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SAFETY BOARD

# Summary Earthquake risks in Groningen

An investigation into the role of the safety of citizens during the decision-making process on gas extraction (1959-2014)



# Summary

## Earthquake risks in Groningen

An investigation into the role of the safety of citizens during the decision-making process on gas extraction (1959-2014)

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## **Dutch Safety Board**

The aim in the Netherlands is to limit the risk of accidents and incidents as much as possible. If accidents or near accidents nevertheless occur, a thorough investigation into the causes, irrespective of who are to blame, may help to prevent similar problems from occurring in the future. It is important to ensure that the investigation is carried out independently from the parties involved. This is why the Dutch Safety Board itself selects the issues it wishes to investigate, mindful of citizens' position of independence with respect to authorities and businesses. In some cases the Dutch Safety Board is required by law to conduct an investigation.

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NB: This summary is published in the Dutch and English languages. If there is a difference in interpretation between the Dutch and English versions, the Dutch text will prevail.

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## **Reasons for the investigation**

The Dutch state and Dutch society have derived significant benefits from gas extraction from the province of Groningen. Gas revenues are considerable. Natural gas has been one of the cornerstones of the Dutch economy for more than half a century. There is no other product from which the Netherlands has earned as much as from natural gas.

Gas extraction also has drawbacks. It was known early on that the extraction of gas would cause subsidence in Groningen and later on the first earthquakes caused by gas extraction occurred in the area. All the parties concerned - including numerous citizens - had long viewed these earthquakes as a cause of damage that had to be compensated. The earthquakes were not deemed to be a safety concern for the citizens of Groningen. Studies suggested that the intensity of future earthquakes would be minimal and even though the maximum intensity had been adjusted upward on a number of occasions, the parties responsible for gas extraction ruled out the idea that the earthquakes would lead to personal accidents. The earthquake in the village of Huizinge in 2012 dispelled this optimistic belief. Since the supervisory authority's warning in early 2013, many people viewed the earthquakes not just as a damage issue but also as a threat to the safety of the citizens of Groningen. The reassuring certainty that the intensity of the earthquakes would not exceed a certain value had vanished.

At the end of 2013 the Dutch Safety Board decided to launch an investigation into the decision-making process on gas extraction in Groningen; a request that had also been made by the Minister of Economic Affairs. One of the considerations that played a role in this decision was the fact that the safety of residents in the area depended on third parties. For this reason residents should - in the Dutch Safety Board's opinion - be able to rely on the parties involved in controlling the risks to which they are exposed to ensure residents' safety. Safety in this context is taken to mean controlling the risk of earthquakes arising from gas extraction and it concerns the safety of the public. Can citizens rely on incidents being prevented, damage being limited, risks being controlled and uncertainties being explored? The term citizen safety is broadly defined: the residents of Groningen must be safe and must feel safe in their daily living environment. The investigation focuses on the question of the extent to which the safety of residents living in the gas extraction area was taken into consideration with regard to earthquakes during the decision-making process on gas extraction in Groningen. This report therefore does not answer the question of how high the risk is to which residents in the gas extraction area are exposed.

The course of events in Groningen has put pressure on the relationship between the residents of Groningen, on the one hand, and the natural gas exploration company (NAM) and the Ministry of Economic Affairs, on the other. Citizens' confidence in safe gas extraction as well as in the parties involved has tumbled. In view of the anxiety that has arisen among the Groningen population, the Dutch Safety Board has not only included

the progress of the decision-making process in the investigation but also the manner in which the parties involved have been accountable to the population.

The investigation stretches across a long period, and is made with the benefit of hindsight. This inevitably means that there is a risk that the information known today about the impacts of gas extraction in Groningen will affect the judgement now being delivered on decisions taken in the past. To avoid hindsight bias, the Dutch Safety Board has always put its investigation into the context in which the parties involved in gas extraction had to take their decisions. The purpose of this Dutch Safety Board investigation is to explain what happened in the past. At the same time the Dutch Safety Board would like to stress that this explanation does not serve to legitimise the situation that has arisen.

