Status

Frisläppt

Dokumentnamn
3.1 Rapport - Allmän

Reg nr	Utgåva	Sida	Bilagor
2017-06350	1	1 (10)	0

Utfärdad	Gäller fr o m	Gäller t o m
2017-05-02		

Titel

Decommissioning of two boiling water reactors and the common waste handling building at the Oskarshamn Nuclear Power Plant

Utfärdare	Katarina Andersson/AF
Skriv- och språkkontroll	Helen Mannerlöf/GAS
Sakgranskning	Jörgen Eriksson/A Jim Håkansson/AG Sofia Eliasson/GRA
Kvalitetsgranskning	Nej
Projektgodkänt	Nej
Linjegodkänt	Andreas Roos/A/2017-07-05
Extern granskning	Nej
Frisläppt	Katarina Andersson, AF, 2017-07-05

Ärende

Distribution
ADR, APS, HER, JEN, ORE, KAT, MII, URB, SOI, JIM

Sekretessklass

Intern

Table of Contents **Sida**

Introduction 3

Background 3

Description of the area 4

General description of the process in a nuclear power plant 7

Radioactive waste 8

Planned activities 9

Effects and consequences 10

Introduction

OKG intends to apply for a change in the licence under the Environmental Code that covers the operation of the entire facility. The application applies to the dismantling and demolition of the nuclear power reactors Oskarshamn 1 and 2 (O1 and O2) at the Oskarshamn nuclear power plant. The nuclear power plant is located on the Simpevarp peninsula and is part of the Simpevarp 1:8 property in the municipality of Oskarshamn. Other operations at the nuclear power plant will remain in operation in accordance with the licence. At present, consultation regarding the dismantling and demolition is being carried out.

Background

The Oskarshamn nuclear power plant consists of three reactors, O1, O2 and O3, which together account for approximately 10 % of Sweden’s electricity generation. Reactor O1 was commissioned in 1972, making it the country's oldest nuclear power reactor in commercial use. Reactor O2 was commissioned in 1974 and has been shut down since 2013, since it was the subject of a modernisation and safety project, intended partly to increase the thermal power of the reactor. Reactor O3 was put into operation in 1985.

During 2015, OKG decided that the decommissioning of reactor O1 would begin in 2017. In June 2016, the Land and Environmental Court issued a permit pursuant to the Environmental Code for changing to shutdown operation and thereafter care and maintenance operation of the reactor. During 2015, OKG also decided to discontinue the modernisation project on reactor O2 and to not re-start the reactor, but instead prepare for decommissioning. An application for a permit for O2 to change to shutdown and care and maintenance operation was submitted to the Land and Environmental court in June 2016.

According to the current planning, the subsequent phases of the decommissioning of the reactors, i.e. dismantling and demolition, will be coordinated. It is OKG’s aim that an application for a permit for dismantling and demolition of the reactors O1 and O2 can be submitted to the court in mid-2017.

The various phases of decommissioning are briefly described below:

Shutdown operation:	An operating condition in which the generation of electricity has ceased and in which the fuel is finally removed and transported from the reactor. When all the nuclear fuel has been finally removed the plant goes over automatically to care and maintenance operation.
Care and maintenance:	An operating condition in which all fuel has been finally removed from the reactor, but in which the reactor still contains radioactive material.
Partial dismantling:	A measure in which some of the plant's internal parts are removed. The parts referred to are internal parts of the reactor pressure vessel and part of the turbine plant.
Dismantling and demolition	Dismantling and demolition is the phase of decommissioning that follows shutdown and care and maintenance operation. During this phase, activities continue to dispose of all or part of the plant and to reduce radioactive substances in ground and remaining buildings to levels that enable exemption from radiological classification for the plant.

