

End disposal of petroleum industry NORM in Norway - Stangeneset NORM Disposal Site

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Oil Industry NORM (1)



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Oil industry NORM originates as a precipitate of Group II elements. When present as waste it is usually in the form of barium sulphate.

The dominating nuclides are ^{226}Ra and ^{228}Ra , and in some cases ^{210}Pb .

^{226}Ra is a long-lived alpha emitter (half life 1600 years) originating from the ^{238}U series.

^{228}Ra is an beta emitter with a half life of 5.75 years originating from the ^{232}Th series.



Sampling of LSA Scale containing sludge.

Scale type	Main constituent	Main radionuclides	Production type
Sulphate scale	Ba/Sr sulphate	^{226}Ra , ^{228}Ra	Oil
Carbonate scale	Ca carbonate	^{226}Ra , ^{228}Ra	Oil
Lead scale	Steel	^{210}Pb	Gas
Sulphide scale	Iron sulphide	^{226}Ra , ^{228}Ra , ^{210}Pb	Oil and gas

Oil Industry NORM (2)



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Oil company	Mass (tons)	Composition (weight %)				
		Water	Heavy oil components	Sulphates	Corrosion products	Sand/clay
Company A	166	23.6	7.4	45.7	8.5	14.8
Company B	4.1	15.9	1.4	77.9	2.0	2.8
Company C	0.5	11.8	1.5	75.4	6.8	4.5
Company D	17.0	45.4	6.6	39.0	6.1	2.9

Oil company	Activity concentration (Bq/g)		
	²²⁶ Ra	²²⁸ Ra	²¹⁰ Pb
Company A	21.5 (9.7 – 74.1)	11.2 (3.3 – 28.9)	2.4 (<0.2 – 11.8)
Company B	19.3 (16.3-23.6)	7.3 (6.4-8.6)	2.7 (2.0-3.7)
Company C	20.8	9.6	1.8
Company D	40.4 (4.9-100)	3.7 (0.4-13-3)	13.8 (2.3-49)



Ba sulphate Scale in oil export pipe.

Where to find NORM



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Oil production

Production tubulars

Christmas trees

Risers

Oil-water separators

Topside tubes before
oil-water separation

Water discharge system

Gas production

Anywhere in the system
from risers to flares

High-Pressure Water-Jetting



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HPWJ (> 2000 bar) has been the preferred NORM decontamination method since 1995. Several specially designed plants perform decontamination on a routine basis. The used water (with NORM) is collected in settling tanks before emission. The NORM material is retrieved and stored. The method works well on easily accessible components, e.g. production tubulars. HPWJ does not create secondary waste, but releases activity to the environment (activity < 1 Bq Ra-226/litre)



NORM Temporary Storage



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NORM temporary storage at CCB base.



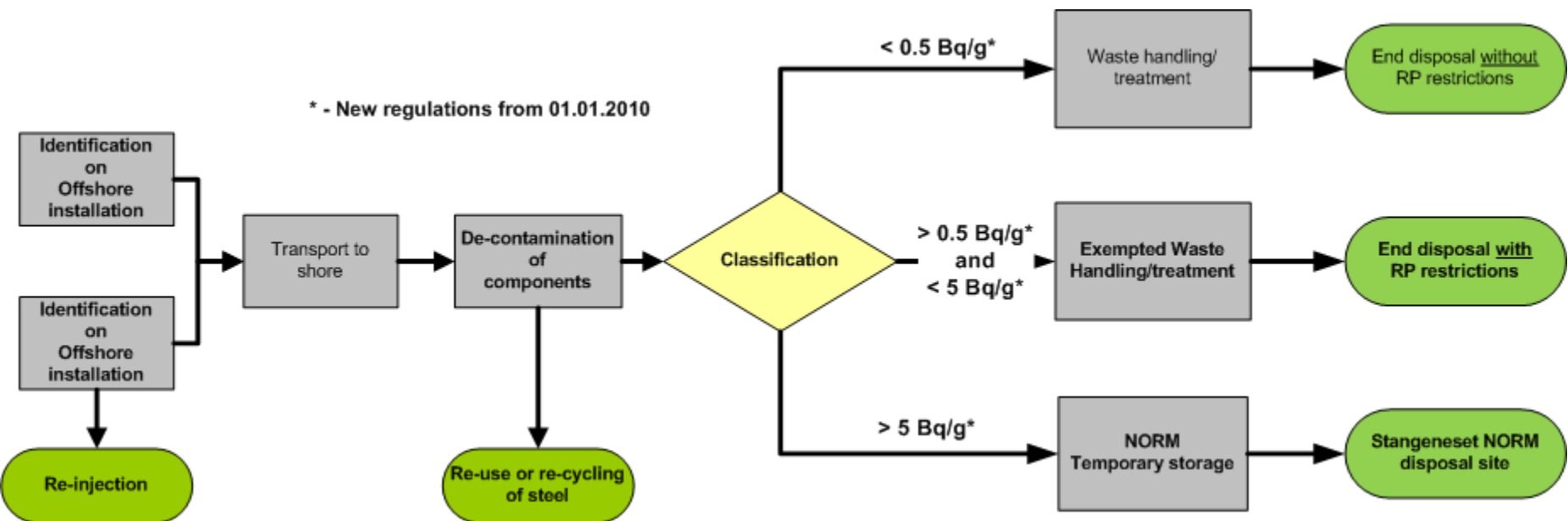
Typical separator mass NORM.

