

Plan Description

Proposal for a Site Plan for Nuclear Installations in Norrsundet, Gävle Municipality, Gävleborg County, Sweden

Consultation Document



This document has been translated from Swedish to English with the assistance of artificial intelligence.

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Introduction

Sweden and the EU have committed to achieving climate neutrality by 2050 at the latest, which requires a comprehensive shift towards the electrification of industry, transport, and societal functions. As part of this direction, the Government has a goal to establish at least 2,500 MW of new nuclear power capacity by 2035 and at least 10,000 MW by 2045, with a focus on installations that can contribute significantly to the stability of the electricity system, power balance, and societal benefit.

On 28 May 2026, the County Administrative Board of Gävleborg County (*Länsstyrelsen i Gävleborgs län*) was commissioned by the Government to prepare a proposal for a site plan (*anläggningsplan*) for a nuclear installation in accordance with the Act (2026:585) on the Government's Approval of Nuclear Installations. The proposal is based on the application submitted by the company Blykalla AB to the Government on 18 May 2026 to construct a nuclear installation at Norrsundet in Gävle Municipality.

The site plan has been prepared based on Blykalla AB's application to the Government for approval of a nuclear installation submitted to the Government on 18 May 2026. The application comprises the following documents:

- application for approval of a nuclear installation
- prerequisites for the management of nuclear waste and spent nuclear fuel
- estimated maximum emergency planning zones (EPZ) (*beredskapszoner*) and urgent protective measures for Norrsundet

The site plan comprises a plan map, a plan description, and an environmental impact assessment. In the plan description (this document), the planning prerequisites, purpose, and how the plan can be implemented are presented.

The site plan describes the enabling of nuclear activities in the form of the construction and operation of a park with six lead-cooled small modular reactors (SMR) as well as an interim storage facility for nuclear waste.

A site plan (*anläggningsplan*) is a guidance document for decisions on how land and water areas shall be used. Upon the adoption of such a plan, Chapter 3 and Chapter 4, Sections 1–8 of the Environmental Code (*miljöbalken*) shall be applied.

The plan is guiding in relation to the environmental assessments conducted for the same land and water area according to other laws and reviews.

The Government's review (*regeringens prövning*) aims to assess, at an overall level, a site's suitability for new nuclear power with the support of the site plan. The review is conducted by the Government first deciding on a site plan for a specific area, and subsequently approving a specific nuclear installation planned within that area.

Purpose and Scope of the Site Plan

The site plan is a state guidance document for how land and water areas shall be used regarding the location and suitability of nuclear activities. Upon approval of the site plan, the Government decides on the suitability of the location based on Chapter 3 and Chapter 4, Sections 1–8 of the Environmental Code.

The site plan constitutes a basis, and is a prerequisite for the Government's decision to approve a nuclear installation according to the submitted application from Blykalla AB.

The site plan shall be seen as a basis for future permit reviews (*tillståndsprövning*) according to the Environmental Code and the Nuclear Activities Act (*kärntekniklagen*) respectively, as well as for the future detailed plan (*detaljplan*) process according to the Planning and Building Act (*plan- och bygglagen*).

Follow-up activities necessary for the installation, such as cooling water supply and roads, are handled at an overall level in the site plan to identify whether there are conditions that could render the site unsuitable.

A strategic environmental assessment shall be carried out for the site plan. The environmental assessment is carried out in accordance with Chapter 6, Sections 3–19 of the Environmental Code. A scoping consultation (*avgränsningssamråd*) has been conducted according to Chapter 6, Sections 9–10 of the Environmental Code. Within the framework of the scoping consultation, various stakeholders have submitted views on the scope and level of detail of the environmental impact assessment.

The views concerned safety and preparedness (emergency planning zones (EPZ), accident risks, chemical handling, transport routes for dangerous goods), environment and nature (water environment, contaminated sediments, natural values and biological diversity, climate adaptation), infrastructure and transport (transport volumes, transport routes and investment needs for road, rail, port, and the electricity grid), cumulative effects (port, permitted biorefinery, application for a server hall), societal development and regional impact, waste management, and technical issues.

According to Chapter 6, Section 12 of the Environmental Code, the scope and level of detail of the environmental impact assessment shall be reasonable with regard to:

1. assessment methods and current knowledge,
2. the content and level of detail of the plan or programme,
3. the stage of the decision-making process in which the plan or programme is located,
4. that certain issues may be better assessed in connection with the review of other plans and programmes or in the permit review of activities or measures, and
5. the public interest.

In the environmental impact assessment, a consolidated assessment is made of the plan proposal's compatibility with the general interests specified in Chapters 3 and 4 of the Environmental Code, the impact on environmental quality standards (*miljö kvalitetsnormer*), and the plan proposal's compatibility with other plans, programmes, decisions, and other decided goals at local, regional, and national levels. Conclusions regarding preparedness are also highlighted.

The assessment is that several issues linked to safety and preparedness, environment and nature, infrastructure and transport, cumulative effects, societal development and regional impact, waste management, and technical issues cannot be studied at the level of detail requested by the referral bodies with support of Chapter 6, Section 12 of the Environmental Code. These issues will, however, be considered and further investigated to the extent that it is relevant within the framework of future reviews according to the Nuclear Activities Act, the Environmental Code, the Planning and Building Act, and any other reviews. More information on future reviews is described under the section on implementation issues.

Plan Process

The site plan is developed by initially consulting on the scoping of the environmental impact assessment. Thereafter, a proposal for a site plan is developed and consulted upon.

Subsequently, any revisions are made, and a proposal for a site plan is sent to the Government for decision, see Figure 1.

The adoption of the site plan does not constitute a permit to construct or operate the installation but enables further review according to other legislation.

