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Shale gas extraction linked to water contamination

A new study suggests shale gas extraction leads to methane contamination of underground water sources and calls for thorough surveys of methane levels at extraction sites. The study presents a timely insight into a relatively under-researched area of science that will help support decisions on the future of shale gas exploration.

Shale gas, or natural gas extracted from sedimentary rocks known as shale, has been hailed as a "cleaner" energy source, releasing less than half the CO_2 emissions of coal. The profitable use of shale gas in North America has prompted scientists to look at how to exploit sources of shale gas in Europe, particularly in Poland, Germany and the United Kingdom. Currently, more than 40 per cent of natural gas is imported to Europe from outside the EU.

Shale gas extraction uses a technique called "hydraulic fracturing" (or "fracking"), which shoots high-pressure jets of fluid into cracks in the shale rocks to break them open and release the gas. Public health concerns have emerged in the United States over contamination of drinking water caused by the fracking process. However, before now, there has been limited scientific evidence available for this.

The US study measured the methane concentration in 68 wells that drew water for human consumption from natural underground sources (aquifers) across northeast Pennsylvania and New York State. The researchers took measurements in wells with similar geological characteristics within both active and non-active shale gas extraction sites to assess the extent of contamination.

The study revealed that, on average, methane concentrations were 17 times higher in wells near active fracking sites (within one kilometre) than those in non-active sites and were well within "hazardous levels", as defined by the US Office of the Interior[1]. The concentration in the wells near active sites increased with increasing proximity to the precise fracking location.

The contamination could be caused by the production of new cracks in the shale rocks, or fractures, caused during the fracking process, which allows shale gas to escape.

The researchers analysed the presence of different chemical forms (isotopes) of methane and more complex hydrocarbons, including ethane, propane and butane. From this, they were able to confirm that the source of the methane contamination was the gas contained in the shale rocks, discounting the possibility that it was produced naturally by microbes that live in the water.

Although methane dissolved in drinking water is not currently classified as a direct health hazard, if it accumulates in underground water sources or other enclosed spaces, there is a high risk of explosion, say the researchers. They also tested for contamination of the water in the wells by other fluids used in the fracking process, such as hypersaline (highly salty) brines, but found no evidence of contamination in any of the wells.

In light of their results, the scientists recommended a co-ordinated policy to collect data on the concentration and chemical form of methane present in groundwater before fracking is carried out at a site, during the process and after completion to assess the level of contamination. They also suggested that more research is needed into the potential health consequences of methane for humans since, although not toxic itself, methane can release toxic gases during combustion. Better scientific knowledge is needed in order to establish safe standards for methane concentration in underground water and to ensure public confidence in the industry, say the researchers.

Source: Osborn, G., Vengosh, A., Warner, N & Jackson, R. B. (2011). Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing. *Proceedings of the National Academy of Sciences*. Doi: 10.1073/pnas.1100682108. This study is free to download from: www.pnas.org/content/108/20/8172.abstract

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