

# Long-term subsidence study in the Wadden Sea Region

## Bestuur

Prof. dr. Pavel Kabat (voorzitter)  
Prof. dr. Jos Bazelmans  
Prof. dr. Jouke van Dijk  
Prof. dr. Peter Herman  
Dr. Hessel Speelman

**To:** NAM/Shell, Steering Committee (SC), State Supervision of Mines (SSM), Advisory Group for Economic Affairs (AGE), Wadden Academy (WA)

**From:** B. Orlic

**Date:** 11 June 2014

**Subject:** Minutes of the Rock mechanics meeting held on 2 June 2014 from 12:00-13:30 at the ARMA2014 Symposium in Minneapolis

**Filename:** [01-Minutes-Rock-mechanics-meeting-2June2014-public.docx](#)

**Legend:** => Action points NAM

## Distribution list:

### NAM/Shell:

Antony Mossop, Pieter van de Water, Dirk Doornhof, Ruud van Boom, Hermann Bähr, Harry Piening, Wim van der Veen, Sander Hol, Arjan van der Linden, Fons Marcelis, Pedro Zuiderwijk

### SC:

Hessel Speelman, Ramon Hanssen, Patrick Baud, Robert Zimmerman, Ryszard Hejmanowski, Rune Holt, Adriaan Houtenbos, Bogdan Orlic

### SSM:

Hans de Waal, Annemarie Muntendam-Bos, Rob van Lieshout

### AGE:

Jaap Breunese

### WA:

Klaas Deen

## Attendance:

**NAM/Shell:** S. Hol

**SC:** R. Zimmerman, R. Holt, B. Orlic

**SSM:** H. de Waal

## Technical documents prepared by NAM and distributed to SC/SSM/AGE before the meeting:

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## Action points from the previous meeting (the 3<sup>rd</sup> SC meeting held in April 2014 in Delft) relevant to this meeting:

### ⇒ [Rock mechanics meeting in June 2014](#)

NAM is requested to consider the recommendations given by the SC and present results from the on-going research at the Rock mechanics meeting to be held separately in June 2014 due to limited availability of the SC members in that period.

The technical documents to be discussed at these meetings need to be prepared and sent to the meeting participants not later than **1 week** before the meetings.

Two Rock mechanics meetings were held in June to fulfil this action point. As this is the first meeting, the action point will be closed after holding the second meeting.

## Meeting objective

- Update on recent experimental results by NAM/Shell.

## Meeting highlights

- **Presentation and review of experimental results**

Shell presented the outcomes of the recently finalized experiments and showed the derived geomechanical parameters.

The tests on Ten Boer samples are being finalized.

The failure tests on Rotliegendes samples are also being finalized.

The long-term tests on Rotliegendes samples are ongoing.

Advice is sought from the SC on long-term creep tests.

Recommendations:

It is suggested to show additional geomechanical parameters, which can be calculated directly from the measurements.

- **Anomalous experimental results**

The vast majority of tests have been successfully completed. However, the anomalous behavior was observed on a few samples. Possible reasons for this were discussed during the meeting.

A drifting radial displacement transducer and movements on a plane of weakness in some of the samples are likely responsible for the anomalous results.

A malfunction of drifting transducer is the likely explanation for the anomalous high-temperature experiment. It is either the electronic drift, or bad performance of the sensor itself. This should be confirmed with a further experiment on a twin sample at high temperature. The repeat experiment (performed in different cell, with different radial strain sensor) was normal.

Recommendations:

Check the anomalous sample with CT scanning.

Check the performance of sensors at high temperatures.

- **The experiments with sample failure**

Explanation was given for the large axial deformations on the samples that showed failure. The samples failed because the resulting radial strain was not seen by the radial strain sensor. Hence, the radial stress was not appropriately adjusted. The control loop failed and no uniaxial strain conditions were maintained anymore. This caused large axial strain and failure of some samples.

- **Questions posed by NAM/Shell to the Steering Committee**

1) Reliability of the anomalous high-temperature experiment.

2) Advice sought on long-term creep tests.

Recommendations:

1) It is suggested to perform one more repeat experiment to confirm the experimental results, which show normal response at high temperature. Repeat

experiment will provide additional information to judge the reliability of the anomalous high-temperature test.

2) It is suggested to perform a long term creep test. This experiment should be performed at worst case conditions and compared against a similar experiment executed at room temperature. A 6-months creep phase should be attempted.