NORM from the offshore oil and gas installations are stored in HDPE drums in steel containers in secured areas on the service bases.

The O&G NORM Waste Stream



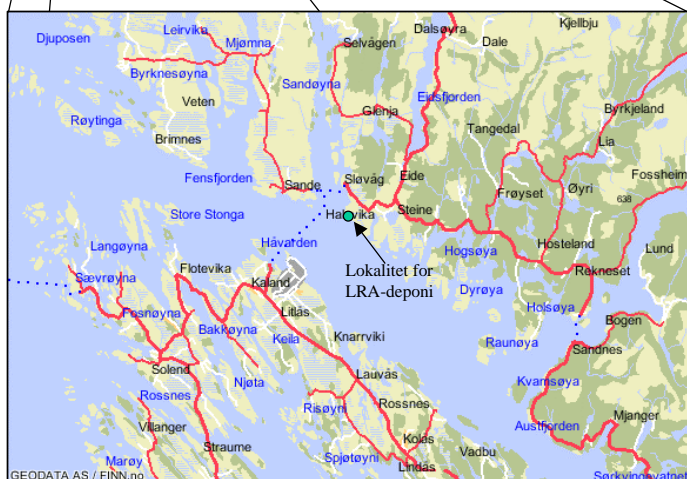
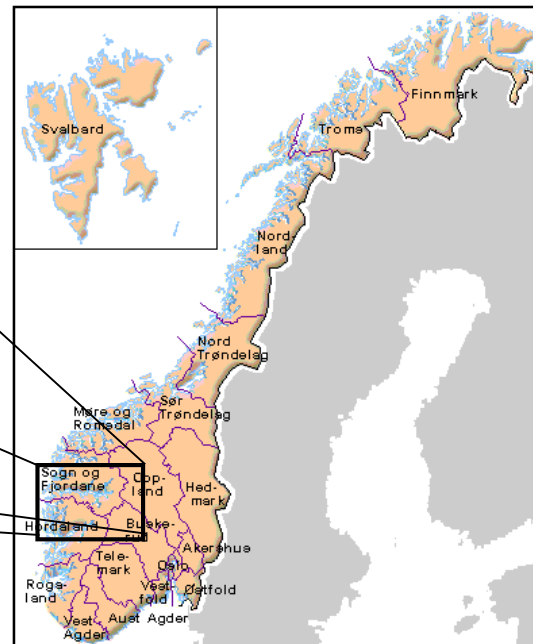
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Stangeneset NORM disposal site Location