### **Conclusions**

On the basis of factual information, the Dutch Safety Board has established that until 2013 the parties involved had not regarded earthquakes as a safety concern for the citizens of Groningen. Until that year, the parties involved viewed the earthquakes as a risk of causing minor damage that could simply be compensated. This finding raises the question of how the risk assessment took place, how the interests at stake were addressed during the decision-making process on the exploitation of the Groningen gas field and what factors played a role.

Based on its investigation, the Dutch Safety Board has reached the following main conclusion:

Until the beginning of 2013, the safety of citizens in Groningen in relation to induced earthquakes had no influence on decision-making on the exploitation of the Groningen gas field. The parties concerned deemed the safety risk to the population to be negligible and thus disregarded the uncertainties surrounding this risk assessment. The Dutch Safety Board therefore concludes that the parties concerned failed to act with due care for citizen safety in Groningen with regard to the earthquakes caused by gas extraction.

### **Explanation**

In the Dutch Safety Board's opinion, three factors influenced how consideration was given to citizen safety in relation to earthquakes during the gas exploitation decision-making process.

The first factor that influenced the decision-making process is the fact that safety had not been embedded as a separate interest in the system of responsibilities surrounding gas extraction. This system is primarily designed to look after significant public interests such as the guaranteed supply of gas and revenue optimisation. Under the current system, besides being a party involved in the exploitation of natural gas, the Ministry of Economic Affairs also serves as the guardian of all the interests at stake, including the safety interests of Groningen citizens. Other ministries and local and provincial authorities had

no or barely any involvement in the gas extraction decision-making process. It is a closed, consensus-driven system, offering little room for opposing viewpoints.

The second factor that influenced the decision-making process is that the parties involved in gas extraction had long lacked any sense of urgency to conduct research that might reduce the uncertainties surrounding gas extraction in the Groningen gas field. Knowledge of the potential impacts of gas extraction had only been developed on a fragmented basis until the supervisory authority issued its warning in 2013. Until 2013, no integral, independent scientific research programme had been initiated to chart the deep substratum of Groningen and the mechanisms at work underground. Furthermore, the parties involved were unreceptive to critical opposing viewpoints that called the accuracy of the assumptions into question. In the Dutch Safety Board's opinion, the parties concerned should have already realised at an early stage that unknown risks would be inherent in a large-scale, multi-year operation such as the exploitation of the Groningen gas field. Uncertainty and reducing that uncertainty should have served as the guiding principle for their actions.

A third and final relevant factor is the inadequate level of accountability to, and communication with, the Groningen population. Until 2013, the natural gas exploration company (NAM), the Ministry of Economic Affairs and the supervisory authority provided citizens with inadequate insight into the uncertainties relating to the earthquake issue. Communication focused primarily on the expected maximum earthquake intensity and the lighter material damage that could be caused by earthquakes. On account of this technocratic approach, insufficient consideration was given to the anxiety and safety concerns of the citizens in Groningen. This moreover precluded citizens and their MPs from acting as a countervailing power.

Much of the prevailing dissatisfaction in Groningen is rooted in the past. The people of Groningen refer to the period - now almost 25 years ago - in which the exploration company categorically maintained that the earthquakes could not have anything to do with gas extraction. When a relationship with gas extraction was nonetheless found to exist, the first crack in NAM's credibility became a fact. This pattern subsequently repeated itself. The earthquakes would only cause slight damage at the most - considerable damage occurred nonetheless. The severity of the earthquakes would not exceed 3.3 on the Richter scale - but they did nonetheless. The supervisory authority warned that citizen safety in the gas extraction area was at risk and recommended that extraction be reduced - and nonetheless in 2013 more gas was extracted from the Groningen gas field. The Groningen population's confidence in both NAM and the central government then plunged to an all-time low. To date, the minister's decision in early 2014 to curb gas extraction in some areas has failed to restore confidence.

