EMERGING ENERGY TECHNOLOGIES – UPDATE ON DEVELOPMENTS WITH UNCONVENTIONAL GAS

Purpose of the paper

1. This paper updates the Board on UK unconventional gas matters.
2. The Board is asked to note the contents of this paper.

Background

3. In 2010, the Board considered a number of reports on HSE’s regulation of emerging energy technologies (the EET Programme). The conclusion was that HSE should use the general provisions of the Health and Safety at Work etc. Act 1974 (HSWA) and associated regulations to regulate the emerging sectors unless there was a clear demonstration to the contrary. The introduction of process/activity specific regulations should only be considered where there is compelling evidence to suggest that the broad framework of the Act was insufficient. The Board asked for regular updates on developments. This paper provides an update on unconventional gas issues. Further papers will follow on ‘renewable technology’ (October 2013).

4. Hydrocarbons are defined as ‘conventional’ or ‘unconventional’ depending on the type of rock they are found in. ‘Conventional’ oil and gas refers to hydrocarbons extracted from sandstone or limestone. ‘Unconventional’ gas and oil refers to hydrocarbons produced from shale, tight sands, or coals.

5. There are three types of unconventional gas in the UK: shale gas, coal-bed methane and underground coal gasification.

Shale gas

6. This is extracted from clay shales. Because fluids cannot readily pass through the very tightly grained shale, the rock needs to be opened up by injection of fluids and sands in order for the gas to flow into a well – a process known as hydraulic fracturing or ‘fracking’. A full background note on shale gas, prepared by DECC, has been circulated with this paper.

7. Exploration for shale gas in the UK is at an early stage and modest in terms of activity. A recent estimate of shale gas in an area between Wrexham and Blackpool in the west, and Nottingham and Scarborough in the east, is 1329 tcf (trillion cubic feet). To put this into context, the UK currently uses about 2.6 tcf of gas a year, 40% of which is imported. However, the proportion of gas that may be extracted depends on the economic, geological and social factors that will prevail at each operation.
8. The key events for shale gas exploration in the UK are as follows:
   a) Exploration drilling begins in Lancashire – March 2011;
   b) The Energy and Climate Change Select Committee reports on shale gas and concludes that risks can be managed successfully with appropriate precautions and urges vigilance from the regulators – May 2011;
   c) Two small earthquakes are recorded near to Blackpool and fracking is suspended – April/May 2011;
   d) The Royal Society and Royal Academy of Engineering publishes its shale gas report on the 13th December 2012, and concludes that shale gas risks can be managed effectively in the UK as long as operational practices are implemented and enforced through regulation;
   e) Independent studies concluded that the seismic risks associated with fracking can be managed effectively and fracking resumes - December 2012; and
   f) The Chancellor announces support for shale gas stating, “shale gas is part of the future, and we will make it happen” - March 2013.

Coal-bed methane (CBM)

9. This is methane extracted from coal beds. Methane naturally occurs in coal deposits; indeed, it presents one of the greatest hazards in underground coal mining. This methane can be extracted by drilling into the coal seam from the surface. There are two CBM wells currently operating in the UK. There has been rapid recent expansion of this technology in the US and Australia but no signs yet of a similar acceleration in the UK.

Underground coal gasification (UCG)

10. This is a gasification process carried out \textit{in-situ} within non-mined coal seams. Oxidants are injected into the seam, a reaction at the seam is initiated and the resulting gas (a mixture of carbon monoxide, hydrogen and carbon dioxide commonly known as syngas) is brought to the surface through production wells. The process can be applied to coal in seams that are otherwise unprofitable or too complicated to extract by traditional mining methods. Although exploration licenses have been issued in the UK, pilots are yet to begin.

Hazard and Risks

11. The major hazard in all three of the technologies involves the unintentional escape of hydrocarbons from the well. The risks will vary largely according to the extent to which a loss of containment incident can be quickly and easily controlled. In contrast to conventional gas extraction operations where gas is naturally often under considerable pressure and will use any loss of containment to escape in great volume and pressure, some unconventional gas operations require a process of forcing gas to the surface or initiating a chemical reaction to generate the gas. This means that loss of containment can be more easily brought under control by stopping the initiating extraction/generation process. In shale gas, there is also seismic risk caused by fracking. In the case of UCG, subsidence from the collapse of the depleted coal structure may be an issue.

12. The occupational health and safety risks to workers from these pilot activities are considerably lower than for other mineral extraction industries (e.g. coal mining and offshore oil and gas). People are generally working at ground level on sites
with traditional health and safety risks comparable to a simple construction site, including falls or being hit by something.

13. These technologies can also result in risks to the environment, including groundwater contamination. These environmental risks are regulated by the environment agencies (EA in England, SEPA in Scotland and NRW in Wales). Operators rely on a high degree of well integrity to ensure safety and to mitigate risks to the environment.

**Argument**

**Legislation**

14. HSWA applies to all unconventional gas operations. In the case of shale gas and CBM, the Boreholes Regulations and our Well Regulations\(^1\) supplement the HSWA. These provide for additional controls on the notification (to HSE) and assessment (by HSE and an independent examiner) of well design, construction and operation. With this emphasis on well integrity, we believe this legislative package is sufficient to regulate these industries at present.