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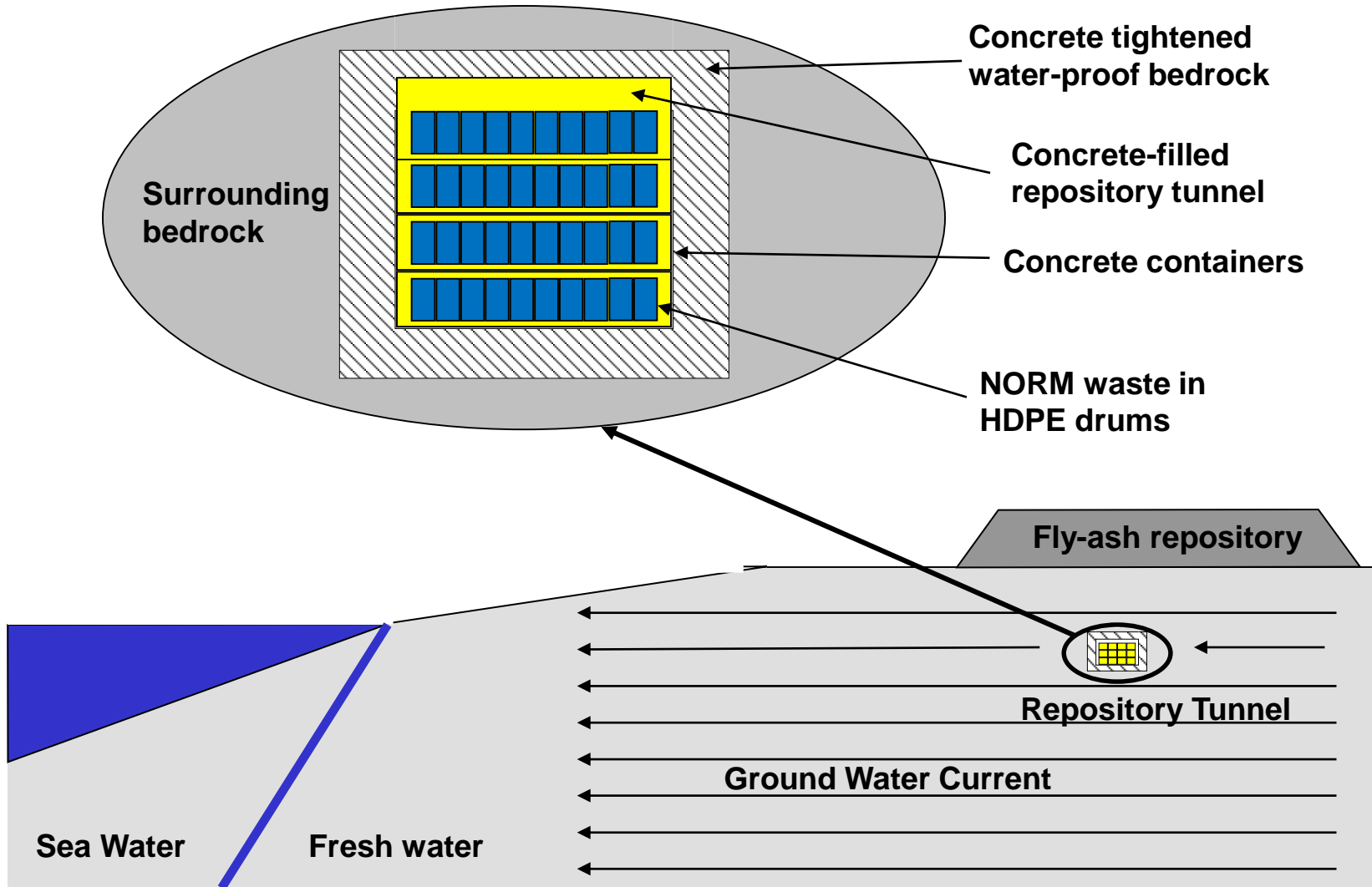


The disposal site is located at Sløvåg in Sogn og Fjordane County, Norway.
The facility was opened in October 2008.
Capacity to receive all European oil and gas industry generated NORM.

