

Abandoned UK Wells: Do they leak?



This research is based on “Fugitive emissions of methane from abandoned, decommissioned oil and gas wells” by Ian Boothroyd, Sam Almond, Suzane Qassim, Fred Worrall and Richard Davies. The paper was published in *Science of the Total Environment* and is available for free download at www.refine.org.uk.

Introduction

There are currently 2193 oil/gas wells in the UK, some drilled as early as 1902. It is estimated that around two-thirds of these wells are what is referred to as abandoned (decommissioned). In order to understand the total potential environmental impact of a shale gas industry, it is necessary to know how much methane, a major greenhouse gas, is emitted from abandoned wells. Such leaks are unlikely to cause harm locally, but do need to be taken into account when analysing the potential impact of shale gas on global warming.

What is Well Integrity?

Wells are designed with multiple layers of protection to prevent pollutants from entering the environment. Wells are fitted with steel casing, with multiple layers of casing used close to the surface or when drilling through sensitive rock layers such as aquifers. Between each layer of casing is a layer of cement that provides extra protection. Over time however, corrosion and cracking (or improper construction) can allow pathways to form that will allow pollutants, such as methane, to enter the environment.

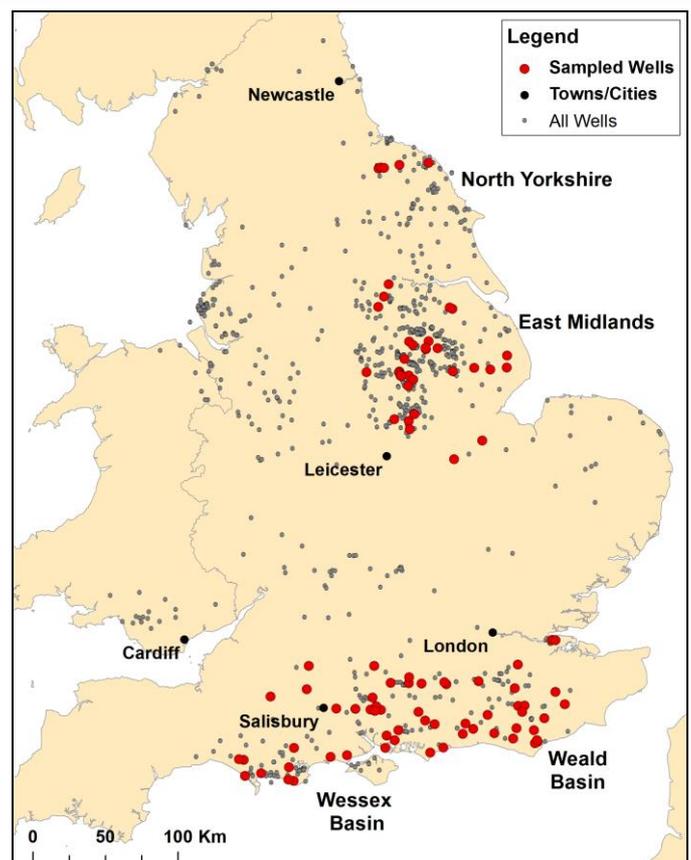


Figure 1: Map of all wells surveyed for methane emissions. In total 102 wells were surveyed across 4 basins: North Yorkshire, East Midlands, Wessex and Weald Basins.



Figure 2: At the end of their lifetime, most UK wells are cut below ground, plugged and the land reclaimed. Picture “A” is the site of an abandoned well near Middlesbrough. Picture “B” is the UK’s first commercial oil well, in Derbyshire. This well was not plugged to modern standards, nor cut off below ground. Oil and gas bubbles can be seen leaking from the casing.

What is abandonment?

When a well is no longer required, it undergoes a decommissioning process called abandonment. During this process it is “plugged”. This involves filling some or all of the wellbore with cement to seal the wellbore against leaks, in addition to the casing and cement that is already present. The well is then cut off several meters below ground, and the land remediated. A well integrity failure is when one or more of these barriers fail, usually due to steel corrosion or cement cracking, allowing gas or liquids out of the sealed well. The presence of methane (natural gas) at the surface is a strong indication that an abandoned well has suffered a well integrity failure.

How was the survey conducted?

As the UK currently has no shale gas industry, conventional wells were examined instead. Abandoned wells were located using GPS, and gas concentration was measured at ground level using a portable methane analyser. As the land is reclaimed after abandonment, most sites are now on agricultural land with no evidence of wells remaining at the surface. Ages of the wells ranged from the early 1900s to the early 2000s. For every well measured, readings were also taken at a control site with no well present; these two values were compared to determine whether or not the well was leaking gas to the atmosphere.

How many wells leak?

Much research has been published on leakage rates of wells from around the world, with recorded leakage rates from 1.9% to 75% across various locations. However, there is little information on what happens to UK wells after abandonment. There is currently no requirement for long-term monitoring of wells after abandonment, so data is scarce. This study found that 30% of wells showed elevated levels of methane compared to measurements taken at control sites. However, a similar number showed slightly lower emissions than controls. The average methane emitted from each well was the equivalent of 364 kg of CO₂ per year; this is roughly the same yearly emissions as would be expected from 2 sheep, or 3000km driving.

Conclusions

Although a relatively minor issue within the context of other emissions sources, abandoned wells are a source of methane that has to be considered when assessing the environmental impact of any oil or gas development. We would recommend that a periodic monitoring programme be put in place to ensure the integrity of abandoned wells in the future.