SOUTH DOWNS NATIONAL PARKS PLANNING DEPT.
REF. APPLICATION No SDNP 13/05896/CM

APPLICATION BY CELTIQUE ENERGIE FOR TEMPORARY USE OF LAND FOR EXPLORATORY DRILLING, (SHALE GAS EXTRACTION) AT LINCHMERE, FERNHURST W. SUSSEX.

Hydrologist's Report attaching to Letter of 21st January 2014

1. GENERAL

The following comments address a number of concerns relating to the environmental implications of the application by Celtique Energie for planning permission to carry out exploratory drilling at Linchmere, approx. 1.5 km west of Fernhurst W. Sussex. If successful, it is expected that there will be further applications for testing and subsequent development of shale gas reserves by hydraulic fracturing (fracking). This involves high pressure injection, via deep boreholes with lateral extensions, of large volumes of water and sand together with a complex mix of chemicals, some of which are known to be toxic, to break up the shales and release the entrapped methane. There are certain features of the chosen location which raise questions relating to the likely, albeit indirect, impact of fracking operations on the integrity and quality of the river and shallow groundwater regimes of the Arun and Rother headwaters.

2. GEOLOGY.

The village of Fernhurst lies within the headwaters of the River Rother, near the western extremity of the Wealden Basin (Fig1), and gives its name to a valley feature marking the axis of a major anticline (Fig 2)

A borehole at this location would be expected to penetrate more than 300m of Weald Clay and approximately 500m of sandstones, shales, clays and limestones making up the Hastings Beds and Purbeck/Portland succession (Fig 3). These are underlain by 500m of Kimmeridge Clay, an Upper Jurassic formation comprising shales, mudstones and limestones; and this could mark the highest productive level for fracking operations. The developers will however be anxious to prove the potential of a second, lower sequence of around 300 – 400m of shales with subordinate limestones, (the 'Blue Lias' of the Dorset Coast). A parliamentary briefing note "Shale Gas Fracking" (SN/SC/6073 10th Sept. 2013) identifies both the Kimmeridge and Lias formations as potential shale gas sources.

The geological map of the region (Sheet 301) also shows 2 prominent faults, planes of structural weakness developed along fractures in the rock formations, which allow vertical or near-vertical slippage between adjacent blocks. These have a North- South trend ,the longer feature with a total length of approx 2Km. located 1 to 1.5 Km west of Fernhurst; both with vertical falls ("throws") of 15 to 20m. These are significant features, bearing in mind the recent history of fracking operations causing seismic tremors in areas such as the Fylde Peninsular, characterised by geological faults. And it is worth noting that high angle faults often feature in the crests of anticlines. Fig 4 shows the Fernhurst fault system to be part of a much larger structural complex extending throughout the western Weald, and it is worth noting the features mapped in the Wisborough Green / Kirdford area which has also been earmarked for shale gas extraction. It is also important to keep in mind that the faults as mapped are simply the visible surface expressions of a more extensive development at depth.

3. ENVIRONMENTAL IMPACT OF FRACKING OPERATIONS.

The fracking process, by virtue of its power to fragment shale beds, is also capable of breaking up other adjacent formations such as the sandstones, limestones and clays of the Jurassic and Wealden series. It could also re-activate the faults of the Fernhurst anticline and these could then become pathways for the upward flow of gases and fracking fluids, many of which are known to be toxic, into the overlying soils, water courses and shallow aquifers. This could have implications for any lawful water-dependant interests, including protected rights and licensed abstractions for private supplies or irrigation. The Paludina limestones of the Weald Clay for example are important local sources of shallow groundwater for domestic and agricultural use. There may also be implications for the 'National Park' status of this part of the headwaters. As evidence of this, we have the case studies by David Smythe, Emeritus Professor of Geophysics at Glasgow University, drawing on examples in USA, Europe, Australia and UK. In summary, he concludes:-

- Shale basins in the UK are typically heavily faulted (in contrast with USA experience)
- Such faults provide a fast track for migration of gases and fracking fluids into overlying aquifers and surface bodies of water. Faced with this risk, fracking has already been banned in France and Germany.
- The relevant regulating bodies in UK are insufficiently staffed and resourced to enforce compliance with the necessary protective measures (and the Environment Agency is now facing further staff cuts).
- Fracking for shale gas should therefore be banned in areas of complex faulted geology.

The Environment Agency has records of more than 40 water abstraction licences, corresponding to approximately 60 abstraction points, on rivers and springheads throughout the Weald Clay area west of Horsham (9 of these in the Fernhurst/Loxwood area and within the catchment of the R. Lod, a headwater tributary of the Western Rother) Most of the licences relate to public supply and agricultural use and could be at risk of contamination by emissions arising from fracking operations. In addition, there are a number of 'protected rights', relatively small abstractions (less than 20m³) for private domestic and agricultural use, drawn from springs, streams and shallow wells tapping sandstone and limestone lenses in the Weald Clay. The register is, we understand, held by W. Sussex CC but, for reasons of data protection they are unable to provide further details. This raises the question as to whether the authorities concerned are aware of the significance of this category and its vulnerability. Do they, for example, have the appropriate procedures in place for their protection in the event of a release of contaminants from any of the fracking sites?

