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Higher rates of damage reported in US shale gas and oil wells than in conventional wells

Over 75 000 regulatory inspection reports for over 32 000 oil and gas production wells drilled in Pennsylvania, US between 2000 and 2012, have been analysed in a recent study. In these reports, the inspectors logged six times as many incidents of damage to the walls of shale gas and oil wells than in wells for conventional oil and gas.

Previous studies have found increased levels of methane, a major component of gas and oil, in the groundwater and air close to 'unconventional' wells. In Pennsylvania, these are drilled into shale rock which is then hydraulically fractured ('fracked') to release the gas or oil. How methane may escape is not well understood, however leaking wells have been suggested as the most likely explanation.

This study explored the extent of damage to well casings and cement – the barrier between a well bore and the surrounding rocks. A number of factors may weaken the cement or the casings, which are made of steel. For instance, joints may corrode or collapse, and cement may crack or deteriorate with age.

The researchers looked for signs of damage to casings across 32 678 conventional and unconventional wells, as recorded in 75 505 compliance reports published between 2000 and 2012 and conducted by the Pennsylvania Department of Environmental Protection. Eighteen per cent of the wells (5763) were unconventional.

The inspectors had noted damage in 1.9% of all the wells, the analysis shows. However, they recorded problems with 6.2% of unconventional wells, compared with just 1% of conventional wells.

Wells in the north-east of the state which had been drilled in 2009 and earlier had the highest rate of recorded problems; 9.84% of these wells were affected (compared with 5.21% of conventional wells in the region overall). The researchers note that these only reflect a small number of wells (61).

However, figures did not show much improvement for the period post-2009, when drilling in the area became more extensive, and the number of wells increased significantly. Signs of damage were logged for 9.18% of the 2714 unconventional wells in the north-east, compared with 2.27% of conventional wells for the same period and region.

More problems were reported for older wells, and this may be partly because the cement had aged, but also because they have simply had more inspections; each inspection increases the risk of finding a problem by 6% for the most recent wells. They also note that there are a further 8703 wells in the state, for which inspection data are not available; therefore their figures likely underestimate the true extent of well damage.

To overcome some of these problems with data, the researchers modelled the risk of impairment if all the wells in Pennsylvania (totalling 41 381) had the same number of inspections. The results of this suggested that damage to casing or cement is likely in over 12% of unconventional gas wells drilled since 2009, and 1.58 times more likely than in conventional wells.

The study does not discuss reasons for the differences in damage rates between conventional and unconventional wells, nor can it explain the regional differences in problems. The authors of the study also stress that damage does not automatically mean that methane has leaked. However, these results are concerning, the researchers say, especially given the severe climate change impacts of methane migration into the atmosphere from leaky wells. Further studies are needed to examine the link between methane migration and well integrity.

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