



Social impacts of earthquakes caused by gas extraction in the Province of Groningen, The Netherlands



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ABSTRACT

Gas extraction from the Groningen gasfield in the northern Netherlands has led to localised earthquakes which are projected to become more severe. The social impacts experienced by local residents include: damage to property; declining house prices; concerns about the chance of dykes breaking; feelings of anxiety and insecurity; health issues; and anger. These social and emotional impacts are exacerbated by the increasing distrust Groningen people have towards the national government and the gas company, NAM, a partnership between Shell and ExxonMobil. The earthquakes have reopened discussions about the distribution of benefits from gas production and the extent to which benefits are retained locally. Mitigation of the impacts is attempted, but the lack of trust decreases the effectiveness of the mitigation measures. The extent of this experience of previously-unforeseen, unanticipated impacts suggests that a new social and environmental impact assessment needs to be undertaken, and a new Social Impact Management Plan (SIMP) and Impacts and Benefits Agreement (IBA) developed, so that the project can regain its legitimacy and social licence to operate. In addition to conventional gas, this paper has wider relevance for unconventional gas developments, for example shale gas extraction by hydraulic fracturing methods (fracking).

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Introduction

The northern part of The Netherlands, particularly the Province of Groningen, experienced around 1000 registered minor earthquakes between 1986 and 2013 (KNMI, 2013a). Now accepted as being a consequence of gas extraction (SodM, 2013), these tremors have led to widespread damage to houses and other buildings. Till about 2011, the tremors tended not to be perceived as a major concern, not by the operator, NAM (*Nederlandse Aardolie Maatschappij* or Dutch Petroleum Company), by politicians, or by most of the inhabitants of Groningen province. However, in August 2012, an earthquake measuring 3.6 on the Richter scale, the largest ever recorded in the region, occurred in the village of Huizinge (KNMI, 2013b). This event created much concern amongst local people and gave the earthquakes a much higher priority in the community and in politics (DvhN, 2014a). It led to the Ministry of Economic Affairs commissioning some 15 studies across a range of topics, including geological and economic assessments. The earthquake issue also led to much media publicity in the international and Dutch press, which we use in our analysis in this research. Various academic research projects into the issue have also commenced, especially at the University of Groningen.

In January 2013, the State Supervision of Mines (SodM) published 1 of the 15 reports commissioned by the Ministry of Economic Affairs. The SodM report concluded that continued gas extraction would lead to more frequent and stronger earthquakes than previously experienced. It warned that there was a 7% chance of an earthquake with a magnitude of between 4.0 and 5.0 in the next 12 months (SodM, 2013). The Minister of Economic Affairs, Henk Kamp, stated at the time that a reduction in gas production was not an option, due to contractual commitments (DvhN, 2013a). The economic dependence of the Dutch State on income from gas extraction means that the government is reluctant to reduce output. Nevertheless, the Minister promised he would consider ways to reduce production quickly if it would be necessary (NRC, 2013a).

Publication of the SodM report publically raised the question of how to deal with the earthquakes. The concerns of the affected people became stronger due to the increased anxiety fuelled by the report. As Vanclay (2012) identified, even in situations where people are aware of a project and its implications, the research undertaken for impact assessments can lead people to think more seriously about what the project may mean for them, and this can lead to increased concern and/or opposition they might not have had previously. People in Groningen had known about the earthquakes for years and had lived with them without much concern, but the SodM report with its prognosis of increasing severity of earthquakes and increased impacts led many people to reconsider their opinions, leading to considerable consternation at the local level.

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The increases in the severity and extent of impacts arguably make it necessary to have a new impact assessment procedure, especially one that would focus on management of the impacts (Franks and Vanclay, 2013). The impacts of continued gas extraction on people should be taken seriously. New mitigation measures may be needed to manage the increasingly severe impacts being experienced. Some of the immediate direct environmental consequences of gas extraction are subsidence and earthquakes. Subsidence on its own is not likely to be life threatening, but according to the SodM (2013) report, the earthquakes might be. Even though the risk of a life-threatening earthquake is low, fear and anxiety about the possibility of a strong earthquake is high. The structural damage to buildings from minor earthquakes should also be considered. A significant social impact is the decline in property values for home owners, and their consequent reduced options for the future. While there is a damage compensation plan, the Groningen inhabitants generally feel it is inadequate (DvhN, 2013b).

In this paper, the impacts of the gas production, especially those caused by the earthquakes, are discussed. The first objective of this paper is to consider the direct and indirect impacts on the people of Groningen of the increased risk of earthquakes caused by continued gas extraction. The second objective is to consider the extent to which these impacts are being mitigated and whether such mitigation is adequate. The third objective is to provide recommendations in relation to impact mitigation. In order to accomplish all this, a background to the project and the impacted area is given, including an overview of stakeholders. We also consider the implications for the commercial operator, NAM, and the government partner, especially in terms of their respective levels of public approval, or 'social licence to operate' (Owen and Kemp, 2013; Prno, 2013; Prno and Slocombe, 2012).

