BCUK Position Paper: Fracking (last updated April 2015)

Background

We outline our current interpretation of the key research surrounding the public health related concerns linked to fracking. What follows is a brief overview of fracking: what it is; where it takes place; and why it may be of concern for public health.

Whilst there is no current evidence to conclude that fracking causes breast cancer, Breast Cancer UK has concerns about the potentially adverse health effects of increased exposure to harmful chemicals and gases that may occur as a result of its use. Therefore, we support a ban on the use of all compounds that show carcinogenic or endocrine disrupting properties in fracking operations in all EU countries (including the UK) and a review of relevant EU policies in this area. A recent report by the UK health charity Medact (1) examined the health implications of fracking and concluded that it poses significant risks to public health. The charity has called for a comprehensive health and environmental impact assessment on fracking and related activities in the UK, which Breast Cancer UK fully endorse.

What is Fracking?

"Hydraulic fracturing" or "fracking", is the technique used to access gas or oil held within shale beds. The process involves drilling a borehole, which is then lined with a steel pipe. The pipe is perforated in target zones that contain oil or gas (2). A mixture of water, chemical additives and sand is pumped into the borehole at pressures high enough to cause a fracture in the rock within the target zone. The sand or other materials, called "proppants", prop open the fractures and allow the gas to flow out into the borehole (3).

Where does it take place?

Significant volumes of shale gas have been extracted via fracking in the USA, but exploration of the technique in the UK and Europe is relatively recent. The British Geological Survey (BGS) suggests that the UK has 'abundant' shales at depth. However, it is not yet known how much shale gas or oil could be extracted nor whether the process would be commercially viable in the UK (4). Studies suggest that sites at which existing conventional gas has been found in the UK represent the most likely areas for future fracking operations (5). The BGS in association with the Department of Energy and Climate Change (DEEC) has have identified potential areas in northern England around the Pennine Basin, in the Kimmeridge Clay of the Weald Basin in Surrey and Sussex, the Oil-Shale Group of the Midland Valley, and the central belt of Scotland, and parts of South Wales (6, 7, 8, 9).

Chemicals and Fracking

Chemicals are used in the fracking process in order to improve the efficiency and effectiveness of extraction. They are added to the water to facilitate boring, reduce friction, shorten drilling time and to prevent accidents (10). Biocides are used to prevent microbial growth (11), stabilisers are used to prevent corrosion of metal pipes and acids are used to remove mud damage caused by drilling within the area (12). The nature of the chemical additives used varies from site to site (13). The fracking process involves the injection of millions of gallons of fluid into boreholes (14, 15, 16).

Reports differ as to how much of the fluid stays in the ground. The International Association of Oil and Gas Producers indicate that between 10% and 70% of it is recovered (17). In the USA, liquid waste, which comprises "flowback" (mostly fracturing fluids that come out immediately after well stimulation) and "produced water" (water present in gas-bearing formations that surfaces over the life of the well) is stored in open pits or tanks prior to disposal (18, 19). This wastewater can carry to the surface gases, liquids and solids which contain toxic materials, including naturally occurring radioactive materials, that are present in underground oil and gas deposits (20). In the USA, chemicals used in fracking have reached groundwater (21) and leakage from open pits, due to poorly designed wells and cement casings, resulted in drinking water becoming contaminated with fracking chemicals (22).

In the UK, the use of open pits or tanks to store flowback is not permitted. All such waste must be stored in above ground double-contained tanks. As flowback wastewater is enriched with heavy metals, radioisotopes and salts (23), as well as fracking additives, it requires treatment prior to discharge. In the USA, municipal wastewater treatment plants (WWTPs) are not always willing to accept such highly contaminated waste (24). Some companies in the USA have begun "recycling" flowback fluid into fracking sites, concentrating contaminants even further (25). In other cases, they have discharged it directly onto roads and forests (26). Although in the UK such contaminated wastewater must be treated prior to discharge, the large volumes may be problematic for many of the smaller municipal WWTPs. In addition, fracking may result in local air pollution by volatile organic compounds, nitrogen oxides and gases (27, 28) and methane, originating from fracking sites, has been found in ground and surface waters as a result of faulty concrete and leaking pipes (29, 30). In the UK operators are obliged to monitor air quality, provide results to the relevant environmental regulator and must demonstrate "their activities have not led to air pollution at levels higher than those set out in their environmental permits" (31).

Fracking fluids, radioactive gases and breast cancer

There is no conclusive evidence that fracking causes an increase in the number of cases of breast cancer. However, many of the chemicals used in fracking (32) are known to be of concern and have been linked to an increased risk of breast cancer. For example, benzene, acrylamide, and formaldehyde are all listed by the International Agency for Research on Cancer (IARC) as human carcinogens

(33) and have been linked to breast cancer tumours in other studies (34). In the USA these chemicals are used in fracking operations. Under current UK regulations, such substances would not be approved for use. However, other chemicals that have been used in fracking in the USA, including many endocrine disrupting chemicals (EDCs), are not on banned lists. Under current UK regulations their use might be allowed. For example, ethylene oxide* has been permitted for use by the Environment Agency (EA) at a site in Balcombe. Ethylene oxide is not listed as being a hazardous or a non hazardous pollutant, but it is a suspected EDC and has been classified by IARC as a carcinogen (35, 36). Other chemicals, such as di (2-ethylhexyl) phthalate, DEHP and Bisphenol A (BPA), are also used in fracking in the USA but are not considered hazardous or pollutants of concern under the Water Framework Directive, despite being EDCs with connections to breast cancer (37, 38). It is unclear at this stage whether these chemicals will be permitted for use under UK/EU law.