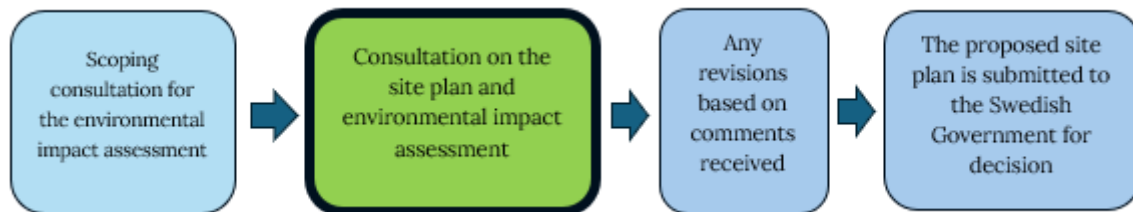


Figure 1. Process for the development of a site plan. Current stage is step 2: consultation on the site plan and environmental impact assessment.

Validity Period

The site plan is proposed to be valid for 15 years from the date of its adoption.

Plan Proposal

Location

The installation is proposed to be constructed and operated just outside the community of Norrsundet on the coast in Gävle Municipality. The area is located within the property Norrsundet 15:28. The area is situated approximately 30 km north of the Gävle urban area, approximately 40 km south of the Söderhamn urban area, and approximately 22 km to just over 20 km east of the Ockelbo urban area.

The choice of location was preceded by a siting process conducted in several stages based on a number of different requirements and selection criteria. The starting point was the guidance documents of the IAEA (International Atomic Energy Agency). Overall selection criteria for the location were the benefit to the electricity system and distance to the regional grid, land availability, suitable distance to protected areas, conflicting interests and contiguous residential development, geological conditions, access to infrastructure, and cooling water. A number of location alternatives were investigated by the applicant both nationally and within Gävleborg County. Based on the selection criteria, the chosen location was assessed as suitable with no or limited obstacles, or alternatively, that the conditions on-site may present challenges but that these can be managed.

The plan area is not designated as a national interest (*riksintresse*) for energy production (thermal power) according to Chapter 3, Section 8 of the Environmental Code. The applicant considered but assessed that a location within the total of eight designated national interest areas in the country is not a reasonable alternative, as the applicant lacks control over these.

The current technology for the nuclear installation allows for the testing of new locations that were previously not relevant for nuclear power establishment.

The chosen location consists of forested land and is situated adjacent to a port and industrial area. The plan area borders a power line corridor to the southwest, forested land to the north, and a landfill and operational land to the east. The site is not covered by any national interest or protected area. No significant conflicting interests within or near the plan area have been identified. The nearest residences are located approximately one kilometer to the south in the community of Norrsundet. The geological conditions are suitable. Existing infrastructure in the area includes roads, industrial railway tracks, a port, municipal water and sewage, and electricity supply. The proximity to the sea enables access to seawater for cooling.

In Gävle Municipality's comprehensive plan (*översiktsplan*) (adopted 2017-12-11), Norrsundet is designated as a larger operational area where the desired development is for the operational area to continue. The comprehensive plan states that disruptive or transport-intensive activities should, as far as possible, be located in, among other places, the port of Norrsundet. The comprehensive plan further describes that Norrsundet shall be strengthened as a coastal town through the development of the port and the industrial area, primarily within the existing area and thereafter in a westerly direction. Hazardous activities and Seveso activities shall be located as far as possible from the general public. The site plan is therefore assessed to be consistent with the intentions of the comprehensive plan. The plan area is not covered by any detailed plan (*detaljplan*).

Land Claims and Design

Land Claims

In total, the plan area is proposed to comprise approximately 40 hectares. The plan area includes the planned area for the nuclear installations and necessary areas for ancillary activities. The land claim (*markanspråk*) means that the land may be used for buildings and surfaces intended by the site plan. The area for nuclear installations comprises approximately 35 hectares, while 5 hectares are intended to be used for ancillary activities such as storage, research and development, and so on.

The delimitation and division of the plan area are shown on the plan map, see Figure 2. Within the area indicated on the plan map as "Area for nuclear installations," free placement of the nuclear installations is permitted.

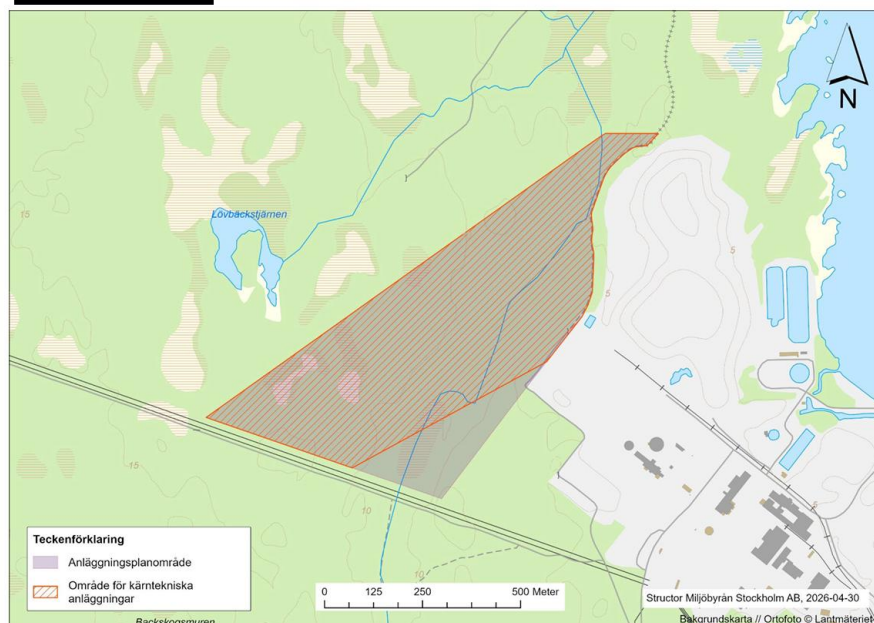


Figure 2. Proposed area for the site plan (all marked area) and area for nuclear installations only (hatched area).