Stangeneset NORM Disposal Site (3) Design



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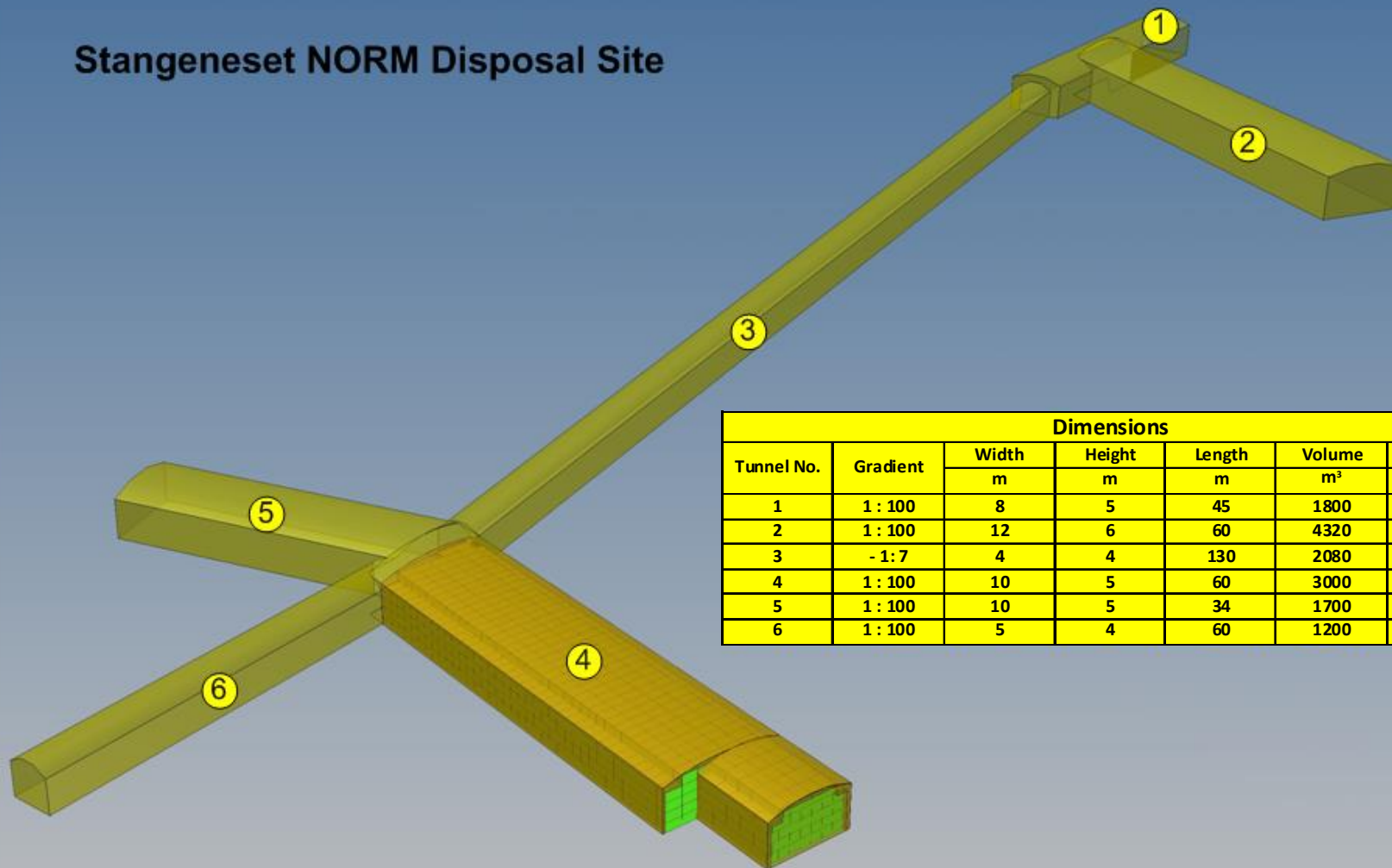


Overview



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Stangeneset NORM Disposal Site

