

KEM Innovation/Research Question (max. 4 pages + annex)

TITLE *Floaters in Salt Drilling Risk Assessment*

Objective

The research request aims for an inventory of current state of the art knowledge and insights concerning type of fluids (water/brine, oil, gases) contained in "stringers" or floater encountered in Salt formations in The Netherlands and the pressures to be expected for various stringers and stringer depths in relation to depth and location of the salt formations.

The inventory consists of a literature search and request for information from mining companies.

State of the art, background

Drilling through Salt formations can encounter "stringers" also called 'floaters or floating blocks'. They consist of rigid but possibly also porous layers which can be considered to be a drilling risk as they can contain methane gas pockets, with high pore pressures (causing kicks) or containing H₂S gas. It is important to map the areas where these stringers can or are likely to occur.

Research Question

The specific research request or tasks are

- *To find in literature a proper definition and explanation on 'stringers' or 'floaters' occurring in The Netherlands or North Sea.*
- *What is the best method to map the possible occurrence of 'stringers' or floaters' ? Proof by application of the method on mapping them for The Netherlands on and off shore territories.*
- *What are the best practices to mitigate 'stringer' drilling risks?*

Deliverables expected

The deliverables anticipated are:

- Definition and specific explanation on stringers occurring in The Netherlands (what do they consist of?, how can they be recognized?).
- A Mapping of the occurrence in The Netherlands
- Analysis of the risks caused by drilling in 'stringers', with the focus on maximum pore pressures to be expected, particularly in combination with the possible pore contents (water, oil, gas).
- First inventory of possible mitigation measures to reduce the drilling risks.

Timeline

The duration of the project is expected to be 3-4 month. The concept reports are expected end of 2018 or ultimately Q1 2018.

Amongst others the following activities are expected:

- Starting by generating an overview of salt domes in The Netherlands and mapping of known stringer occurrences
- Detailed investigation on stringers: how can they be interpreted on seismic: are they always visible?, minimum detection thickness?, can they be found in an inventory of core data and reports, check on log-signatures or boreholes and wells
- Generation of an overview of (maximum) pore pressures found in stringers so far
- Description of subsurface mechanisms explaining the pore pressures in stringers at various depths
- Description of the mechanisms explaining the movements (directions, rotations) which different stringers in various salt formations can make in combination with the effects these movements have on observed pore pressures.
- Description of permeability of 'stringers' which do not move in line with forces in the salt formation and the possible effects on permeability caused by the movements of the 'stringers'
- Summarizing the experiences of creating over pressures inside the 'stringers' (ref. art. 68 in the Mining Law), including a scientific and/or technical description of the subsurface processes and mechanisms explaining the experiences
- Summarizing the experiences of depressurisation while drilling through the overpressured 'stringers'
- Inventory of known incidents, listing the characteristics of 'stringers'
- Describing a protocol for recognizing 'stringers'

- Identifying and describing proposals for the mitigation of 'stringer' related risks.

Two workshops are expected for SodM staff. One midterm and one workshop at the end of the project.

Expected use

The results will be to update Mining Law protocols for drilling in Salt formations.
They will also be used in assessing the drilling risks associated with well proposals.

Expertise and tools preferred for the team

Geological expertise (TNO) as well as drilling expertise (operators) is required.
Also scientific expertise or long term driller's expertise should/could be included in the team.

Quality assurance, Organisational and communication requirements

Project risks identified are

- o Difficulty in identifications of Stringers in available data.
- o No are limited data on stringer fluid content.
- o Too little data on 'stringers' are available to be able to come to conclusions.

Therefore regular reporting on progress and team meetings is required.

The time pressure might be risk in timely externally reviewing the results.