Design

The planned installation consists of reactor buildings with control rooms, changing rooms, loading/unloading areas, a turbine hall, a generator hall, and other support functions. Adjacent to the reactor buildings, a steam cell is constructed where steam from the reactor is converted into kinetic energy in a turbine, which drives a generator where electricity is produced. Spaces and buildings for the interim storage of radioactive waste and spent nuclear fuel resulting from the installation's operation are also planned within the area, as well as, if necessary, spaces for the examination and research of radioactive materials and fuels.

The reactors are planned to be submerged approximately 15 meters below the ground surface, where components such as steam generators and cooling systems are also placed. The above-ground parts of the installation are planned to consist of reactor buildings and associated operation and service buildings. The reactor buildings are planned to have chimneys that protrude above the buildings approximately 20 meters above ground level, and with air cooling of the secondary circuit, the cooling system may have a height of approximately 40 meters above ground level.

The entire plan area will be fenced so that the general public does not have access to the area.

Emergency Planning Zones (EPZ)

An inner and outer emergency planning zone (EPZ) (*beredskapszoner*) with preparedness measures shall be included for the installation. The emergency planning zones are an administrative tool to enable society to prepare for extremely unlikely but serious accidents. The inner zone aims to enable rapid evacuation, and the outer zone aims to reduce the risk of long-term health effects through planned protective measures. Considering the power of the SEALER reactors (Swedish Advanced Lead Reactor), the inner zone is estimated to be 1 km and the outer zone 5 km. The applicant states that this estimate contains significant conservatism and that it is likely that the final emergency planning zones will be smaller or much smaller than this. This

is, however, dependent on the results of future detailed analyses and the position of the authorities regarding these.

Conditions within the Inner Emergency Planning Zone

The estimated maximum inner emergency planning zone consists of forested land, water areas, and an industrial area. In the industrial area, an application is underway to establish a facility for data center services, and a permit according to the Environmental Code has been granted for a biorefinery. The area has minor roads and a railway for freight traffic. There is also a national interest for commercial fishing within the zone, which is described in more detail in a later section.

Within the estimated maximum inner emergency planning zone, there are no permanent residents. No sensitive activities such as hospitals, elderly care homes, primary schools, preschools, or similar are present within the zone. Furthermore, there are no facilities for drinking water supply and no agricultural land within the zone.

Conditions within the Outer Emergency Planning Zone

Within the estimated maximum outer emergency planning zone, there is forested land, agricultural land, an industrial area, a port, a water area, and two smaller urban areas with a total of approximately 2,500 permanent residents.

Just over one kilometer southeast of the plan area lies the urban area of Norrsundet, where there is a preschool, a primary school, and a music school. The urban area of Bergby is located approximately three kilometers west of the plan area, where there is a health center, a care and nursing home, a preschool, and a primary school.

The infrastructure in the area consists of road 575, E4, the East Coast Line (*Ostkustbanan*), and a railway for freight traffic. There is also a port facility for freight traffic within the zone. Water supply and treatment exist in the form of the groundwater body (*grundvattenförekomst*) Gävle-/Lössenåsen-Totra, a waterworks in Totra, and a wastewater treatment plant in Norrsundet.

The zone includes several national interests, including commercial fishing, nature conservation, communications, and valuable substances and minerals. The Natura 2000 area Hådelles gammelskog is also located within the zone. These interests are described in more detail below.

Type and Number of Nuclear Installations

The site plan proposes the establishment of nuclear activities in the form of the construction and operation of a park with six lead-cooled small modular reactors (SMR) as well as an interim storage facility for nuclear waste. The reactor park is planned to have an electrical output of approximately 330 MWe. This corresponds to approximately one-tenth of the installed capacity at the Forsmark nuclear power plant. The operating life is planned to be approximately 50 years. The reactors shall be used for electricity production and, if necessary, industrial heat production.

Small modular reactors consist of a smaller nuclear reactor based on the same basic principle as today's large, traditional reactors. SMRs are more compact and are built in modules at a factory, making them faster and easier to construct. When the land and buildings are prepared, the reactor can be transported and installed at the facility.

The reactors planned are developed by the applicant Blykalla AB, are called SEALER (Swedish Advanced Lead Reactor), have built-in safety systems, and are cooled with lead. In the reactor,

uranium is fissioned, which releases heat used to boil water and form steam, which drives a turbine and a generator that produces electricity.

Planning Prerequisites and Compatibility with Chapters 3–4 of the Environmental Code

This section describes how the site plan relates to the management provisions in Chapters 3 and 4 of the Environmental Code.

General principles for land and water use, Chapter 3, Sections 1–3 of the Environmental Code

According to Chapter 3, Section 1 of the Environmental Code, a land area shall be used for the purposes for which the area is most suitable, taking into account its nature, location, and existing needs.

According to Chapter 3, Section 2, large land and water areas that are not at all or only insignificantly affected by development projects or other interventions in the environment shall, as far as possible, be protected against measures that could significantly affect the character of the areas.

According to Chapter 3, Section 3, land and water areas that are particularly sensitive from an ecological point of view shall, as far as possible, be protected against measures that could damage the natural environment.

The adoption of the site plan means that a limited area will be taken into claim to enable the construction of a nuclear installation with a total capacity of 330 MWe of dispatchable electricity. The land within the plan area is currently used for active forestry, and no protected areas are affected. Some species occurrence exists within the area that requires further inventory. The plan area is currently affected by nearby industry, and the plan can be seen as an extension of the existing industrial area.

Based on existing knowledge, the plan proposal is compatible with a generally sound management of land and water.

