

KEM Innovation/Research Question

Geomechanical analysis for investigating the occurrence of induced seismicity in small gas fields in The Netherlands

Objective

The focus of the current proposal is to explore the feasibilities of a physics based numerical (geomechanical) analysis of the causes of induced seismicity in the small gas fields in The Netherlands. With the study, we seek to physically explain why seismicity has occurred in certain gas fields, whereas other gas fields remained seismically quiet. With the results we aim to provide a physical basis for future hazard assessments and seismicity forecasts.

State of the art, background

In The Netherlands gas has been produced from approximately 166 onshore gas fields. Since the mid-1980s, approximately 1,400 induced earthquakes were recorded in the vicinity of producing gas fields. Most earthquakes were associated with the largest Groningen gas field. Some of the smaller gas fields, however, also produced significant seismicity giving rise to seismic hazard concerns.

For operators and the regulator it is of primary importance to understand the circumstances under which induced seismicity occurs. This is a strict requirement for seismic hazard assessments.

In previous studies (e.g. van Eijs et al., 2006; van Eck et al. 2006; van Thienen-Visser et al., 2012; van Wees et al., 2014; Fekkes, 2016) geological and operational parameter were correlated with induced seismicity observations. By this, key parameters associated with induced seismicity have been identified. For example, seismic activity was observed only in those gas fields which were depleted by at least 30%. Such key parameters formed the basis for many seismic hazard assessments (van Eijs et al., 2006; TNO-rapport 2012 R10198; van Eck et al., 2004).

Conceptually, it is reasonable to assume that the key parameters presented in the studies mentioned above are actually related to the occurrence of induced seismicity. A physics based geomechanical analysis of the induced seismicity, however, has not been conducted for (most of) the small fields. Compared to the evidenced based approach applied previously, a physics based approach has the potential to assess seismic hazard also in a scenario which is outside the range of previous experience.

Research Question

Maximum 400 characters (what to be addressed and what not AND Link to KEM Research Agenda)

The central research question is why seismicity has occurred in certain gas fields, whereas other gas fields remained seismically quiet. The objective is to develop a physics based numerical based 2D geomechanical analysis method of induced seismicity, which can also be used in scenario's which are outside the range of previous experience.

Deliverables expected and expected use

1. A physics based analysis of why induced seismicity occurs in some gas fields and non in other gas fields using evidence of (non)seismicity in small fields and geomechanical analysis method.
2. A physics based, proven methodology to derive the hazard of induced seismicity for new and producing small gas fields in the Netherlands.
3. Scientific report of the methodology and projects results.

Timeline

The study will be complete within 8 months after receipt of contract.
Intermediate project and milestone meetings are a requirement.

Expected use

With the results we aim to provide an improved physical basis for future hazard assessments and seismicity forecasts for the small gas fields.