Description of the area

The Oskarshamn nuclear power plant is located by the Baltic Sea in the municipality of Oskarshamn, on the Simpevarp peninsula, 20 km north-east of Oskarshamn; see Figure 1. Also located on the Simpevarp peninsula (Simpevarp 1:9) is the Swedish Nuclear Fuel and Waste Management Company (SKB), the central interim storage facility for spent nuclear fuel (Clab). SKB also runs harbour activities at the Simpevarp harbour. The harbour is situated directly adjacent to the Oskarshamn power plant and is mainly used to land spent nuclear fuel en route to Clab and for the outward transportation of radioactive waste to specialist handling facilities.

Seawater is used for cooling the process in the reactor units. The water is heated inside the nuclear power plant and is then discharged into Hamnefjärden on the north side of the peninsula. The surface water intake is to the south-west of Simpevarp and can only be used by units O1 and O2.

Purified waste water from Simpevarp is also discharged into Hamnefjärden. Waste water is divided into active waste water, sanitary waste water, drainage water and storm water.

Figure 1. Overview map OKG's facility marked with a red circle

Within the operating area there are the three reactors with steam turbines and electricity generators, as well as a number of facilities and operations that are necessary for the generation of electricity, such as cooling water intake, facilities for handling and storing radioactive waste, oil-fired back-up power generators, a hydrogen plant, drainage plant, water treatment plant, oil tanks, workshops and a waste handling station.

Also within OKG's area is a Landfill (surface repository) for very low-level waste and a bedrock depository for the temporary storage of low and intermediate level waste (BFA), situated 20 metres below ground level. The various parts of the operating area are shown in Figure 2.

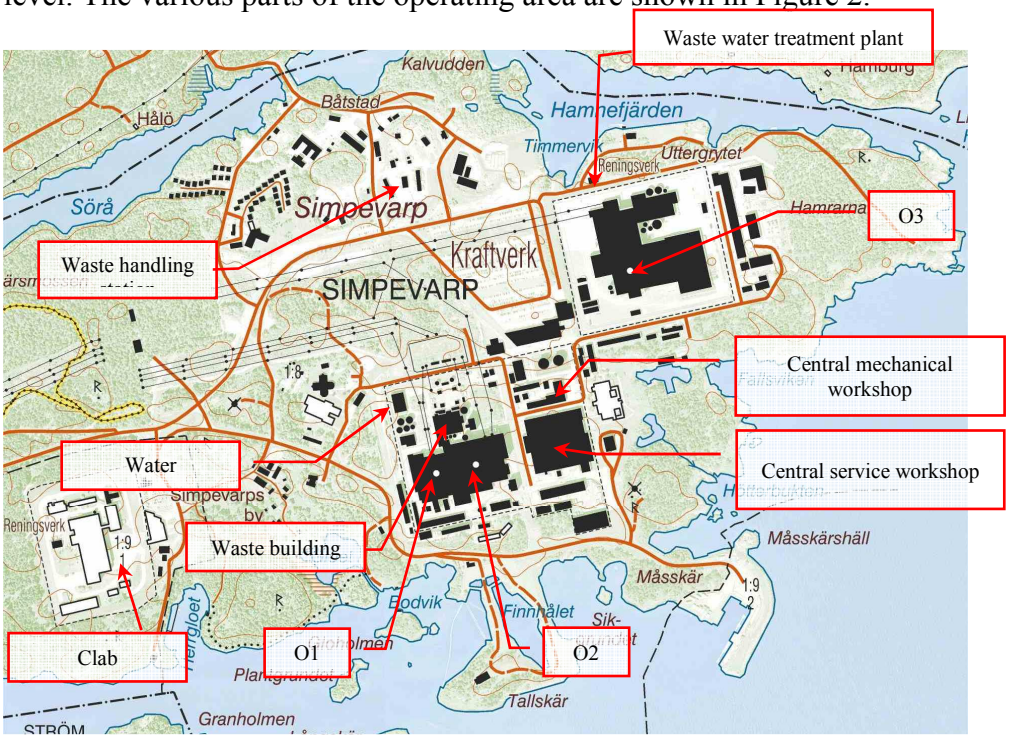

Figure 2. Map of the operating area and the Simpevarp peninsula.