Agriculture and Forestry, Chapter 3, Section 4 of the Environmental Code

According to Section 4, agriculture and forestry are of national importance.

The plan proposal entails that productive forest land is taken into claim for the establishment of nuclear installations, which means that the ongoing land use for forestry is changed. The proposed area is located directly adjacent to the Norrsundet industrial area, which means that the plan proposal constitutes an extension of existing land use. This also means that the need to take into claim more unaffected areas in other locations is limited. No arable agricultural land is taken into claim within the plan area.

The taking into claim of the forest land is assessed not to significantly hinder rational forestry outside the plan area.

National Interest for Commercial Fishing, Chapter 3, Section 5 of the Environmental Code

According to Chapter 3, Section 5, land and water areas that are of importance for reindeer

husbandry or commercial fishing or for aquaculture shall, as far as possible, be protected against measures that could significantly hinder the conduct of these industries.

The plan area is not covered by any designated national interest claim according to Chapter 3, Section 5. However, a national interest for commercial fishing is designated along the coastline, within the surface water bodies (*ytvattenförekomster*) Norrsundet and Fårholmen, where a potential intake and discharge of cooling water is planned.

The national interest may be affected through the impact on local stocks via losses of fish, roe, and fry as a result of the cooling water intake, as well as altered local temperature conditions as a result of the discharge of heated cooling water.

There are good conditions for minimizing the impact on the national interest for commercial fishing. The intake and discharge of cooling water need to be planned so that the risk of impact is considered. Further investigations are needed to more closely assess the impact and the need for adaptations. Overall, the site plan, after any adaptations, is assessed not to cause significant harm to the national interest for commercial fishing.

National Interest for Nature, Culture, and Outdoor Recreation, Chapter 3, Section 6 of the Environmental Code

According to Chapter 3, Section 6, land and water areas and the physical environment in general that are of importance from a general point of view due to their natural or cultural values or with regard to outdoor recreation shall, as far as possible, be protected against measures that could significantly damage the natural or cultural environment. The need for green spaces in urban areas and near urban areas shall be particularly considered.

Within the plan area, there are no national interest areas for nature, culture, or outdoor recreation.

Outside the plan area, there are two national interests for nature conservation: Lindön-Björnön-Iggösundet at a distance of approximately 2 kilometers, and Hamrångeån approximately 5 kilometers from the plan area. The assessment is that the site plan is compatible with these national interests.

National Interest for Valuable Substances and Minerals, Chapter 3, Section 7 of the Environmental Code

According to Chapter 3, Section 7, land and water areas containing valuable substances or materials shall, as far as possible, be protected against measures that could significantly hinder the extraction of these.

Outside the plan area, approximately 1.7 km northwest, there is a designated national interest for valuable substances and minerals, named Bergby, referring to lithium. The national interest is assessed not to be affected by the site plan.

National Interest for Communications, Chapter 3, Section 8 of the Environmental Code

According to Chapter 3, Section 8, land and water areas that are particularly suitable for installations for industrial production, energy production, energy distribution, communications, water supply, or waste management shall, as far as possible, be protected against measures that could significantly hinder the establishment or utilization of such installations. Areas of

national interest for installations shall be protected against measures that could significantly hinder the establishment or utilization of the installations.

The site plan may affect national interests for communications regarding road, rail, and shipping located within the emergency planning zones. Outside the plan area, east of the port area, there is a national interest for shipping. Closest, approximately 4.5 km to the west, there are also three national interests – road E4, the East Coast Line railway, and the planned railway for the East Coast Line Gävle-Kringlan and Kringlan-Dingersjö.

The national interest for communications is assessed not to be affected by the site plan during either construction, normal operation, or decommissioning. The location does not entail that existing roads, railways, or fairways are taken into claim or that their function as communication routes is limited. The activity is also assessed not to hinder the possibilities to conduct operation, maintenance, or future development of the affected communication installations.

In the event of a nuclear accident, however, a temporary impact on national interests for communications within the emergency planning zones may occur. Deeper analyses of the impact on the national interest are needed when establishing the emergency planning zones. For example, regarding how road and rail traffic shall be regulated during and after a potential radiological event.

The transport generated by the site plan may lead to a certain increased use of the road, rail, and/or sea transport systems. This use is, however, assessed not to imply such a limitation of the communication installations' function or development possibilities that the national interests risk being significantly harmed.

Overall, the site plan is assessed to be compatible with the national interests for road, rail, and shipping and not to cause significant harm to the values that the national interests intend to protect.

National Interest for Total Defence, Chapter 3, Section 9 of the Environmental Code

According to Chapter 3, Section 9, land and water areas that are of importance for the total defence (*totalförsvaret*) shall, as far as possible, be protected against measures that could significantly counteract the interests of the total defence. Areas of national interest for total defence installations shall be protected against measures that could significantly hinder the establishment or utilization of the installations.

No openly disclosed land or water areas of importance for the total defence are affected by the site plan. Based on existing documentation, the national interest for the total defence is assessed not to constitute an obstacle to the site plan.

National Interest according to Chapter 4 of the Environmental Code

Chapter 4 of the Environmental Code contains specific provisions on the management of land and water areas that are of national interest for the country. There, specific geographical areas are designated as national interests with regard to the natural and cultural values present in the areas.

The plan area is not located within or near any areas specifically designated as national interests according to Chapter 4 of the Environmental Code. The nearest located Natura 2000 area is

located approximately 3 km northwest of the plan area, Hådells gammelskog. The assessment is that no Natura 2000 areas are affected in such a way that a permit is required.

Environmental Impacts and Implementation Issues

This section provides a brief description and assessment of the significant environmental impacts that the implementation of the site plan is expected to entail. The section also contains a description of other prerequisites and the future reviews required for the site plan to be implemented.

