Environmental regulations of subsea geological storage of CO₂ in Norway

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The Environment Agency

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Our professional responsibility

Climate  Biodiversity  Pollution  Outdoor life

The Environment Agency is an agency subordinate to the Ministry of Climate and the Environment
NEAs history on CCS

- Has supported CCS since it was first deployed at the Sleipner field (1996)
- Has argued for deployment of CCS on gas power plants if these should be built in Norway the last 20 years
- Considers Sleipner and Snøhvit to be excellent demo cases for promotion of geological storage of CO₂
- Has actively engaged in international work to develop regulations in order to enable CCS
- Revised the environmental permits for Sleipner and Snøhvit in 2016
The Pollution Control Act (March 13, 1981) stipulates that all activities that may entail pollution or risk of pollution need to have a permit to pollute.

Subsea injection of CO$_2$ is defined as pollution, hence a permit is required.

Permits (pursuant to the Pollution Control Act) were issued for Sleipner (1996) and Snøhvit (permit issued 2004).

Environmental Impact Assessment (EIA) is required by law for CO$_2$ storage (Petroleum Act).
Norwegian regulations vs EU-regulations and other international commitments

- The EU-directive 2009/31 EC on geological storage of CO₂ was transposed into Norwegian legislation on Dec 5, 2014


- CCS was included in the EU-ETS system from Jan 1, 2013. The EU-directive 2007/589/EC on monitoring, reporting and verification of emissions applies for CCS

- Norway is Contracting Party to OSPAR and to the London Protocol. Decisions and Recommendations are observed.
The EU-directive on geological storage of CO2

- The responsibility for implementing the provisions of the EU-directive on geological storage is shared between
  - the Norwegian Petroleum Directorate (NPD)
  - the Norwegian Environment Agency (NEA)
- NPD issues a storage permit pursuant to the Petroleum Act (or, alternatively «The Act related to exploitation of subsea natural resources other than petroleum»)
- NEA issues an environmental storage permit pursuant to the Pollution Control Act
Key elements in an application for a CO2-storage permit

- Environmental risk in case of leakages has to be assessed
  - Leakage scenarios
  - Mapping natural resources in the influence area for leakage scenarios and assess the impact

- Monitoring program
- Financial security and financial mechanism
Provisions in the environmental permits

The regulations require that an environmental permit for CO2 storage shall comprise:

- The total quantity of CO₂ authorized to be stored, injection rate, injection pressure and pressure in the reservoir
- The composition of the CO₂-stream and the procedure for receiving CO₂ for storage
- Any other measures necessary to prevent irregularities
- The monitoring plan and criteria for updating the plan
- Reporting procedures
- The establishment of a plan for corrective measures in case of leakages
- Procedures regarding closing down of the storage site and a plan for the post operational phase
- The establishment and maintaining of financial security
Monitoring program

The purpose is

- to verify that CO₂ behaves as predicted (and with no risk of leakages)
- to detect and quantify leakages and to implement corrective measures

The program shall run throughout the injection phase, during the close down phase and in the post-injection phase as long as the State finds it necessary (in any case > 20 years)
Monitoring Program

- Pre-injection
  - Establish baseline (seismic/chemistry/biota/marine resources)
- Injection phase
  - Continuously monitoring of p, t of CO₂ at the wellhead
  - 4 D seismic survey at regular intervals
  - Gravimetry (to verify seismic interpretation)
- Close down phase
  - 4 D seismic survey
- Post-injection phase
  - 4 D seismic survey at defined intervals (declining frequency)
4-D Seismic – Image of injected CO2 in the Utsira formation
Temperature and pressure data– wellhead Sleipner

Figure: Statoil
Monitoring methods need to be developed

- 4-D Seismic provides excellent images of CO$_2$-movements in the formation, but
  - Cannot meet the requirement in the ETS on quantifying leakages with a certain accuracy
  - Missed CO$_2$ cannot be detected if not in the order of Mt
  - Seismic surveys not *economically* feasible to undertake more frequently than every 2. or 3. year?
Financial security

- The financial security shall ensure that all permit obligations can be met.

- These permit obligations include:
  - monitoring program
  - corrective measures
  - closure of the storage site
  - post-operational monitoring
  - surrender of allowances for any emissions from the site, including leakages, pursuant to ETS Directive

- The decision on what kind of Financial Security that can be accepted, will be decided on a case-by-case basis in a joint decision by the Ministry of Climate and Environment and the Ministry of Petroleum and Energy.
Thank you for the attention!

For detailed questions and more information, please contact

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