A lot has changed since 2013. Not only is more attention being paid to the uncertainties surrounding earthquakes caused by gas extraction, but measures have also been put in place for the purpose of clearly identifying and controlling earthquake risk. In view of the situation that has arisen, while technical, building-related and other measures are indeed a necessary condition, in the Dutch Safety Board's opinion they are inadequate for restoring the Groningen population's confidence in both safe gas extraction and the parties involved. The measures announced can only instil credibility if they are

implemented visibly and expeditiously, and do in fact improve the situation of the citizens of Groningen. Furthermore, a key condition is that all the parties concerned must acknowledge that they have failed to act with due care for the safety of Groningen citizens. Acknowledgement will open the door to restoring confidence in the future. It must be equally clear to residents which concrete objectives the central government and NAM have defined and how they have set priorities: what can residents expect, within what time frame and on the basis of which criteria? It is imperative that the Ministry of Economic Affairs, NAM and State Supervision of Mines (SodM) communicate openly about the uncertainties inherent in gas extraction to enable citizens to build realistic expectations.

Not only do the events in Groningen compel measures to be taken in Groningen, they also serve as lessons for future activities deep underground, a world in which uncertainties eclipse certainties. After all, where activities deep underground are concerned, the long-term consequences of decisions taken today usually cannot be predicted. These consequences may also jeopardize citizen safety. The Dutch Safety Board therefore believes that it is imperative to safeguard citizen safety in the event of current and planned activities deep underground.

## **Recommendations**

The Dutch Safety Board wishes to highlight the need for the parties involved in gas extraction to restore their tarnished relationship with the Groningen population. A key condition is that the parties concerned must acknowledge that they have failed to act with due care for the safety of citizens in Groningen.

The Dutch Safety Board primarily aims to ensure that safety interests are given sufficient attention where activities deep underground are concerned. To this end, the Dutch Safety Board believes that the following aspects are important:

- a. reinforcement of safety interests during decision-making on activities deep underground;
- b. apply the guiding principle that complex and uncertain risks are inherent in these activities and communicate this information to citizens.

On the basis of its investigation, the Dutch Safety Board has formulated five recommendations that are applicable to the current situation in Groningen as well as to current and planned activities deep underground (>15m) in other parts of the Netherlands.<sup>1</sup>

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<sup>1</sup> Two recommendations are directed to mining companies. Applied to the situation in Groningen, the Dutch Safety Board directs the recommendations to NAM. Applied to current and planned activities deep underground (>15m), the Dutch Safety Board directs the recommendations to the Netherlands Oil and Gas Exploration and Production Association (NOGEPA). The other recommendations are directed to the Minister of Economic Affairs and, given the necessity to weigh interests more at the interdepartmental level, to the government.

*Sub a) Reinforcement of safety interests*

In the Dutch Safety Board's opinion the decision-making process on activities deep underground should be structured in such a manner that explicit consideration is given to residents' safety when balancing interests. In Groningen's case, this means the 'Gasgebouw' (the Dutch Gas Structure) must be fundamentally changed.

**To the Minister of Economic Affairs:**

1. Ensure that other ministries (particularly the Ministry of Infrastructure and Environment and the DG Housing of the Ministry of the Interior and Kingdom Affairs) are involved in decision-making on the exploration and exploitation of mineral resources.
2. Ensure that consideration is structurally and recognisably given to the citizen perspective in the decision-making process by allocating a role to the provinces and the local authorities.
3. Reinforce the independent status of SodM vis-à-vis the ministry and the sector.

*Sub b) Acknowledge and communicate uncertainty*

Uncertainty is an inextricable feature of underground activities. Uncertainty and reducing uncertainty should be the principle guiding the activities of the parties concerned, including in citizen communication. In Dutch Safety Board's opinion, reducing uncertainty by conducting research and taking measures accordingly is a crucial component of the licence to operate. However, research should not be used as an excuse not to put measures in place or to defer decisions. As regards the impacts of gas extraction, there has been insufficient attention paid to the development of knowledge. Furthermore, operating companies must treat uncertainty seriously, both now and in the future, by being alert to and pro-actively developing knowledge about safety issues.

**To the Minister of Economic Affairs, the mining companies and the Netherlands Organisation for Scientific Research (NWO):**

4. Reinforce the duty of mining companies to conduct research. Ensure a structural and long-term research programme is put in place in which integral and independent scientific and applied research is conducted into this issue.