Environmental Impacts of Implementation

The plan proposal entails the taking into claim of natural land in close proximity to existing industrial activities, which results in an extension of the existing industrial area. The proposed establishment does not affect any protected areas. The land taken into claim consists of managed forest land.

Within the outer emergency planning zone (EPZ), there are areas of national interest for nature conservation, shipping-fairways, commercial fishing, and railways. Otherwise, no protected natural or cultural values or other national interests are present. No known recreational values occur in the vicinity of the plan area, and the plan proposal is assessed to be compatible with the nearby industrial environment.

The plan proposal gives rise to impacts through, among other things, the taking into claim of land, intake and discharge of water, groundwater drawdown, noise, raw material and chemical consumption, handling and interim storage of waste, energy consumption, and emissions to air. Regarding the intake and discharge of cooling water, particular consideration must be given to the impact on fishing and environmental quality standards.

Taking into claim of land

Natural Environment and Species

Conducted inventories generally show that the natural values in the area are low and that only limited values linked to habitats for protected species occur. This is with the exception of the southwestern corner of the plan area, where there are certain higher natural values. As there is some occurrence of suitable habitats and protected species, further inventory and investigation are assessed to be needed in connection with future reviews to determine whether protective measures and/or minor adaptations of the plan area are necessary. This is, however, not assessed to constitute any obstacle to the plan proposal.

Cultural Environment Values

The plan area is located at a relatively low altitude above sea level. Due to this, prehistoric remains are not expected to occur in the area. However, it cannot be excluded that unregistered cultural-historical remains exist, which implies a need to carry out an archaeological investigation in connection with future reviews. The plan proposal is, however, not assessed to be affected by the results of an archaeological investigation.

Climate Change

Due to its coastal location, the area is potentially exposed to flooding risks due to sea-level rise, as well as as a result of heavy rainfall in a future altered climate. The area is at its closest approximately 300 meters from the coast, and the elevation level is between +10.8 and +7.5

meters above sea level. The future mean water level in Gävle in the year 2100, according to a high-emission scenario (SSP5-8.5), is +27 centimeters (RH2000). This corresponds to an increase of 13 centimeters compared to the reference period 1995–2014 (SMHI, 2026).

The installation needs to be planned with consideration for future climate change. This includes the management and diversion of flows resulting from extreme rain and floods. The plan area, however, consists of undeveloped land, which means the land can be designed and graded to withstand more extreme rain and floods. The installation will also be adapted so that surface runoff of stormwater flows away from buildings and other sensitive infrastructure. Furthermore, the stormwater management will be designed so that precipitation can be delayed and treated within the property.

The assessment is that the plan proposal will not entail any significant risks due to climate factors. The possibilities for adaptations and protective measures are assessed as good.

Intake and Discharge of Water, Impact on Water Environment and Environmental Quality Standards

The assessment of the impact on the water environment and environmental quality standards is based on the extent to which the plan proposal affects the status of water bodies, contributes to deterioration, or hinders the possibility of achieving applicable environmental quality standards.

Both the discharge of stormwater and the intake and discharge of cooling water can affect the surface water bodies concerned.

Stormwater

Pollutants in stormwater normally constitute a significant contribution to the pollutant load in lakes and watercourses adjacent to developed areas. Stormwater management must therefore be carried out in such a way that discharges to the recipient do not risk compromising environmental quality standards. In preparation for future permit processes (detailed plan and permit according to the Environmental Code), a stormwater investigation will therefore be produced where flows and pollutant content are calculated, and the need for delay and treatment of the stormwater is investigated. No pollutants in the stormwater other than those commonly occurring in stormwater from industrial areas are expected to arise due to the plan proposal.

Regarding stormwater, the plan proposal is not assessed to affect the possibility of achieving good chemical and ecological status in the affected water bodies. The possibility is assessed as good to collect and, if necessary, establish systems for the delay and treatment of stormwater before diversion to the recipient.

Cooling Water

The amount of cooling water that will be needed for the reactor park depends on many factors, but in the current case, assessments are based on a requirement of approximately 18 m³/s of cooling water during the operation of six SEALER reactors.

In conducted modelling, the discharge water is assumed to be approximately 10 degrees warmer than the intake water. The intake of cooling water and the discharge of heated water can affect the aquatic animals and plants present in the immediate area. Impacts may, for example, include higher metabolism which can lead to food shortage problems, and problems with recruitment as eggs, larvae, and fry are lost in the intake or affected by temperature shocks. Problems with invasive species may also arise as a result of local heating.

The results of initial hydrodynamic modelling show a geographical distribution of heated water in the shallow areas around the discharge point. Future pelagic investigations (plankton, benthos, fish, etc.) will form the basis for further modelling and assessment of how the pipeline routing should be appropriately placed to minimize negative impact. The intake and discharge of cooling water will be located in either the Norrsundet or Fårholmen water bodies, alternatively, the intake may be located in the S S M Baltic Sea coastal waters.

In the event that intake and discharge points for cooling water and associated pipelines in water are placed adjacent to contaminated sediments in the Norrsundet water body (WA87973988), protective measures must be taken with regard to the presence of contaminated and fiber-rich sediments from previous industrial activity. This is because work in water and currents during the intake and discharge of cooling water can cause bottom sediments to be stirred up and dispersed, which could, among other things, further deteriorate the chemical status of the water body. If there is a risk of such impact, appropriate protective measures will be taken during both the operational and construction phases.

For example, the contaminated sediments can be encased with covering and erosion-protecting material, such as concrete mattresses, geotextiles, or isolation capping with, for example, sand and stone. Examples of protective measures that can be used during potential work in contaminated bottom sediments are protective turbidity curtains (e.g., silt curtains) that limit particulate dispersion. Additionally, there are several specially designed dredging methods for work in contaminated sediments that minimize dispersion risks, such as grab dredging with an environmental bucket or low-flow dredging.