General description of the process in a nuclear power plant

O1 and O2 are BWR (Boiling Water Reactor) type nuclear power reactors. In production, a uranium core is split to release energy in a process called fission. The energy released is transferred to water, which boils, creating steam. The steam drives turbines that produce motion energy. This motion energy is converted into electricity in the generator.

Seawater is used to condense the steam in a condenser after it has been used in the turbines. The water that is used in the process comes from a nearby lake and is de-ionised in a water treatment plant. The main flow chart for the process is shown in Figure 3.

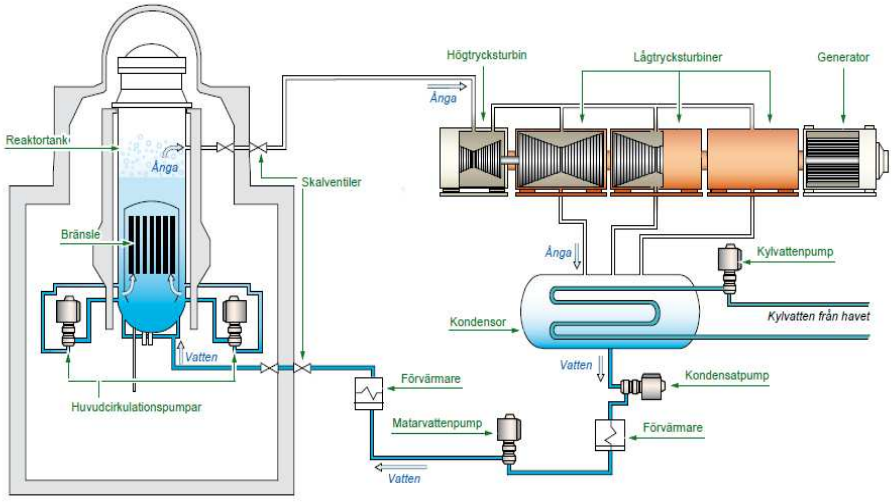

Figure 3. Main flow chart for the process

The nuclear power plant also has auxiliary power consisting of eight diesel sets and two gas turbines.

O1 and O2 have a common waste facility. The waste facility handles radioactive waste – filter material – arising from the purification of process water. The water is purified and can then be re-used in the process or discharged to Hamnefjärden. The waste facility also handles water from the central service workshop and embedding of ion exchanger resin from O3. Conventional waste water is directed to the waste water treatment plant, which has mechanical, biological and chemical treatments.

Radioactive waste

The operation and demolition of a nuclear power plant gives rise to radioactive waste. The demolition waste mainly consists of the waste categories large components, metal, compactable/flammable and other. Large components are material that cannot fit into a 20 foot container and metal includes, for example, metal scrap, cables and pipes. Compactable/ combustible waste includes insulation, rags, plastic, protective clothing etc. and the category other includes sand and concrete. There is also process waste in the form of ion exchanger resin and filters, for instance.

The radioactive waste is categorised on the basis of the radioactive half-life of the radio nuclides that are included and based on the activity content of the waste. Radioactive waste may be short-lived very low-level, short-lived low- and intermediate-level or long-lived low- and intermediate-level. High-level waste consists of spent nuclear fuel. Material that from a radioactivity point of view can be classified as clean (clearance – exemption from radiological classification) can be used freely.

Short-lived very low-level waste is currently placed at a landfill operated by the waste producer, or is alternatively treated externally for classification exemption and volume reduction. The short-lived low- and intermediate-level waste is finally disposed of in the final repository for short-lived radioactive waste; SFR, in Forsmark. Long-lived low- and intermediate-level waste mainly consists of core components, i.e. reactor components that were installed close to the core and thus subjected to powerful neutron induced radiation. OKG has a licence for temporary storage of core components in the bedrock depository for active waste (BFA). It is planned that final disposal of long-lived low- and intermediate level waste will take place in a special repository for long-lived waste (SFL) which is expected to be in operation by 2045.