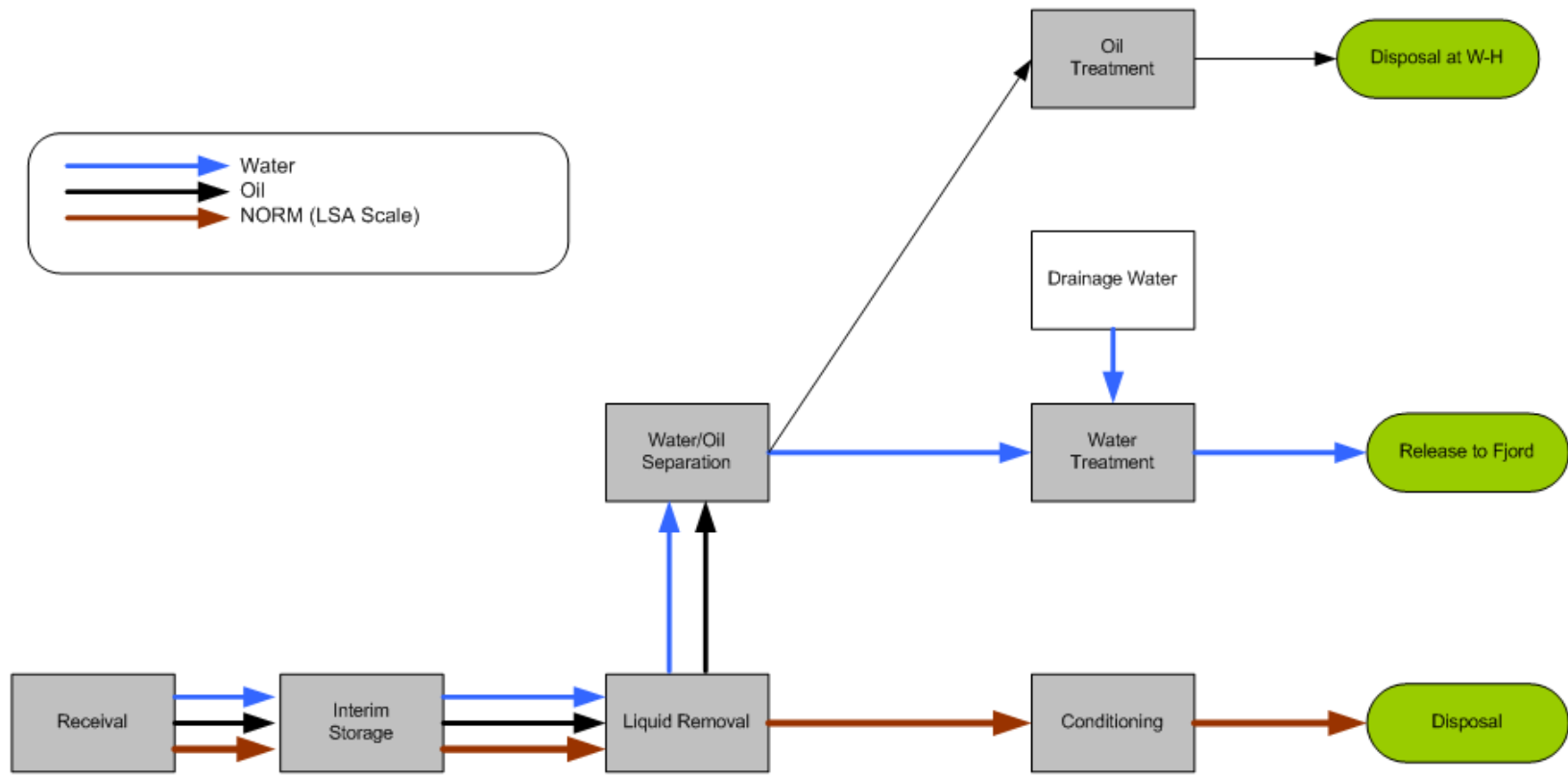


Dimensions						
Tunnel No.	Gradient	Width	Height	Length	Volume	Capacity
		m	m	m	m ³	tons
1	1 : 100	8	5	45	1800	
2	1 : 100	12	6	60	4320	
3	- 1 : 7	4	4	130	2080	
4	1 : 100	10	5	60	3000	4500
5	1 : 100	10	5	34	1700	2550
6	1 : 100	5	4	60	1200	

Mass streams



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Receival



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First container received at quayside 31 Oct 09 01:04



Containers in storage tunnel awaiting unloading.

Containers with NORM drums are received at quayside and transported unopened to the Storage & Conditioning Tunnel.

Typically the waste is packed in 10' containers with 8-12 drums (220L). Weight of each drum varies between 300 Kg to 600 kg.

The drums are registered, weighed and conditioned (if necessary).



Drum No. WH-0001 unloaded and ready for handling.

End Disposal



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Work in repository tunnel.



Grouting.

Disposal-ready drums are transferred to the Repository Tunnel and grouted into concrete blocks (up to 100 drums per block).

Currently processed 185 tons.

Current total capacity 7 000 tons. Can be extended.



First shipment drums grouted and secured.

Stangeneset NORM Disposal Site

Permits



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NORM drums from first shipment

**Permit to operate: Norwegian Radiation Protection Authority (NRPA),
Norwegian Pollution Authority (SFT):**

Waste type: - NORM and/or NORM containing sediments, < 300 Bq/g, < 5 % oil
- NORM infected production equipment, < 300 Bq/g, < 5 % oil
- may contain sand, rust and heavy metals

Amounts: disposal of up to 1 000 tons until 2012. Up to 100 tons in temporary storage at one time.

Release limits: 20 kBq/year ^{226}Ra , 10 kBq/year ^{228}Ra og ^{210}Pb ,
oil components: 100 kg/year (1000 mg/L)

Fe: 10 kg/year (100 mg/L)

Ba: 1 kg/year (10 mg/L)

V, Cr-tot, As, Ni, Cu, Pb, Zn, Co, Cd, Hg, Sb: 2 - 200 g/year (0,02 – 2 mg/L)

Thank you for the attention



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Environmental solutions for the energy industry