Fact Sheet: Well Integrity

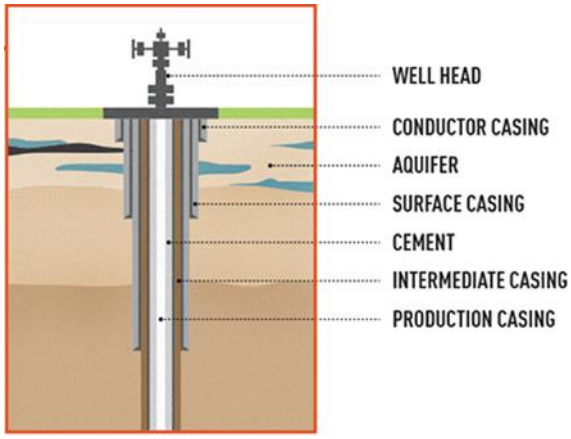
KEY POINTS:

- High standards of well integrity ensure long-term safe and environmentally responsible operations.
- Wells are designed and built using multiple layers of steel piping and cement, and pressure tested before production commences. Acoustic monitoring can also be used to verify cement bonding.
- Regular maintenance is carried out during the life of a well, which usually extends for decades.
- Reviews of thousands of wells over decades of operation reveal very low rates of well integrity failure.

THE FACTS:

Design and construction

Before a well is drilled, it is carefully designed to make sure it meets the highest safety standards and can withstand challenges such as pressure, corrosion, high temperatures, and fluid flows that may erode pipe. The design also accounts for maintenance programs over the life of the well, which is usually decades-long.



Above: Multiple pipe casing and cementation

During construction, wells are lined with multiple layers of high-quality steel pipe and cement casing. These barriers prevent unwanted flow of liquids or gases between rock zones, or inside the well itself. Once the steel and cement casing is in place, pressure testing is used to confirm the well's integrity. The well's cement bonding can also be tested by using sound waves.

Production and decommissioning

A well will only be brought into production after its integrity is confirmed. Maintenance programs involving regular monitoring and servicing ensure a well's ongoing integrity. Maintenance operations are performed

by specialised "workover rigs" and may involve replacing internal steel piping, testing pressure seals and making detailed measurements such as flow rates and temperatures.

Once a well has reached the end of its useful life, it must be remediated (the industry term is 'plugged and abandoned'). Steps taken to remediate a well are usually well defined by the relevant regulator. A typical well remediation requires the use of a drilling rig which removes any equipment in the wells such as subsurface pumps and pipe tubing. Then the rig pumps cement into the well and sets mechanical plugs as a backup, to create long term barriers to fluid flow and to isolate rock zones. Once the well is safe from a below surface point of view, the well head is removed, and for onshore wells, cut off below ground level so past practices such as agriculture can resume over the well site.

Well integrity failure

The United States has the world's longest history of oil and gas production, and the most intensive drilling programs. The US Ground Water Protection Council examined more than 34,000 wells drilled and completed in the state of Ohio between 1983 and 2007, and more than 187,000 wells drilled and completed in Texas between 1993 and 2008. Included in the study period were more than 16,000 horizontal shale gas wells, with multi-staged hydraulic fracturing stimulations, completed in Texas.

The data[1] shows only 12 incidents in Ohio related to failures of (or graduate erosions to) casing or cement – a failure rate of **0.03%**. In Texas, the failure rate was only about **0.01%**. Obviously zero is the aim, but this is still a very low percentage considering the number of wells drilled.

[1] http://fracfocus.org/sites/default/files/publications/state_oil__gas_agency_groundwater_investigations_optimized.pdf