**To the mining companies and the Minister of Economic Affairs:**

5. Be transparent about uncertainty in communication and dialogue with citizens and make explicit and substantiate how uncertainty will factor into decision-making on the exploration and exploitation of mineral resources. This communication may not be reduced to a public relations exercise.

## Main conclusion

The Dutch Safety Board concludes that the safety of citizens in Groningen with regard to induced earthquakes had no influence on decision-making on the exploitation of the Groningen gas field until 2013. Until that time, the parties viewed the impact of earthquakes as limited: a risk of damage that could be compensated. The parties concerned deemed the safety risk to the population to be negligible and thus dismissed the uncertainties surrounding this risk assessment. The Dutch Safety Board therefore concludes that the parties concerned failed to act with due care for the safety of citizens in Groningen in relation to the earthquakes caused by gas extraction.

According to the Dutch Safety Board, an explanation for this can be found in the manner in which the decision-making process was organised and how it was executed.

1. The safety of the public with regard to induced earthquakes is inadequately embedded in the system of responsibilities surrounding gas extraction from the Groningen gas field. Insufficient consideration is given to citizen safety interests.

The 'Gasgebouw' (the Dutch Gas Structure) consists of NAM, the Ministry of Economic Affairs, Gastera, Shell and ExxonMobil. The Dutch Gas Structure is designed to optimise revenues and the guaranteed supply of gas. It is a private, closed and consensus-focused system. Safety interests have not been embedded in this system as a separate interest. The supervisory authority long adhered to this consensus-based approach, partly as a result of which there was insufficient countervailing power to ensure that the existing intervention mechanisms were applied for the purpose of safeguarding safety interests. Under the current system the competent authority itself, the Ministry of Economic Affairs, is a party involved in the exploitation of natural gas and serves as the guardian of all the interests at stake. Other ministries and local and provincial authorities have little or barely any involvement in the gas extraction decision-making process. From an administrative perspective the organised system consequently also offers no room for opposing viewpoints. The combined effect of all this was that safety interests were poorly embedded and until 2013 had been given insufficient consideration in the gas extraction decision-making process.

2. NAM, the Ministry of Economic Affairs, SodM and knowledge institutions failed to apply uncertainty and reducing uncertainty as the guiding principle for their actions.

Forecasts on the expected maximum earthquake intensity are surrounded by numerous uncertainties. When drawing up forecasts, no one knows exactly what mechanisms are at work deep underground, and insufficient research was initiated to examine these factors. The method on which the forecasts are based also has limitations. Until 2013, no integral and independent scientific research had been carried out to obtain greater insight and thereby produce more reliable forecasts. Gas extraction is a large-scale intervention in the underground environment. Yet the parties concerned neither felt any sense of urgency nor any sense of responsibility to develop their knowledge actively and thus reduce uncertainties. With its passive attitude, NAM failed to fulfil its duty of care. Equally, the Ministry of Economic Affairs, as the guardian of safety interests, should have taken charge back in 1993 and initiated further independent scientific research to reduce the uncertainties surrounding induced earthquakes. Similarly, as the supervisory authority, SodM should have insisted more strongly that this be carried out well before 2012. Knowledge institutions could have indicated the fact that uncertainties were given insufficient consideration in the decision-making process, and the Dutch scientific community could also have initiated research into gas extraction, independently of NAM and the Ministry of Economic Affairs.

3. The parties involved in gas extraction failed to be adequately accountable to and communicate with the provincial residents about how they dealt with earthquake risk.

NAM, the Ministry of Economic Affairs and SodM should have provided citizens with greater insight into the complex nature of the material and the interests and uncertainties surrounding the earthquake issue. However, communication was focused primarily on the expected maximum earthquake intensity and the lighter material damage that could be caused. In this technocratic approach, insufficient consideration was given to the anxiety and safety concerns of the citizens in Groningen. Consequently, and by communicating not 'with' but rather 'about' residents and local representatives, the parties themselves in fact contributed to the anxiety and safety concerns of residents. This modus operandi caused numerous residents of the province of Groningen to not only lose confidence in safe gas extraction in early 2013 but also in the parties involved.

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