

Negligent provision of information about earthquakes in Groningen?

By Stephan Okhuijsen

ANALYSIS – Earlier this month NAM (Nederlandse Aardolie Maatschappij, a Dutch joint venture between Shell and ExxonMobil) announced its [new production plan](#) for the Groningen gas field. In the autumn, Dutch minister of Economic Affairs Henk Kamp will make a decision on this plan. Meanwhile, a heated debate has been going on for a long time about the consequences of gas extraction for the people living on top of the Groningen gas field. Also, it is questioned whether people are being compensated for damages incurred. The biggest obstacle is who is willing to take responsibility. To this day, it looks like both the government and NAM are expertly trying to evade their responsibilities in order to [secure gas revenues](#).

Let's begin at the basis. Since ancient times, we've known – and this knowledge has come at a cost – that almost all interventions in the subsurface impact our immediate surroundings, in particular all that's going on directly above the intervention site. This is why we shore up tunnels, hammer dam walls and fill up man-made holes with something else. Impact differs from case to case. It goes without saying that any and all impact detected is researched.

Research

In 1993, research institute KNMI published [a report about the impact of gas extraction on earthquakes in Groningen](#). The main conclusion was this:

“In the light of the results of the investigation into the relationship between gas extraction and earthquakes, the Commission concludes that earthquakes are, under certain circumstances, the result of gas extraction. The number and magnitude of earthquakes in the Northern Netherlands are not such that there should be cause for concern.”

Soothing words, but unfortunately we now know better. The people living on top of the Groningen field sometimes need [horrid constructions](#) to prevent their homes from collapsing. After all the uproar in recent years, NAM has finally introduced a research program to study the effects of gas extraction. This fits in well with a widely used delaying tactic in response to public unrest: indicating that more research is needed in order to reach a decision.

Negligence

For scientists it is customary to carefully consider previously published relevant scientific research. Both the KNMI report and NAMs study plan are conspicuous by the absence of reference to previously published relevant (scientific) research.

What could be the reason for this lack of references? Here are some possible explanations:

- Nowhere in the world has anyone ever researched induced seismicity.
- KNMI and NAM researchers are not aware of any previous research.
- KNMI and NAM are aware of previous research, but haven't mentioned this on purpose.

Wilmington

In 1933, Los Angeles was rocked by a magnitude 6.3 earthquake (Richter scale). Although it isn't certain that this quake was induced, it was one of the first quakes monitored with an accelerometer. In a 1974 article in [Bulletin of the Seismological Society of America](#), Robert Kovach proves that the earthquakes that took place in the Wilmington Oil Field near Los Angeles in the forties and fifties of the last century originated in oil extraction:

“An unusual set of man-made “earthquakes” was generated in the Wilmington Oil Field, California, during the exploitation of this field. The Wilmington Oil Field was the classic example of an elliptically shaped subsidence bowl produced by the extensive withdrawal of the underlying oil. This surface subsidence produced horizontal shear stresses relieved several times by damaging sudden horizontal movements on very shallow slippage planes. Damaging shocks occurred in 1947, 1949, 1951, 1954, 1955, and 1961. These shocks produced seismograms, primarily composed of surface waves, which present an interesting opportunity to study seismic source mechanisms inasmuch as the focal depth, amount of slip, and source dimensions are known.”

Is this the only induced seismicity research available? Of course not. To [quote](#) the *Earth Sciences Division of the Lawrence Berkeley National Laboratory* ([alternative link](#)):

“Induced seismicity in oil and gas production has been observed ever since the 1930s, i.e., ever since large-scale extraction of fluids occurred.”

Another quote, from [Induced Seismicity Potential in Energy Technologies](#) (2013):

“Since the 1920s we have recognized that pumping fluids into or out of the Earth has the potential to cause seismic events that can be felt.”

And here are some more references to relevant research:

- [USGS publications](#) on induced seismicity, starting in 1968.

- Grasso, J. R. (1992). Mechanics of seismic instabilities induced by the recovery of hydrocarbons. *Pure and Applied Geophysics*, 139 (3-4), 507-534. ([link](#))
- Nicholson, C., & Wesson, R. L. (1992). Triggered earthquakes and deep well activities. *Pure and Applied Geophysics*, 139(3-4), 561-578. ([link](#))
- Wetmiller, R. J. (1986). Earthquakes near Rocky Mountain House, Alberta, and their relationship to gas production facilities. *Canadian Journal of Earth Sciences*, 23 (2), 172-181. ([link](#))
- And over [18.000 other hits](#) in Google Scholar for ‘*induced seismicity extraction natural gas*’.