There is also the possibility that the pressures applied in fracking could be sufficient to drive the gases and other more mobile fluid components into the Lower Greensand horizons flanking the Western Rother Valley. The Environment Agency in their Catchment Abstraction Management Strategy (CAMS) for the Arun and Western Streams (March 2013), identifies this as an important local aquifer supporting a "significant number" of abstractions in the Rother valley. The distance from the site to the aquifer at O. D level exceeds 4 Km but we should not too readily discount the possibility of contaminants migrating into the aquifer from one of the deeper laterals 'chasing' the shales or by diffusion via limestone and sandstone lenses or stringers within the Kimmeridge Clay.

The process of boreholes construction and installation of casing also carries the risk of fragmentation of the rock formations penetrated; and there are no techniques for grout-sealing within the damaged zones which would ensure complete protection against migration of contaminants. In any event, all steel casings, even those of the highest quality, have a limited life and many will begin to break-down within a few years.

4. ASSESSMENT OF ENVIRONMENTAL IMPACT.

CPRE is currently preparing its response to the consultation document, drafted by AMEC (Association of Mineral Exploration Companies), commissioned by the Dept. of Energy and Climate Change under the title "Strategic Environmental Assessment for Further Onshore Oil and Gas Licencing" Our contribution will address the special case of "Unconventional Development" with an emphasis on shale gas extraction by hydraulic fracturing. The study relates to the environmental impact of development beyond the current licensing round under both "Low" and "High" Effect scenarios; corresponding respectively to 50 new licences (4,000 Km² area) and 150 new licences (20,000 Km² area). Detailed assessments are presented under 12 "objectives":-

1. Biodiversity/Nature Conservation
2. Population/Economy
3. Health
4. Land Use, Geology and Soils
5. Water (Supply and Resources)
6. Flood Risk
7. Air
8. Climate Change
9. Waste
10. Resource Use
11. Cultural Heritage
12. Landscape

In summary, the consultants conclude that fracking operations at the exploration, development and production stages would have a negative (i.e. adverse) environmental effect for all but 2 of the 12 objectives: Flood Risk and Population. Of these, Flood Risk as 'uncertain' and Population as equal negative and positive on the assumption that a substantial financial contribution would be made to the community by the developer. But this seems to miss the point that the contribution amounts to no more than a compensation payment in recognition of the inevitable distress and disturbance to the affected communities. It cannot be construed as a net positive or beneficial outcome. It is perhaps significant that the report makes no reference to possible future reductions in energy charges to consumers, suggesting that the developers have now accepted the consensus of expert opinion to the contrary.

Faced with this substantially negative assessment; the authors are anxious to stress that the impact can be managed or minimised by competent monitoring and supervision by the relevant regulating authorities, including EA, NE and HSE. There are however operations that will require continuous (i.e. 24 hour) on- site monitoring and control to ensure full compliance with the licence/consent conditions; and the question arises as to how this can be achieved given that the Environment Agency, for example, is already under-staffed and under-resourced for its existing commitments, and is now facing further staff cuts. And however comprehensive and sophisticated the monitoring regime, there is no means by which any regulator can predict or anticipate the re-activation of a geological fault and the subsequent escape of contaminating fluids; and once triggered, there is no action that could be taken to halt the process or ameliorate its impact.

The recent announcement by Government of improved financial incentives for affected communities could perhaps be taken as recognition of the continuing public anxieties with respect to the environmental and social outcomes.

5. CONCLUSIONS AND RECOMMENDATIONS.

- We have concerns that hydraulic fracturing operations at this site could re-activate the high angle geological faults that have been mapped in the vicinity.

- This could in turn provide new pathways for the migration of gases and fracking fluids into higher levels and ultimately contaminate shallow aquifers and surface waters, some of which are tributary to the R. Rother which supports abstraction for public supply and agriculture.

- There is a body of international expert opinion which opposes fracking in geological fault zones.

- Conclusions from the recent study commissioned by DECC indicate that almost every aspect of the environmental and social impact of shale gas extraction by fracking would be to the detriment of the community.

- Furthermore, we are not persuaded that the statutory regulators are sufficiently staffed and resourced to ensure full compliance by the operators with the requisite planning conditions.

- We are of course aware that this application is for exploratory drilling and testing, but this stage also has provision for trial fracking and could therefore create a regime of disturbance, distress and expense for the local community.

- And if the premise is accepted that this site would, in any event, be unsuitable for fracking operations, then no purpose would be served by authorising an exploratory programme, the purpose of which would be to assess the potential of the site for shale gas extraction.

- To do otherwise, and grant planning permission, could therefore be construed as tacit approval for subsequent full development.

Graham Warren
Chartered Geologist (C Geol), BSc Geology, MSc Engineering & Hydrology
Fellow of the Geological Society (FGS)
Diploma of Imperial College (DIC)
Member of Institution of Civil Engineers (MICE)
Member of Institution of Water and Environmental Management (MCIWEM)

15/01/2014