Regarding the quality factors that prevent the Norrsundet and Fårholmen water bodies from achieving good ecological status, both the intake and discharge points need to be placed with consideration for these, and particularly the discharge point. The discharge point needs to be placed in a location with sufficient depth to mitigate the effects linked to the resulting temperature increase, primarily linked to biological quality factors. Regarding flow changes (the quality factor "hydrographic conditions") and morphological changes and continuity (the quality factors "connectivity in coastal waters" and "morphological condition in coastal waters"), these are also assessed to potentially be affected by the intake and discharge of cooling water, but to a lesser extent than the biological quality factors.

Further modelling, pelagic investigations, and sediment sampling need to be carried out to more accurately adapt the placement of the intake and discharge points so that impact can be limited, sensitive areas protected, and environmental quality standards not deteriorated or compromised.

Regarding cooling water, the plan proposal is not assessed to deteriorate the possibility of achieving good chemical and ecological status in the affected water bodies. Intake and discharge points and pipelines should be able to be placed within the current water bodies. There are good conditions for implementing protective measures in the event of impact on contaminated sediments, and intake and discharge points can be placed and technically designed so that the environmental impact is as limited as possible.

Groundwater Drawdown

The reactors are planned to be constructed approximately 15 meters below the ground surface, which means that parts of the installation will lie below the groundwater pressure level. The groundwater level will temporarily need to be lowered in connection with the construction phase and potentially also during the operational stage. During groundwater drawdown, there are

generally risks of ground settlement, which can cause damage to buildings, pipelines, and other infrastructure. When lowering the groundwater reservoir, there is also a risk of impact on groundwater-dependent vegetation.

To counteract such effects, protective infiltration can be applied during the construction stage, which means that water is added to the groundwater reservoir to avoid harmfully low groundwater levels. Another possible protective measure could be, for example, an adapted working method, such as limiting the duration of the groundwater drawdown. The extent of the groundwater drawdown, the risk of impact on the surroundings, and the need for protective measures will need to be investigated more closely in the permit process for the Environmental Code permit.

The assessment is that the plan proposal will not entail any significant risk of impact on surrounding activities, the natural environment, and land use due to the groundwater drawdown. The possibility of taking protective measures to counteract settlement and impact on the surroundings is assessed as good.

Noise

The activity will give rise to noise during both the construction and operational stages. During construction, this includes blasting, piling, compaction, and heavy transport; during operation, it includes moving installation parts such as ventilation systems and generators. No problems in meeting applicable noise guideline values for nearby residents, during either the construction or operational stage, are expected. This is because the nearest residents are located approximately one kilometer away, noise requirements will be stipulated in the procurement of installation parts, and the possibility for protective measures is assessed as good. The assessment is that the plan proposal will not cause any nuisance to human health based on noise.

Handling of Raw Materials and Chemicals

During operation, in addition to lead, chemicals such as nitrogen, argon, and oxygen, as well as chemicals for the treatment of incoming cooling water, will be used. All handling of chemical products will follow applicable legal requirements, and all liquid chemicals will be stored in a secure manner using bunding or similar. The assessment is that the plan proposal does not risk causing any nuisance to human health or the environment due to the handling of raw materials and chemicals.

Handling and Interim Storage of Nuclear Waste

Within the area for nuclear installations, spaces are planned for the interim storage of radioactive waste resulting from the installation's operation, including spent nuclear fuel. The waste is stored interim until it can be cleared (*friklassas*) and sent for external waste treatment, external interim storage, or directly to a final repository. The fuel will be stored interim in dry storage within the installation in licensed containers or in dedicated spaces.

Dry storage is a passive storage method. All safety functions—namely containment, radiation shielding, criticality safety, and removal of decay heat—are provided by the licensed container or the space adapted for that purpose. Decay heat is removed through natural convection of the surrounding air, which is why the method is not dependent on electricity supply, pumps, or coolants. The method is proven through more than four decades of commercial use in a large number of countries. The characteristics of the site therefore have less significance for the radiation safety of the interim storage, and dry storage can be applied safely regardless of the site in principle. The site is, however, significant in the following respects, all of which are assessed as favorable:

- The passive cooling is dimensioned against the surrounding air temperature, and the Swedish climate provides a significant margin to the temperatures for which commercially available container systems are licensed.
- Low seismic activity results in low design loads for the storage area, which must support heavily loaded containers.
- A secluded and contiguous operational area enables common physical protection for reactors and interim storage.
- The technology is modular, meaning capacity can be expanded as fuel is generated.

The spaces for interim storage will further comply with applicable requirements for physical protection according to the Nuclear Activities Act and SSM's regulations, including measures to prevent unauthorized access, sabotage, and unauthorized handling of nuclear material. The spaces for interim storage of radioactive waste and spent fuel will also be equipped with radiation shielding, physical protection, ventilation, and monitoring systems to ensure that the waste does not pose a risk to personnel or the surrounding environment. In addition, the interim-stored radioactive waste and spent fuel will be inspected regularly, and radiation levels monitored.

The assessment is that the plan proposal will not entail any unmanageable risk regarding the interim storage of spent nuclear fuel at the site. Conditions for handling and interim storage on-site are assessed as good.

Emissions to Air

The main emissions to air are primarily linked to transport, especially during the construction stage. Transport entails, among other things, emissions of particles and nitrogen dioxide. The addition, both regionally and locally, of these during both the construction and operational phases is, however, assessed to be negligible. In the event that air cooling is used, the operation in use will give rise to water vapor; no other emissions are expected from the activity during normal operation.

The assessment is that the plan proposal does not imply any nuisance to human health or the environment due to emissions of air pollutants. It is also assessed that the plan proposal will not result in any environmental quality standard according to the Air Quality Ordinance (2010:477) being exceeded.