Deliberate negligence?

The first of the above-mentioned possible explanations for the fact that both KNMI and NAM have ignored previous research (“No-one has ever researched it”) can be relegated to the wastepaper basket. So, they either purposely didn’t mention it, or didn’t know about it. Whichever way around, this amounts to (gross) negligence.

Given the fact that [Shell and Exxon](#) were involved in [Wilmington Oil Field](#) back in 1933, it’s reasonable to assume they knew about earthquake risks associated with oil and gas extraction. From the perspective of risk management, too, the oil and gas extraction industry is bound to have excellent knowledge of the seismic risks involved in oil and gas extraction. Shell and Exxon started exploitation of the Groningen field in 1963 – 30 years after Wilmington.

It really is outrageous that residents of Groningen are being put off with a new research program.

We’re very grateful for the contributions of several authors and one external expert to this story.

Post Production Remark

Our readers pointed out that the [full 1993 KNMI report](#) (which we couldn’t find at the time when we wrote this article) in fact does contain references to relevant scientific research (see the list of references in the Full Report). Though this undermines some of our statements regarding KNMI, it also raises further questions:

- If researchers knew about relevant scientific research in 1993, how come they reached the conclusion that there’s little risk involved?
- In the five years following the report, the number of earthquakes in Groningen has [more than tripled](#). Wasn’t this cause for critical review of their previous conclusion?

Also, the [documentary by Dutch national broadcaster NPO](#) our reader Jan Boven linked to, clearly shows that previous warnings have been ignored and incriminating information was kept secret.

Reader Comment by Hans Custers

Your allegation levelled against KNMI about them ignoring previous research, is unjust. It's true that the Summary Report doesn't contain any references, but the [Full Report](#) does. Some of the studies you mention are in the List of References in the full KNMI report.

Of course, that doesn't alter the fact that they've underestimated the risks.

Reader Comment by B. Ubink van der Spek

The BOA report, which is the KNMI report Hans Custers is referring to, dates back to 1993. For a long time, many residents of Groningen couldn't find it on the web.

The Dutch Safety Board, in its report about earthquake risks in Groningen, had this to say about the BOA report:

“The message NAM and other parties extract from the valuable BOA report is erroneously reassuring. Uncertainties about the likely effects have become secondary to the assessment that these effects will turn out less serious than expected. Despite their awareness of uncertainties and limitations, research institutes, NAM, the Dutch ministry of Economic Affairs and State Supervision of Mines do nothing to remedy this. There's no critical review of the basic assumptions.”

And:

“The assumptions used by KNMI, NAM and the ministry of Economic Affairs remain the same, even after KNMI notices changes in the seismic behaviour of the Groningen field in 2004. Furthermore, before the end of 2013 no research is conducted that sheds light on the earthquake mechanisms taking place in the deep subsurface of the Groningen field. And so, at the end of 2013, the 1993 BOA report hypotheses remain unverified. KNMI, NAM and the ministry of Economic Affairs should have conducted studies earlier on, and more extensively, precisely because of the existing uncertainties and increase in earthquakes.”

The BOA report does indeed reference Kovach 1974, but no mention is made of the fact that the 1933 earthquake in all likelihood was the first induced quake to be measured by accelerometers. At the time of publication of the BOA report, in 1993, Shell and Exxon had known about the possibility of induced quakes for 60 years.

Although the Dutch Safety Board drew harsh conclusions, the list of references in their report indicates that the Board didn't study Kovach' article. This means they haven't explored an essential part of the history of induced seismicity knowledge.

Since the Board is a rather important safety institute, this can be seen as negligence. Surely, disregarding previous relevant research must have influenced their assessment of how NAM, the ministry of Economic Affairs and research institutes have dealt with seismicity and risks resulting from gas extraction in Groningen.

'Allegation' doesn't quite cut it in light of the fact that gas and oil partners have known about this for almost a century. We should give due consideration to the matter. Why did the Dutch Safety Board not include this period in its investigation?