

The new Norwegian repository for LSA scale from the petroleum industry

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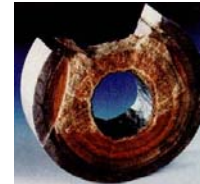
NSFS meeting
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LSA scale – what is it?

Definitions and explanations

- **LSA scale** (Low Specific Activity scale) is a radioactive deposit inside pipes and other production equipment and consists of carbonates and sulphates of Ca, Ba and co-precipitated Ra.
- The salts were dissolved in the reservoir itself in a mixture of original formation water and injected seawater. When transported to the surface together with the oil, the pressure and temperature drops, and the salts are deposited.
- LSA scale is a type of NORM – Naturally Occurring Radioactive Material



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LSA scale – quantities

Annual production (Norway)

- LSA scale – **about 20 tons** – expected to increase to >100 tons within few years (the production increases with increasing age of the oil fields).

Stored quantities (Norway)

- Scale, sludge, etc. – **about 400 tons** at different coastal bases, containing about 0.25 gram of radium

Radwaste classification

- LSA scale may be classified as VLLW
- In Norway it is defined as non-nuclear radwaste

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End solutions for LSA scale

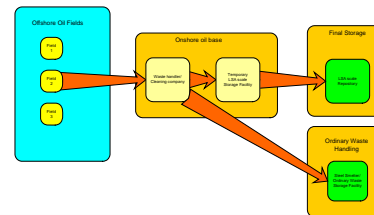
- In common terms "repository" means "facility for final (eternal) storage (of waste)".
- For a LSA scale repository "eternity" is 10 x 1600 years.
- An LSA scale repository should satisfy the following criteria:
 - The waste material should be chemically stable.
 - The repository should withstand weathering.
 - The repository including the area should have a sustainable owner.
 - The repository concept should be likely to be accepted by future generations.
- 3 examples of final storage for LSA scale in Norway and UK:
 - Storage of 70 tons of LSA scale in KLDRA Himdalen (Norway).
 - Storage of material from 44 drums from Brent Spar at Drigg.
 - Storage of unknown amounts of LSA scale in an "unconstricted repository" in UK: the bottom sediments of Aberdeen harbour.

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Waste handling

LSA scale is handled according to the same principles as all other waste in the industry i.e. in a "cradle to grave" perspective with focus on highest possible degree of reuse and recycling. Therefore, LSA scale contaminated equipment is cleaned by e.g. high-pressure water jetting facilitating recycling of the component steel and minimisation of the NORM waste.



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The new repository

The new repository is designed for safe disposal of NORM bearing waste i.e. LSA scale from the oil and gas industry

- The facility will receive untreated LSA scale which, after being conditioned and packed in HDPE-lined concrete containers, will be disposed of in underground rock caverns.
- The repository has a current capacity of 6300 tons of LSA scale. The capacity can be extended to meet any future demand.

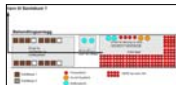
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LSA scale from "cradle to grave"



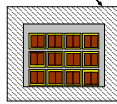
LSA scale is collected and stored at onshore bases and decommissioning sites



LSA scale is dried, chemically stabilised and packed in HDPE drums and concrete containers



LSA scale is transported to Stangeneset Repository

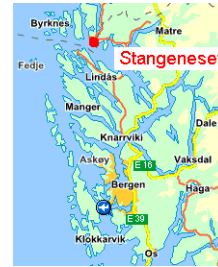


The containers are placed in the repository tunnel

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Location of the new repository



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The repository is located in a quarry area (see arrow) on the northern side of the Fen Fjord.
(The Mongstad refinery site is seen on the far side of the fjord.)



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Operational conditions

- The construction of the facility started in August 2006.
- The operator is the company **Wergeland-Halsvik AS**.
- **Norse Decom AS** – which is a subsidiary of IFE – is responsible for QA, environmental monitoring and radiation protection.
- The Norwegian Government has given **State Fund Guarantee** for the repository and thereby approved it.
- Due to an explosion in May 2007 in a large oil tank in the close vicinity of the repository, the authorities did not want to grant the permit of operation for the repository until official accident investigations had been performed and conclusions drawn.
- The **Permit of Operation** was granted by the Norwegian Radiation Protection Authority (NRPA) in March 2008.
- Operation will start in June 2008.

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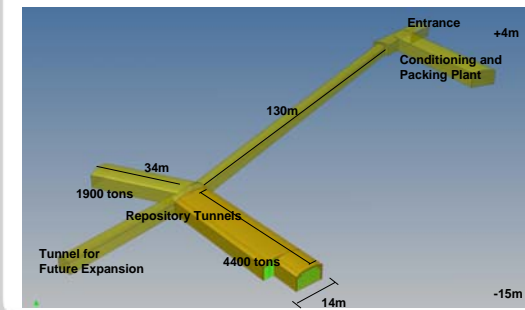
Contractual and legal conditions

- The LSA scale producer is the scale owner. In practice this means the actual licence holding oil and gas company.
- Prices and other conditions for disposal in the new facility are defined in a major contract with Statoil (now StatoilHydro).
 - But all Norwegian producers have the right to establish contracts at the same terms.
 - The LSA scale is defined according to current Norwegian legislation. Other conditions with respect to physical and chemical properties are also set.
- The country of origin defines the LSA scale "nationality". LSA scale can be exported from e.g. UK for disposal in the repository. However, to do so requires approval from both the exporting and the importing country.
- The repository has the capacity.

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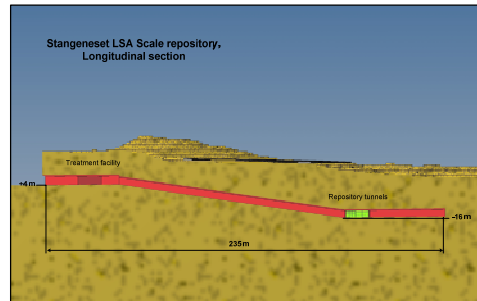
3D model of the repository



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Longitudinal section



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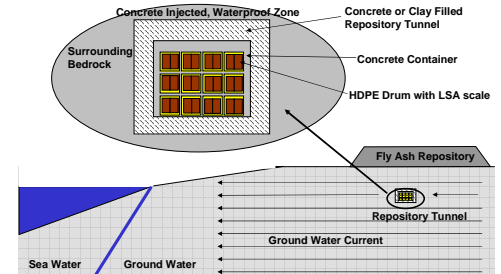
Environmental monitoring programme

- Radiological investigations were performed in 2005 and 2006, well before start of operation of the repository.
- Terrestrial samples of local rock, fly ash, birch, and bog cotton were collected at the surface area above the repository.
- Marine samples of sea water, sediment and blue mussels were collected near the outlet of the discharge pipeline, while cod was sampled as close to the pipeline outlet as possible.
- Ground water was sampled from a drainage basin in the repository tunnel.

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Hydrological conditions in the post operational phase



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Day 1 – construction start 18 August 2006



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A look towards the entrance a rainy day in November 2006



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At the surface above the repository. The fly ash dump to the left.



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Entrance tunnel August 2007



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Storage tunnel August 2007



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The accident at the nearby oil tank facility May 2007



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