Risks

During the construction stage, there will be construction work steps that entail accident risks, for example, in connection with heavy transport, heavy lifts, excavation, blasting, hot work (*heta arbeten*), and so on. In a risk identification, a number of risk sources have been identified for the activity in the operational stage. These include the handling of environmentally or health-hazardous substances, the handling of flammable or explosive substances, the handling of certain hazardous substances that can cause a serious chemical accident, stockpiles of large quantities of combustible or organic material, substances handled under high pressure or high temperature, and cooling systems and/or substances handled at low temperatures. Accident risks have been identified based on the perspectives usually considered according to the Environmental Code.

Lead will be used as a cooling medium in a closed circuit in the reactors, in quantities that exceed the higher requirement level according to the Seveso Act, which means that the installation becomes a so-called Seveso establishment.

Accident risks in the surroundings that have been assessed as relevant have been identified as follows:

- Transport of dangerous goods.
- Accident risks within the Norrsundet port area. Various types of goods such as wood products, coke, and waste are handled at the quay.
- A company has been granted a permit to establish a biorefinery within the Norrsundet industrial area. The biorefinery, if constructed, would comprise the production and storage of green fuels such as aviation fuel, diesel, or gasoline to such an extent that it becomes a Seveso establishment at the higher requirement level. The process involves flammable goods which, in the event of an accident, could cause an impact on the surroundings and parts of the plan area in the form of heat radiation, shrapnel, shockwaves, and fire gases. Cooling systems may contain ammonia (up to 25 tonnes), a toxic gas that poses a risk impact on the surroundings.
- Other activities within the Norrsundet industrial area. Among other things, the establishment of a data center is planned within the area, which, due to the backup power installation, will be classified as a Seveso establishment.

All accident risks as above, both within and outside the plan area, will need to be managed to enable the establishment of a nuclear installation within the plan area. A number of risk investigations will therefore need to be carried out in connection with the permit review according to the Environmental Code. Among other things, the Seveso legislation will place special requirements on the risk investigation if several Seveso establishments are located next to or near each other. The focus then falls on identifying and managing so-called domino effects and the cumulative risk at the site.

The plan area is large, which means there are good conditions for adaptations, including the placement of installation parts to reduce identified risks. Furthermore, there are also good conditions for managing risks within the area and risk impacts from activities outside the plan area using various appropriate protective measures.

The assessment is that the plan proposal does not entail risks that cannot be managed during future permit reviews. The possibility for adaptations and protective measures is assessed as good.

For the management of radiological risks and extremely unlikely events, emergency planning zones (EPZ) will be established; see further under future reviews. Within the emergency planning zones, pre-distributed warning receivers, iodine tablets, and information to the public are available. There are also evacuation plans to enable the rapid evacuation of both the inner and outer emergency planning zones in the event of an accident.

The location is assessed to be suitable from a preparedness perspective because the number of residents and sensitive activities within the estimated maximum inner and outer emergency planning zones is limited, which facilitates the planning and implementation of protective measures.

Responsibility

The applicant is responsible for the implementation of the plan and for constructing the nuclear installation in accordance with the permits and reviews required. The applicant is the party that secures access to the land, initiates, drives, and funds the implementation and future investigations in consultation with the affected infrastructure owners and principals.

Future Reviews

The Government's adoption of the plan is a first step in a multi-year permit process, with extensive reviews according to the Environmental Code and the Act (1984:3) on Nuclear Activities, where safety, environmental, and radiation protection issues are examined in detail by the Swedish Radiation Safety Authority (*Strålsäkerhetsmyndigheten*), the Land and Environment Court (*mark- och miljödomstolen*), and other affected authorities before the installation may be constructed and put into operation. Below is a description of the most important permit reviews required for the plan proposal to be implemented.

Reviews according to the Planning and Building Act

The installation and the activity may have various effects on the community of Norrsundet and the immediate surroundings. The landscape is changed, and there may also be both short-term and long-term effects on residents, services, business, and culture during the construction and operational stages. This aspect of the installation affects several stakeholders.

The municipality is affected, among other things, through its planning monopoly (*planmonopol*) where land use is regulated according to the Planning and Building Act. The installation is subject to the detailed plan requirement due to its impact on the surroundings and because the installation constitutes a Seveso establishment of the higher level. In the detailed plan, the municipality reviews the suitability of the land based on both general and individual interests. Among other things, risks linked to a changed climate with more extreme weather will be handled in the planning process.

After the Government has adopted the site plan, it constitutes a new planning prerequisite, which the municipality needs to relate to in connection with reviews according to the Planning and Building Act in the area. The plan area and the emergency planning zones will be regarded as a general interest. In the emergency planning zones, the County Administrative Board will monitor that changed land use does not hinder the possibility of taking appropriate protective and preparedness measures.

Permit according to the Environmental Code

Constructing and operating a nuclear installation is an environmentally hazardous activity that can cause nuisance to human health or the environment and therefore requires a permit according to Chapter 9 of the Environmental Code. An application to construct and operate a reactor shall be reviewed by the Land and Environment Court, see Chapter 1, Section 6 and Chapter 21, Section 7 of the Environmental Review Ordinance (2013:251). The Environmental Code shall be applied so that human health and the environment are protected against damage and nuisance.

The activity may also be dependent on extensive water operations, which require a permit according to Chapter 11, Section 9 of the Environmental Code, which is also reviewed by the Land and Environment Court. For an activity that involves water operations due to, for example, the intake and discharge of cooling water, the permit review according to Chapter 9 of the Environmental Code and Chapter 11 of the Environmental Code will be conducted in the same permit review by the Land and Environment Court.