The reactor owners have together formed the Swedish Nuclear Fuel and Waste Management Company (SKB), whose task is to handle nuclear waste and spent nuclear fuel from the Swedish nuclear facilities.

When handling radioactive waste at SKB’s facilities, SKB is also responsible for the transport, storage and final disposal of the waste. Radioactive waste from the Swedish nuclear power plants is transported by a specially built vessel called m/s Sigrid.

Planned activities

The main activities concern the dismantling and demolition of reactors O1 and O2. The intention is to ensure that the dismantling and demolition activities at O1 and O2 take place in a coordinated manner. The reactor buildings and the building housing the waste facility 0AVF are, together with a number of other buildings not located within the controlled radiological area, physically connected to one another. OKG has at the present time not decided whether or not some or all of these buildings will be demolished in connection with the radiological dismantling and demolition of the reactors. When in time and to what extent the buildings will be demolished depends on any interest existing concerning the future use of the site.

Before dismantling and demolition begins, the internal parts of the reactors will be removed and system decontamination performed so as to minimise dose commitment to personnel who will work in the plant during the dismantling and demolition work. Decommissioning work in the turbine building will begin in parallel with this. After this, the decommissioning work continues in other parts of the reactor building, at the same time as work is also initiated in other parts of the plant. The choice of techniques for dismantling and demolition is generally based on experience of international decommissioning projects, as well as national segmentation projects. The aim is to reduce the dose to personnel and minimise the quantity of active waste.

All in all, the decommissioning of O1 and O2 is estimated to give rise to approximately 270,000 tons of material, of which circa 10 % is deemed as active. These figures include all buildings semi-detached to the reactors.

Handling and temporary storage of waste will primarily take place within OKG’s operational area. An adjacent building will be adapted in order to be used for clearance of waste, or a new building will be built for this purpose. The low level waste handling building (HLA) must be supplemented with preliminary two to three additional positions for nuclide specific measurement of waste packages. Increased capacity for interim storage of demolition waste in the storage facilities for low level waste (LLA) will also be required.

Radioactive waste, which will be transported to an external final storage facility, will primarily be transported by sea. Waste to be treated externally, such as for smelting, may be transported either by land or sea. The conventional waste will primarily be transported by road to a conventional waste reception centre. Sea transport may also be used for this waste.

The dismantling and demolition of O1 and O2 is estimated to take seven years, the first five of which would be used for the decommission and demolition radioactive parts.

The waste management infrastructure, such as extension of the interim storage of low level waste, is expected to take place early in the process.

Effects and consequences

The effects and consequences for human health and the environment of the activities covered by the application will be described in an Environmental Impact Statement, which will be attached to the application. The environmental consequences that are expected to arise are primarily linked to the demolition work, handling of waste and transportation.

Spent nuclear fuel is removed from the reactors before large-scale dismantling and demolition begins. OKG also intends to perform partial dismantling of internal parts located in the reactor pressure vessel during care and maintenance operation and to perform system decontamination before large-scale dismantling and demolition begins. Therefore, before large-scale dismantling and demolition begins, most of the radioactivity and radioactive components in the facility will have been removed, for which reason the risk of dispersion of radioactivity in the facility or to the environment will be small.

Handling and sorting the demolition material will entail that areas of ground are used, but it has been determined that appropriate areas for this are available within OKG’s operating area. The occurrence of contaminated surface water from areas where demolition material is handled will be limited, in that the material will be protected from precipitation and wind. The demolition work and transport will give rise to noise and emissions to air. Both sea and road transport will be used. The systems needed for operation will be decommissioned, which reduces the energy consumption and resources needed for their operation. The energy consumption and resources needed for waste handling will however increase during dismantling and demolition as the volume of waste being handled increases.