15. However, we do not think that these additional requirements on wells apply to UCG. The syngas produced by UCG may fall outside the definition of a mineral, which defines the scope of the regulations. Therefore, there may be a regulatory gap for this technology. As the first UCG pilot is only expected to start in 3-5 years, officials are reviewing the position of UCG within our major hazard regime and will develop proposals.

**HSE’s Intervention Approach**

16. Our intervention approach has two elements. The first was to contribute to setting standards for the industry as a whole. HSE was part of a working party set up by the United Kingdom Onshore Operators Group, which published best practice guidelines for shale well operations in February 2013. The second is to focus our operational effort on well integrity.

17. The primary specialist expertise required in regulating unconventional gas operations is wells engineering. The HSE wells team is located in Energy Division and it covers all types of hydrocarbon wells, both onshore and offshore.

18. An oil or gas well is a complex engineered construction, most of which is not accessible to visual inspection. We take a life cycle approach to well integrity which has the following main components:

- Assessment of well notifications submitted to HSE. This assesses well design prior to construction, a key phase of work where the vast majority of issues likely to have an impact on well integrity will be identified and addressed by the well operator;
- Monitoring of well operations during construction based on weekly operations reports submitted to HSE by the well operators. This provides HSE with the assurance that the operator is constructing and operating the well as described in the notification, and when they are not, HSE can take appropriate action; and
- Meetings with well operators, both prior to and during the operational phase. This includes site inspections to assess well integrity during the operational phase and for new and first time shale gas operators we (HSE and EA) will

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\(^1\) The wells aspects of the Offshore Installations and Wells (Design and Construction, etc) Regulations 1996 apply onshore as well as offshore.
meet and advise them of their duties and conduct a joint inspection of their key operations.

17. This is supplemented by a requirement for an independent well examiner to assess design, construction and maintenance.

18. Wells specialists are a very scarce discipline in HSE. HID’s Energy Division are actively recruiting offshore inspectors, including Wells Specialists, to meet the demands of regulating the on- and offshore oil and gas sectors. HSE can provide effective regulatory oversight of the small number of pilot projects proposed within existing resource, and other demands of this emerging technology, including attending public meetings, have to be very carefully prioritised. However, if extraction of shale gas starts to develop to a significant commercial scale then this will not be the case. This issue will be placed into the context of broader recruitment needs of specialist disciplines within HSE’s major hazard remit.

The Wider Regulatory Picture

19. DECC (which grants drilling consents), local authorities (which give planning permission), Defra (which has the environmental policy lead), the environment agencies (EA, SEPA and NRW, which issue operating permits) and HSE are all involved in the life cycle of shale gas exploration and exploitation. A joined up approach to provide protection without unnecessary burden is a government policy objective.

20. Co-ordination is achieved through a Whitehall Shale Gas Strategy Group set up under the auspices of DECC’s Office for Unconventional Gas and Oil (OUGO). This cross Whitehall/agency activity is supplemented by a memorandum of understanding between HSE and Environment Agency (EA) on regulation of shale gas operations. OUGO lead on unconventional gas communications, including industry promotion activities. HSE supports OUGO on health and safety issues, making it clear that HSE does not promote any particular technology but we are there to ensure that any selected technology is implemented safely. We also sometimes assist the EA (and to a lesser extent their devolved equivalents) in commenting on well integrity which is our primary health and safety focus but which also has a key role in mitigating environmental risks.

Land Use Planning

21. HSE is not a statutory consultee on land use planning decisions for unconventional gas activities, unless these involve the storage of COMAH quantities of hazardous substances, which trigger consultation by planning authorities. So far, none does. Longer-term, if larger production sites are planned, this may change and we will return to the issue if and when this looks likely.

European Position

22. Many European countries have proven shale gas reserves, some such as Poland potentially huge. In anticipation of this being a growth industry, the European Commission has initiated research on how shale gas is regulated by a selection of Member States. The Commission is currently considering options for health and safety and environmental protection in shale gas operations. These are:

a) To provide specific guidance under existing legislation and other measures (e.g. voluntary agreements, Best Available Techniques Reference Documents);
b) To amend parts of the existing EU legislative framework to address specific issues; or

c) To put in place specific legislation relating to shale gas.

23. DEFRA leads for the UK on this. So far, the Commission seems to be favouring a combination of options (a) and (b). HSE has reminded the Commission of the existence of European Directive 92/91 - on the minimum requirements for improving the safety and health of workers in the mineral extraction industries through drilling, and that this Directive covers unconventional gas activities. HSE feels that this Directive, with some updating to reflect requirements that are seen as key to managing well integrity (e.g. well notifications, well reports and independent well examinations), could be the basis for a consistent European approach to addressing safety issues in this area.

Devolved Administrations

24. Unconventional gas work activities are taking place in England, Scotland and Wales. As environmental issues are devolved, the Environment Agency in England, Natural Resources Wales and the Scottish Environment Protection Agency will all have a key regulatory role.

Resources and Cost Recovery

25. Recognising the growth of the onshore oil and gas industry, HSE amended the Health and Safety (Fees) Regulations so that it was able to recover full costs from the review of notifications made under the Borehole Sites and Operations Regulations 1995. This will cover current shale gas and CBM work activities.

Action

26. The Board is invited to note the contents of this paper. Further updates will be provided as the technologies develop and when our position on legislative and resource requirements become clearer.

Paper clearance

27. This paper was cleared by Gordon MacDonald on the 13th August 2013.