In a permit review according to the Environmental Code, a specific environmental assessment according to Chapter 6, Section 28 of the Environmental Code shall be carried out. This means that the operator (*verksamhetsutövaren*), i.e., the party intending to conduct the activity, consults on how an environmental impact assessment shall be scoped, produces an

environmental impact assessment, and submits it together with the permit application according to the Environmental Code to the Land and Environment Court.

By identifying, assessing, and documenting environmental effects after consultation with authorities, specially affected parties, and the public, the operator obtains a basis to gradually plan their activity based on knowledge of environmental effects.

The specific environmental assessment further means that the Land and Environment Court gives affected parties the opportunity to comment on the environmental impact assessment. The court shall ultimately decide whether the environmental impact assessment meets the requirements in Chapter 6 of the Environmental Code so that the specific environmental assessment can be completed. This usually occurs in connection with the resolution of the case, i.e., when the judgment is rendered in the matter and when a permit is granted or not.

The judgment also contains the conditions needed to prevent or limit the activity from causing damage or nuisance to human health or the environment. This may concern conditions for noise, emissions to air and water, handling of chemical products, handling of waste, and so on.

The environmental impact assessment for the nuclear installation planned at the site will need to be detailed. It will, among other things, need to include investigations showing that applicable noise guideline values and environmental quality standards can be maintained and that the impact due to the planned groundwater drawdown can occur with acceptable environmental impact and acceptable risks for surrounding land use.

If the intake and discharge of cooling water becomes relevant, it will be necessary to account for the location of the pipeline routing and the intake and discharge points and that the environmental impact resulting from the chosen locations is acceptable. It will, among other things, need to be shown that any placement at or near contaminated fiber-rich sediments can occur with acceptable risk and environmental impact. For chosen locations, it must also be clear that the impact on the water environment at the intake and discharge points is acceptable and that the environmental quality standards for the affected water bodies are not at risk of being deteriorated or compromised. It is likely that detailed hydrodynamic modelling will be required to show that the environmental impact can be accepted.

The installation will also constitute a Seveso establishment because lead will be used as a cooling medium in the reactors in quantities that exceed the higher requirement level according to the Act (1999:381) on measures to prevent and limit the consequences of major chemical accidents (the Seveso Act). The review according to the Seveso Act will be conducted by the Land and Environment Court in the same permit review as the review of the Environmental Code permit. In the permit review, cumulative risks to other nearby constructed and permitted Seveso establishments will need to be carefully highlighted.

Permit according to the Nuclear Activities Act

Constructing, possessing, and operating a nuclear reactor requires a permit according to the Act (1984:3) on Nuclear Activities (the Nuclear Activities Act). The Nuclear Activities Act regulates nuclear activities with a particular focus on nuclear safety, the prevention of radiological emergencies, and the limitation and management of the consequences of such events. According to the Act, a nuclear installation shall be designed, sited, constructed, commissioned, operated, and decommissioned in such a way that radiological emergencies are avoided and that the consequences can be managed if such a situation nevertheless occurs. Also of importance are the requirements to prevent and limit emissions of radioactive

substances and to prevent such emissions that could necessitate protective measures outside the installation.

When reviewing a permit according to the Nuclear Activities Act, several provisions of the Environmental Code shall also be applied, such as the general rules of consideration in Chapter 2, provisions on plans and planning documentation in Chapter 3, provisions on environmental quality standards in Chapter 5, and the provisions on environmental assessments and environmental impact assessments in Chapter 6. The Swedish Radiation Safety Authority investigates the question of permits for new nuclear reactors and submits a statement with a recommendation to the Government, which decides on the permit. The Swedish Radiation Safety Authority is also the supervisory authority and decides on the conditions needed with regard to safety.

Establishment of Emergency Planning Zones

The current distances for emergency planning zones are regulated in the Ordinance (2003:789) on Protection Against Accidents and are designed for existing Swedish nuclear power plants. For small modular reactors, the legal situation is unclear because the ordinance does not contain any general model for establishing an installation-specific emergency planning zone for new reactors. The future design of the Swedish regulatory framework regarding emergency planning zones is currently being investigated by the Nuclear Power Review Committee (*Kärnkraftsprövningsutredningen*) KN 2023:04, and changes may be introduced as a result of this.

When establishing emergency planning zones, the risk profile is analyzed. The main issues primarily investigated are:

- What can happen? (accident scenarios and radiological risks)
- What can be released? (radioactive inventory and source term)
- How does it spread? (atmospheric dispersion under different weather conditions)
- What doses arise? (dose to humans at different distances)
- What protective measures are needed and can they be implemented?

The Swedish Radiation Safety Authority performs radiological analyses and dose calculations to calculate consequences for the public. Radiological risks include potential unplanned events where acceptance criteria are applied as the requirement for radiation dose to the public. The nuclear installations will need to be constructed so that the dose to a representative person from the public is lower than the acceptance criterion for the respective event class. Subsequently, an assessment is made as to whether emergency and planning zones are needed and to what extent. The assessment is linked to which protective measures need to be implementable, for example, staying indoors, evacuation, and iodine tablets. The extent of the emergency planning zones is determined not only based on the power of the reactors but also based on risks and consequences.

The estimated maximum emergency planning zones for the installation with six SEALER reactors are estimated to be one-fifth the radius of existing nuclear power plants, i.e., an inner emergency planning zone of approximately 1 kilometer and an outer emergency planning zone of approximately 5 kilometers. According to current regulation under Chapter 4, Section 21 c of the Ordinance on Protection Against Accidents, the exact design of the emergency and planning zones is established by the County Administrative Board where the nuclear installation is located, after views have been obtained from the Swedish Radiation Safety Authority and the Swedish Civil Contingencies Agency (*Myndigheten för civilt försvar*).

Appendices

- Appendix 1. Plan Map
- Appendix 2. Environmental Impact Assessment
- Appendix 3. Distribution List