extent that they apply under applicable data protection legislation and are therefore limited in some cases.

9.3.5. Right of access

You have the right to know what personal data Vattenfall processes about you. You also have the right to access such personal data through a so-called register extract and request further information about its processing.

9.3.6. Right to rectification

You have the right to request that incorrect or incomplete personal data that Vattenfall processes be corrected or supplemented.

9.3.7. Right to erasure

In certain cases, you have the right to have your personal data that Vattenfall processes deleted. The right to erasure applies if processing the personal data is no longer necessary for the purpose for which it was collected or if the personal data is processed based on your consent and you choose to withdraw your consent. However, Vattenfall will not delete your personal data if your personal data is needed for Vattenfall to fulfil a legal obligation, if it is still necessary to process it for the purpose for which it was collected, or if Vattenfall's interest in continuing to process the data outweighs your interest in having it deleted.

9.3.8. Right to file a complaint

If you have objections or comments about Vattenfall's processing of your personal data, you have the right to contact or file a complaint with the Swedish Data Protection Authority.

9.3.9. The right to object

You have the right to object to the processing of your personal data based on a balancing of interests. If Vattenfall cannot demonstrate that there are compelling and legitimate reasons to continue processing the personal data, Vattenfall must cease processing.

9.3.10. Right of restriction

You have the opportunity to demand restriction of the processing of your personal data provided that (i) you have objected to the processing and are awaiting Vattenfall's assessment of whether Vattenfall's legitimate interest outweighs it, (ii) you do not believe that the information that Vattenfall has about you is accurate, (iii) the processing is unlawful but you object to the deletion of the personal data or (iv) Vattenfall no longer needs the personal data for the purposes for which it was collected and you need it to, for example, assert legal claims. By requesting a restriction on processing, you have the opportunity, at least for a certain period of time, to stop Vattenfall using the personal data for purposes other than, for example, defending Vattenfall's legal claims.

9.3.11. Miscellaneous

Further information about Vattenfall's processing of your personal data, including further information about your rights, can be found in Vattenfall’s privacy policy https://group.vattenfall.com/se/site-assets/personuppgifter-hos-vattenfall.

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