RESTORATION OF LAND FOLLOWING ONSHORE OIL EXPLORATION ACTIVITIES IN ENGLAND[1]

by

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Abstract. Onshore oil exploration has only recently become widespread in England, often in rural areas of the country previously unaffected by mineral extraction or other developments. There is often considerable local apprehension, although there are strict environmental controls on visual intrusion, ecological disturbance, noise and traffic, and sites are chosen initially so as to cause minimal disturbance. Drilling sites are small (about 2.5 acres) and take about 6 weeks to prepare. Soil removal and site levelling is followed by the placement of a protective membrane and a layer of crushed stone. Plastic lined cutoff drainage ditches are provided and a concrete 'mud pit' prepared to receive drilling fluids and rock cuttings, which are subsequently removed from the site. The actual drilling lasts for about 6-8 weeks and if the borehole is dry the hole will be plugged with cement and made safe. All machinery, hard standing, membranes etc., will then be removed and the site restored to its original condition, followed by a 5 year aftercare programme. If hydrocarbons are found, a fresh planning permission will have to be sought for drilling appraisal boreholes under the same stringent environmental controls. Finally, if commercial quantities of hydrocarbons are discovered, further planning permissions for the necessary installations have to be obtained.

Introduction

England's first productive oilwell was drilled in 1918. Annual production from small fields in Eastern and Southern England has been of the order of 2 million barrels/annum, with one field, at Wytch Farm in Dorset producing about two-thirds the total. Onshore production is very small compared with North Sea oil but is attractive because of relatively low development and production costs. Also it has been recognised that many more areas of England may have commercially viable accumulations of hydrocarbons than was previously thought.

The Planning Framework

The Government has sought to encourage onshore exploration activities but in an orderly manner, subject to environmental and safety controls (Department of the Environment, 1985; Department of the Environment & Department of Energy, n.d.; Mineral Planning, 1985). Onshore oil and gas activities in Britain are now regulated by the Secretary of State for Energy through a system of licences under the Petroleum (Production) Act 1934 as amended by Section 18 of the Oil and Gas (Enterprise) Act of 1982. The Act vests the ownership of underground hydrocarbon reserves in the Crown and provides the Secretary of State with power to grant such persons or bodies as he sees fit licences to search, drill for and recover these hydrocarbons.

From 1972 to 1984 the licencing system consisted of two licences, for exploration and production respectively. The Exploration Licence allowed holders to search for petroleum (including seismic surveys) and to drill shallow boreholes (up to 350m). The licence covered an area of up to about 500km^2 and was valid for up to 6 years. A Production Licence conferred rights to drill deeper boreholes and to produce petroleum.

On the general grounds that this licencing regime did not adequately reflect the necessary sequence of exploration, appraisal and development a new threefold system was introduced in 1985. An Exploration Licence valid for 6 years covering a 10x10km block now allows seismic surveys and drilling of deep boreholes, subject to appropriate planning permission. If exploration is successful, on Appraisal Licence valid for 5 years can be applied for, allowing the testing and appraisal of a field, and a satisfactory development programme to be prepared, prior to application for the Development Licence. This is valid for 20 years (renewable).

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The licences do not confer automatic permission to carry out drilling, and planning permission has to be sought from the Mineral Planning Authority, which in England & Wales is the county council. Also agreement has to be reached with the landowner and occupier of a proposed site who have no rights in the hydrocarbons beneath their land. No standard agreement exists between owners/occupiers and exploration companies, and some of the earlier agreements to rent the necessary land and pay compensation for disturbance were not particularly favourable to the owner/occupier. The Country Landowners' Association has, however, recently issued an advisory memorandum, as a result of which harder bargains will doubtless be struck in the future.

Site Selection

A site of about 1ha (2.5 acres) is required for drilling purposes. Selection of sites has, of course to be based primarily on geological requirements, with the most desirable locations directly over promising structures. Deviated drilling techniques, however, do permit some flexibility in site selection.

The Mineral Planning Authority will wish to be assured that the environment impact is minimal. The exploration company therefore carries out a very careful assessment of a proposed site and presents the results in an Explanatory Statement accompanying the planning application. In effect this is an environmental impact statement, covering such subjects as local amenity, noise, visual intrusion, risks of pollution, affect on agriculture, affect on local flora and fauna, traffic, and site restoration if the well site proves to be dry.

At all stages in the preparation of a planning application there will be close liaison with local residents and other interested parties. Exploration companies work on the basis of full, open discussion with local communities concerning their proposals, and appropriate meetings and exhibitions are arranged. This aspect of onshore oil exploration is vital, especially in Southern England where the predominantly rural communities have had no previous experience of mineral exploration or extraction and are initially fearful that the peace, tranquillity and beauty of their environment may be ruined forever. When they are fully acquainted of the proposals, and of the strong commitment of the exploration company to minimise the effects of their activities, however, most potential opposition evaporates.

Granting of planning permission (with appeal to the Secretary of State for the Environment if necessary) will be subject to a number of conditions to ensure compliance with the original proposals and to minimise the environmental impact. Some of these are fairly standard, for example:

(a) the rig employed to drill the borehole shall be the Bolden 61 or such other type as may be agreed by the Mineral Planning Authority;

(b) except in the case of emergency, no commercial vehicle shall enter or leave the site except between the hours of 0700-1900 on Monday to Friday or 0700-1800 on Saturday;

imposed in the interests of noise and traffic respectively.