The majority of the research and writing of our paper occurred during 2013, with revisions in 2014 when the paper went through the journal review and publication process. As a current and emerging topic, the various issues changed over the course of the research, and the positions of the various actors also changed over that time. We have tried to ensure our paper was accurate as at January 2014, but we note that further changes are likely to occur in the future. Should there be a major earthquake (i.e. greater than 5.0 on the Richter scale), this would have a significant effect on the situation. Firmly based in the discourse of social impact assessment (Esteves et al., 2012; Vanclay, 2003, 2014; Vanclay and Esteves, 2011), especially as it relates to the extractives sector (Esteves and Vanclay, 2009), this paper is not intending to be just a description of a case study, interesting as this case is, rather it is an analysis of the social impacts and mitigation attempts that are likely to be applicable in other situations where unforeseen impacts arise from projects in their operational phases. Thus, although the conventional gas extraction operations in Groningen are very different in technical terms to unconventional gas extraction activities (e.g. shale gas and fracking), to some extent the social issues will be similar, particularly in relation to fear and anxiety. This is what makes this case particularly interesting.

Methodology

The overarching methodological framework is a case study, using a multi-methods approach. Primarily, our analysis is based on a qualitative content analysis of news sources which discuss the impacts of the earthquakes on the people of Groningen. LexisNexis Academic was used to identify initial leads to consider. Each related link was also followed up. We concentrated on local newspapers, especially *Dagblad van het Noorden* (DvhN), using the Dutch equivalents of terms like earthquake, tremor, NAM, gas and gas production. We also used the Google search engine to find items in the international English language media. The search process was non-exclusive and open-ended, in other words, we followed all leads to gain a comprehensive volume of material about the earthquakes in Groningen, rather like a domino or snowball sample. We also scanned the websites of various media

outlets, particularly RTVNoord (a regional television station), and local activist groups. Saturation was achieved in the sense that eventually no more new themes emerged, and also in the sense that we had likely read almost everything published about the situation in Groningen.

The research also comprised a substantial document analysis of key company documents, official statements and reports, ministerial statements, and relevant legislation, regulation and procedural manuals. This included the 15 reports commissioned by the Ministry of Economic Affairs, as well as responses to these reports by other agencies, municipalities and local activist organisations.

Another important source of information was a survey of members of the standing market research panel, RegioNoordPanel. The regional paper, *Dagblad van het Noorden*, commissioned a social survey of social issues associated with the earthquakes. The market research company, Enigma Research, and *Dagblad van het Noorden* graciously provided us with the aggregated survey data and permission to use the results. The survey, which was conducted in February 2013, had 686 respondents living in the Groningen earthquake region, and contained a range of questions including some specifically relating to anxiety, trust in the national government, and feelings about safety (DvhN and Enigma Research, 2013).

Although we have not done formal research interviews for this project, mindful of research ethics (Vanclay et al., 2013) and consistent with how social impact assessments are often done (Baines et al., 2013), various discussions about the earthquake issue with a range of people in various agencies and with some local residents have generated insights we also utilise in our thinking and analysis.

An overview of gas extraction in the Northern Netherlands

NAM, a 50:50 joint venture between Royal Dutch Shell (Shell) and ExxonMobil, established an exploratory gas well at Slochteren, in the Province of Groningen, The Netherlands, in 1959. This gasfield has since proved to be one of the largest in the world, and is now known as the Groningen gasfield (NAM, 2013a). With commercial production commencing in 1963 (NAMPlatform, 2013a), the Groningen gasfield has become very important for the Dutch economy and domestic energy supply. In 2012, NAM produced a total of 59.6 billion m³ gas, representing 76% of total Dutch gas production, with some 88% of NAM's production coming from the Groningen gasfield (i.e. about 52.4 billion m³) (Ministry of Economic Affairs, 2013; NAM, 2013b). Because of various import and export arrangements, it is not clear which part of Dutch or Groningen production is used strictly for domestic consumption. However, it is known that total Dutch domestic gas demand in 2012 was approximately 43.6 billion m³ (Centraal Bureau voor de Statistiek, 2014), thus the production volume from the Groningen gasfield is about 20% more than total domestic consumption.

Groningen, 1 of the 12 provinces of The Netherlands, is located in the far north (Fig. 1). With a surface area of 2325 km², the province had 581,705 inhabitants in January 2013 (Centraal Bureau voor de Statistiek, 2013a). It consists of 23 municipalities, with the City of Groningen being the capital of the province.

The Groningen gasfield is located in the eastern part of the province (Fig. 2). The gasfield covers approximately 900 km² and it is now known that it contained 2800 billion m³ of gas when production commenced. At the end of 2012, some 780 billion m³ remained, arguably sufficient for another 50 years of production depending on the rate of extraction (NAM, 2013b). The gasfield covers approximately 39% of the land area of Groningen. Around 190,000 people live within the gasfield (Centraal Bureau voor de Statistiek, 2013a). The gas is located approximately 3 km below the surface in a porous layer of sandstone. When the gas is extracted, the sandstone compresses. Usually this is a gradual process leading to surface subsidence, which is barely noticeable and not generally regarded as being problematic. Along fault lines, however, it is now accepted that the movement of the sandstone layers can happen quickly, causing minor earthquakes (Deltares, 2011).

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