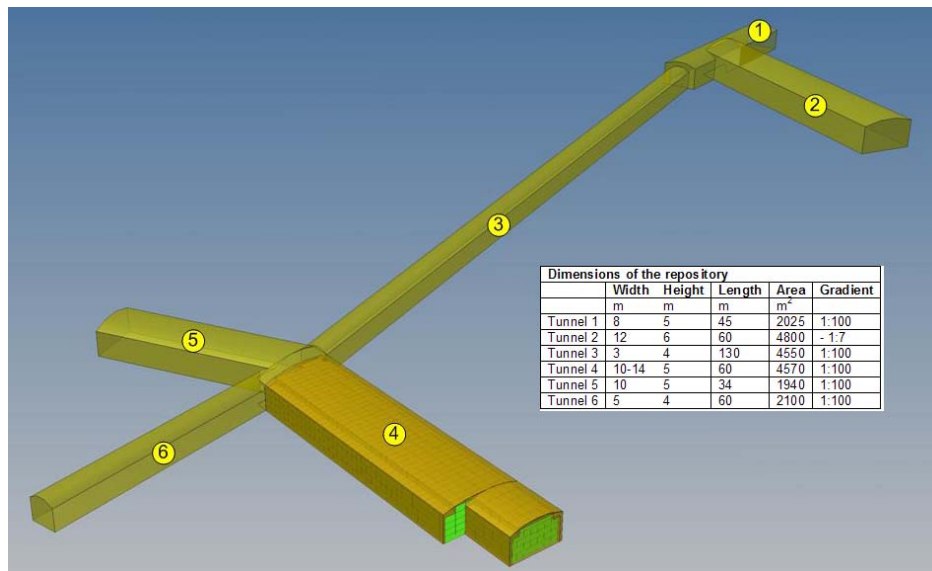


## Repository for radioactive waste from petroleum operations

In March 2008, the Norwegian Radiation Protection Authority (NRPA) gave authorisation to a new repository for radioactive waste from the petroleum industry on the Norwegian continental shelf. The authorisation is for four years initially. The repository will be the final storage destination for radioactive waste which contains enhanced levels of naturally occurring radioactive substances from petroleum extraction operations. Thus, it gives a safe and final storage facility for radioactive waste temporarily stored in facilities along the Norwegian coast. The repository is the first of its kind in Norway and is situated at Stangeneset Industrial Site in Gulen, Sogn og Fjordane County.



Overview of the repository 1. Entrance; 2. Treatment facility and intermediate storage; 3. Entrance tunnel; 4 and 5. Deposit tunnels; 6. Entrance tunnel extension.

The NRPA has authorised Wergeland-Halsvik to manage the repository, pursuant to the Norwegian Act on Radiation Protection and Use of Radiation (No. 36 of 12 May 2000) and Regulations on Radiation Protection and Use of Radiation (No. 1362 of 21 November 2003). The Norwegian Pollution Control Authority has likewise authorised the repository pursuant to the Pollution Control Act (No. 6 of 13 March 1981). The repository has also been assessed pursuant to The Planning and Building Act (No. 77 of 14 June 1985).

### What is to be stored in the repository?

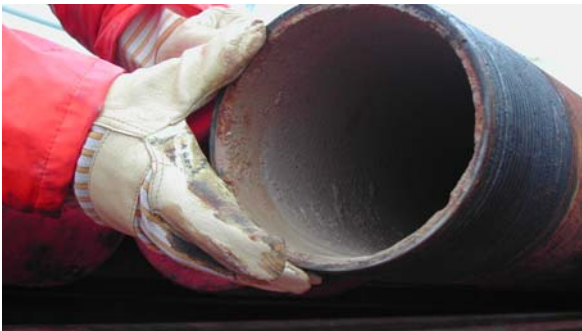
The geological rock formations where oil and gas reservoirs are found contain small concentrations of natural radioactivity, including radium. As the oil or gas is extracted some of the radium reacts with seawater to produce a hard and nearly insoluble coating inside the pipes and other production equipment. This coating is commonly called “scale” and creates problems for the petroleum industry due to clogging of production equipment which reduces efficiency. The clogged equipment is regularly cleaned at land based facilities, which are authorised by NRPA, for the treatment and intermediate storage of radioactive waste. Waste containing scale with an activity

level exceeding the current limit of activity must be treated as radioactive waste and finally stored at the repository. By May 2008 the limit is 10 Bq/g for the total activity. Generally, radioactivity in scale ranges from 10 to 100 Bq/g.

### The role of the repository

Waste containing scale is temporarily stored in one of eight storage facilities along the Norwegian coast. When the authorisation for the repository was given, about 400 tons of such waste was in temporary storage. The operators of the repository will focus on depositing existing waste in the first phase of operation. The repository will then become a final storage for existing radioactive waste from the petroleum industry.

Waste containing scale is continuously being produced due to petroleum extractions and the amount produced is expected to increase due to future decommissioning of oil platforms. It is assumed that in the next 30 years, about 3000 tons of such waste will be produced. The repository has capacity for 6000 tons of waste.



*Production pipe with scale.*

### The repository's design

The repository is situated within an underground rock formation. It consists of an entry tunnel, a tunnel for waste treatment as well as two tunnels for waste deposition. Treatment consists of dewatering waste and sealing them in a cement matrix. The repository tunnels are to be filled with waste, cemented in concrete mould castings, as shown in the drawing.

There are four barriers to stop the spread of radioactivity from the stored waste. The first barrier consists of either the plastic barrel in which the waste is stored or the matrix material, cement. The concrete walls of the permanent

mould casting constitute the second barrier whilst the third barrier is the cement around the castings. The final barrier is the surrounding rock formation itself.

The repository has been assessed in relation to possible future impacts from e.g. flooding, mud slides, decomposition of barriers and attempted unlawful entry.



*Sketch of a repository tunnel with concrete mould castings; units are measured in metres.*

### Conditions set by the Norwegian Radiation Protection Authority

The authorisation from the NRPA is given under the condition that a State guarantee is also given for the facility.

Only waste which contains enhanced levels of natural radioactive substances, and discarded production equipment with the associated scale from petroleum operations on the Norwegian continental shelf are to be deposited in the repository. Due to risk of fire, it is specified that the waste shall contain less than 5 % oil, such as required by the Norwegian Directorate for Civil Protection and Emergency Planning.

Other conditions for the authorisation include:

- There shall be no leakage of radioactive substances to the environment.
- Waste water arising during treatment shall be collected in containers, measured for radioactivity, and if necessary “cleaned” before released.
- The operator shall annually monitor the environment around the repository and report potential incidents involving radioactive substances. The monitoring shall include testing of treatment water, seawater, sediment, benthic fish, soil, vegetation, the rock formation, groundwater and ash waste.
- Updated journals on the deposited waste shall be available at any given time.
- The facility will be required to report annually to the NRPA.