Others are much more site-specific, for example the two nature conservation requirements imposed recently on a site in Surrey:

(c) prior to the construction of the proposed access road hereby permitted the sedge Carex strigosa to be found growing at the entry to Highfield Copse shall be transplanted elsewhere within the copse to the satisfaction of the Mineral Planning Authority;

(d) prior to the construction of the proposed access road hereby permitted measures shall be taken to the satisfaction of the Mineral Planning Authority to minimise the disturbance to any remaining occupants of the badger set at the entry to Kiln Copse.

Site Restoration

Site preparation and the actual drilling take a matter of a few weeks only, so that adverse affects on the locality, if any, are relatively short-term. There are fears, however, that in the longer term, the borehole site will be a semi-permanent scar on the landscape. Accordingly the exploration companies, Mineral Planning Authorities and landowners pay particular attention to the subsequent restoration of the borehole, site if, as in 85-90% of the cases, it proves to be a 'dry' site. It is standard practice for a detailed restoration and aftercare scheme to be submitted either with the planning application or soon thereafter. Experience with sites restored so far has indicated that, provided such schemes are carefully folllowed, then restoration of the site back to its original condition can be achieved. Mostly restoration is of agricultural land back to agricultural land, but some sites are due to be restored to woodland.

The basis of the restoration scheme is an initial soil survey of the site on which the amounts and kinds of soil resources to be stripped, stored and re-used can be evaluated, and methods of soil handling devised. Topsoil (the agricultural plough layer) is always separately removed, followed as a separate operation by the subsoil where a discrete layer of this can be identified. Sometimes, however, on sites overlying chalk or clay a genuine subsoil worth conserving for restoration is not present and only topsoil is saved. Storage locations are designated on the site plans, and may be situated so as to serve as visual or acoustic screens.

Particular attention is paid to minimise soil damage during stripping. This is largely dependent on the soil moisture conditions, since it is known that most damage occurs if the soil is moved when it is too wet, especially if traffic over the soils, causing compaction, is involved. Thus earthscrapers are used only if dry conditions can be ensured, which in practice means they can be used only during the summer months. If the site has to be prepared at other times in the year then potential soil damage is reduced by using tracked bulldozers to 'blade' the soils to heaps on the margin or lifting soils by hydraulic 'back-acter' into dump-trucks.

Several methods have been suggested for deciding which machines can be safely used. Those based on rainfall criteria (devised for experiments on restoration of sand and gravel quarries) are of dubious validity, while actual measurements of soil moisture linked to a pre-determined moisture/compaction relationship are cumbersome. The most satisfactory method has been to use the concept of the Lower Plastic Limit of the soil, easily determined immediately prior to the start of earthmoving operations. Earthscrapers are permitted if the soil is drier than the Lower Plastic Limit, but if it is wetter then only the dump-truck/back-acter, or bulldozer methods are permitted.

After soil removal, any site levelling which is required is carried out as a 'cut and fill' operation. A protective membrane of 'Terram' or equivalent is then laid, followed by a layer of crushed stone. A plastic-lined cut-off ditch to an oil interceptor is provided, and run-off collected in it during drilling operations is tankered off site. Beyond the ditch is a continuous bund to provide containment of oil or water spillages in excess of the capacity of the ditch. Separate ditches surround the site as necessary to accept runoff from adjacent land or to intercept the outfalls from any field underdrainage system which is encountered.

Within the drill site, a well cellar and concrete raft for the drilling rig will be constructed out of concrete, and storage pits dug for drilling fluids and rock cuttings. Suitable temporary buildings are installed, the drill rig is erected and the drilling begins.

When the drilling is complete, and if the well proves dry, then site restoration can take place. The borehole is plugged with cement at a number of levels and made safe, and all the site hardware, including the crushed stone hardstanding and linings are removed. The landowner may choose to retain certain elements of the site such as all or part of the access roadway, subject to the approval of the planning authority, but usually all traces of the drilling activities are removed.

The site is then regraded to original contours (less the depths of soils to be returned) and a soil profile reconstituted which is similar to that which previously existed. The care and attention to minimising soil damage which will have been displayed during the site stripping is now even more important. Fortunately, soil reinstatement can usually be scheduled so as to take advantage of dry summer conditions and so earthscrapers are normally used. These inevitably cause some soil compaction and so there is an accompanying programme of soil loosening by drawing a tined implement or 'subsoiler' through the reinstated soils to disrupt any compact layers. An underdrainage system will then be installed, integrated as necessary with the severed underdrainage system of the rest of the field.

Finally, a five year aftercare cropping programme will be begun according to the Town & Country Planning (Minerals) Act 1981, (Department of the Environment, 1982) designed to help the soil recover from the disruptions it has undergone. Cropping regimes based on grass or arable crops can be implemented depending on the needs of the landowner/occupier.

Appraisal and Development Stages

If hydrocarbons are found in the exploration stage, then the site is not immediately restored since it may be used for appraisal or further development of the discovery. Each of these stages, however, is subject to fresh planning permissions with the same stringent requirements as for the exploration borehole sites. Eventually 'appraisal-only' sites will be restored to their original conditions but if commercial quantities of hydrocarbons are proved, then they may be needed as part of the development of the field.

The development stage can only be undertaken if a satisfactory programme is presented covering all aspects, including the possible effect on the environment and the necessary planning permissions are obtained. The planning permissions will have such conditions and requirements as the planning authority deems necessary and it is likely that local liaison committees will be set up to ensure that operations run smoothly and adverse environmental effects are kept to the minimum.

Where no hydrocarbons are found, then, within a very short time the exploration site will be returned to its original condition and all, or virtually all traces of the drilling will have disappeared. On sites so far restored the only way of recognising them is the excellent field gateway which the farmer usually chooses to retain. Perhaps the finishing touch ought to be to replace these with the more traditional patched up wooden gate and muddy field entrance typical of the fields on which no onshore oil exploration has taken place.

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