An EDC is any chemical that can interfere with hormone functions in humans and/or animals (39). Many of the EDCs implicated in breast cancer interfere with oestrogens (female hormones) or androgens (male hormones) (40). A recent study (41), which examined oestrogenic, anti-oestrogenic, or anti-androgenic activity in water samples from the Colorado river, found elevated EDC activity in surface and ground water samples from regions where fracking occurs. Furthermore, water samples from sites with known natural gas drilling accidents had greater oestrogenic and androgenic activities than drilling-sparse or reference sites where no drilling had occurred. The study also found that a subset of chemicals used in fracking operations showed oestrogenic, anti-oestrogenic, or anti-androgenic activity.

Health data on a small percentage of chemicals used in fracking in the USA showed that more than 25% of them can cause cancer and mutations and 37% can affect the endocrine system (42). This study made the assumption that their results "underestimated the consequences of the health impacts to the labor (sic) force, residents living in close proximity to the wells and those depending upon potable and agricultural water that could be affected by natural gas operations". An overarching concern is that a large proportion of the chemicals used in fracking have not been tested for adverse health effects in humans (43).

A recent scientific paper analysed indoor measurements of the radioactive gas, radon, in hundreds of thousands of homes and other buildings located in Pennsylvania, USA. The study concluded that fracking was associated with elevated indoor radon concentrations (44). Radon is a potential public health concern as elevated levels increase cancer risk, especially cancer of the lung. Increased levels of radon gas have also been associated with increased breast cancer risk (45).

Potential links to other diseases

Chemicals used in fracking have also been linked to other diseases and disorders from the relatively minor, such as rashes, nosebleeds, joint pain and headaches, to more serious disorders such as breathing difficulties, memory loss, and

intestinal problems (46, 47). One study found that 75% of chemicals used can affect the skin, eyes and other sensory organs, respiratory system and gastrointestinal system and more than half can affect the brain and nervous system (48). Some of these health problems were identified in a 2013 paper by Rafferty and Limonik (49). Another study suggested fracking activities were linked to congenital heart defects and neural tube defects in new-born babies (50). Despite public concern, no comprehensive population-based research on the health effects of fracking operations has been published, making it difficult to understand either the short or long term health impacts of this activity (51, 52, 53).
It is important to emphasise that all of the above studies are based on operations in the USA. Data relating to the UK is currently not available, mainly because the industry is not yet fully operational in the UK. Fracking in the UK is subject to different laws and conditions (see below) but this does not mean we can safely ignore data on public health studies from the USA; they should inform and strengthen UK policy and legislation in this area.

What is the current regulatory position on fracking in the UK?

Shale gas drilling is currently at the exploratory stage in the UK. However, the UK Government has stated that it believes fracking could provide the UK with an effective and efficient energy source and is encouraging exploration to determine its potential (54). In April 2015, Lancashire County Council will decide whether to grant permission for fracking to take place during explorations for shale gas at sites in Roseacre and Little Plumpton on the Fylde coast.

In January 2015 the Scottish government announced a moratorium on fracking (55) and plans to conduct a public health impact assessment and public consultation. The following month the Welsh Assembly expressed their opposition to fracking and will oppose any local authority that approves planning applications for fracking activities in Wales (56). The UK government recently voted against a moratorium on fracking.

The regulations concerning gas and oil drilling and water pollution in the UK are more stringent than those in the USA. Here, operators must submit details of plans to the EA in England, Natural Resources Wales, or the Scottish Environment Protection Agency before drilling proceeds. Environmental Impact Assessments may be required and EA permission is needed when fluids or chemicals are introduced into groundwater (57). Chemicals classified as hazardous (58) are currently not permitted for use in any fracking operations in the UK. Although this means some of the carcinogens used in fracking operations in the USA will not be permitted in the UK, many EDCs, not currently classified as hazardous, could be allowed (as discussed previously). Furthermore, the Medact report (59) highlighted a number of regulatory gaps pertaining to fracking operations in the UK and suggested there is an over-dependence on self-regulation. The report proposed a moratorium on fracking for at least five years whilst a comprehensive health and environmental impact assessment is undertaken.

Public Health England carried out a review of the risks to public health from exposure to emissions from fracking and concluded that: “the risks to public health from exposure to emissions from shale gas extractions are low if operations are properly run and regulated” (60). Other agencies and scientists have expressed concern about the sketchiness of the available information and the inability to rule out adverse environmental impacts and have advised against further exploration until more data becomes available (61, 62, 63, 64, 65, 66). In particular, there is concern that groundwater contamination might arise as a result of accidents, such as well casing or cement failures, or accidental wastewater spillages (67).

Doubts have been expressed as to whether the fracking process can be “well run and well regulated” (e.g. 68, 69). According to a report commissioned by the German Federal Environment Agency (70), “Assessment of selected fracking fluids used in unconventional gas reservoirs in Germany, along with the available information on the characteristics of flowback, have revealed that injected fluids, and fluids requiring disposal, can pose considerable hazard potentials”. The authors conclude that “currently missing knowledge and data prevent a profound assessment of the risks and their technical controllability in Germany”. Some EU countries, including France and Bulgaria, have imposed a ban on all fracking operations (71). In summary, most of the evidence concerning fracking comes from the USA where regulatory procedures are different to those in the EU. Currently, there is no direct evidence yet available that fracking leads to an increased incidence of breast cancer. However, the process does introduce chemicals into the environment which may lead to an increased risk.

* A permit was allowed in the UK for the use of Ethylene oxide at Balcombe but was apparently not used in practice.