Functionality and Durability Study on Typical Construction Elastomeric Materials for CO2 Storage Wel

Publieke samenvatting / Public summary

Aanleiding

New ways to decrease the level of CO2 in the atmosphere are necessary to reduce the effects of the global warming. Subsurface CO2 storage has been identified as one of the key methods to reduce the emissions of CO2. The environmental risk linked to carbon capture and storage (CCS) is a concern to both regulators and the general public. Injection of CO2 can lead to critical technical challenges on the well design and on the behavior of non-metallic materials when in contact with it. Several studies have been carried out on CO2 resistant cement, but little knowledge has been developed on the behavior of typical well construction elastomeric compounds in CCS systems. In this project we aim to understand how polymeric materials behave, perform and resist at different operational conditions in wells used for CCS. This will allow us to also identify which materials in the existing wells that can perform in CCS systems and, if necessary, define the way forward for the design of better resilient elastomeric materials.

Doelstelling

The main goals of the project are: • identify which commercially available materials are stable when used for CO2 injection wells; • identify the elastomeric materials' issues when in contact with CO2; • understand the failure mechanisms of typical well construction elastomeric compounds; • understand the ageing/degrading behavior of these

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materials in CCS operational conditions; • plan a way forward for the design of resilient elastomeric materials to use in CCS wells; • prepare the upscaling to large scale experiment to be performed in the Rijswijk labs. This requires the following questions to be answered: • Which conditions are present in CCS wells? • What are the cyclic stresses (temperature, pressure, mechanical ..) present and applied in CSS wells? • Which are the requirements for typical well construction elastomeric compounds of CSS wells? • Which system components are present? Materials of well's system, construction remainders, formation generated, etc.

Korte omschrijving

WP1: Literature and Data Collection • Compile the existing knowledge about the interaction between commonly used elastomers in well construction and CO2. • Collect data about operational conditions of wells used in CCS systems. • Identification of material issues for resistance at operational conditions: temperature, pressure, acidity, salinity, contact materials and possible time related products, cyclic stresses. • Identification of commercially available elastomers table at CCS operational conditions. Versie november 2019 3 WP2: Small Scale Durability Experiments The most relevant materials will be tested under operational conditions. Samples of material will be collected at different time steps in order to have sufficient data points to be able to define the behavior of the elastomer. Several lab tests will be conducted to define functionality, durability, mechanical and chemical changes of the elastomer and will be related to the expected performance. WP3: Analysis and Reporting The data collected in WP1 and results generated in WP2 will be analyzed and included in a final report, including a description of the approach followed and suggestions for the way forwards.

Resultaat

The results of the small scale analysis will give a better understanding of the behaviour of typical well construction elastomeric materials when in contact with CO2 at operational conditions. Moreover, it would be possible to estimate the long term

behaviour of the materials and which kind of degradation occurs in time. Understanding the material degradation behaviour is critical in the planning of the risk mitigation measures and for the design of better performing materials. This study will be made available via a report describing the followed approach, the main results, the results' analysis. A way forward both in terms of best choice of materials present and/or designing material solutions for the needed performance in CCS wells together with a proposal for large scale experiments (to be executed at the TNO Rijswijk facilities) will be present. If sufficient experimental data are collected and the participating parties are in favour, the results will be critically discussed and disseminated in a manuscript suitable for a journal relevant for CCS applications.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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