Summary

The Department for the Economy (DfE) has received an application for a Petroleum Licence covering a substantial area to the west, south and east of Lough Neagh. This area overlies part of a geological basin, with deeply buried sedimentary rocks that are likely to include potential porous reservoir rocks, reservoir sealing rocks and hydrocarbon source rocks. The underlying geology means that there may potential for oil to be present.

This document provides you with detailed information about the geology, the history of exploration in this area and the applicant’s proposed Work Programme.

Location and Geology

The application area overlies part of the Lough Neagh sedimentary basin which is known to contain rocks of Carboniferous, Permian, Triassic, Lower Jurassic, Upper Cretaceous, Palaeocene and Oligocene age (Figure 1). In the deepest parts of the basin there are successions of sedimentary rocks likely to be in excess of 4.5 kilometres thick. Depths to the non-reservoir, older ‘basement’ rocks below these sediments reduces towards the margins of the basin. Several deep boreholes have previously been drilled in these more marginal locations and much of the information about the geological succession comes from the results of this drilling.

In terms of petroleum geology the Carboniferous strata may contain coal seams and organic-rich shales (potential hydrocarbon source rocks), sandstones (potential reservoir rocks) and mudrocks (potential caprocks or seals); the Permian has sandstones (reservoirs) and mudrocks (seals) and the Triassic has sandstones (reservoirs) and mudrocks (seals). Analysis of the potential Carboniferous source rocks suggest that oil should be the prevalent hydrocarbon in the basin.

Figure 1 below shows the Geological succession expected in the subsurface based on information from deep exploration wells and rock units exposed at surface. The rock units are shown in sequence with cumulative stratigraphical depth based on the thicknesses proven in boreholes. Many areas have not been drilled and the maximum thicknesses of the rock units are predicted to be greater in the deepest parts of the Lough Neagh sedimentary basin. Colour in the stratigraphic column corresponds to units recognisable on seismic sections in Figure 2.
Available seismic lines indicate trap structures either in the form of tilted fault blocks or anticlinal structures at depths of 1-2.5 kilometres (see Figure 2). Sandstone reservoir quality studies indicate that porous and permeable reservoirs exist at depth and would lend
themselves to conventional oil or gas extraction processes if they are filled with hydrocarbons.

Figure 2  Interpreted Seismic Sections

Figure 2 shows interpreted seismic sections across structures typical of the Lough Neagh Basin. The numbers on left hand side of sections relate to seismic two-way travel times (TWT), where 1.0 second TWT approximates to 3 kilometres depth.

Previous exploration in the area

The area previously formed part of a Petroleum Licence, PL7/87, which covered most of the Lough Neagh sedimentary basin. The Licensee was given 12 months to carry out a preliminary evaluation of the area before deciding which part of the basin they wished to explore in greater detail. In the end the company involved applied for an area over the northern part of the Lough Neagh basin which formed PL9/88 and led to the acquisition of 2D seismic reflection survey data and the drilling of two exploration wells (Annaghmore No. 1 and Ballynamullan No. 1) south of Toomebridge.
In the area currently applied for there is a limited amount of 2D seismic reflection data collected from surveys commissioned by DfE in 1981 and 1983, as well as borehole, geophysical and geochemical data in the Geological Survey Northern Ireland (GSNI) archives. The area west of Lough Neagh contains the East Tyrone coalfield and it is possible that the Carboniferous coals and other organic-rich mudrocks may be buried deep enough elsewhere in the basin to have become thermally mature gas or oil source rocks.

**Proposed Work Programme**

The applicant proposes using geochemical surveys as an initial reconnaissance tool to identify areas suitable for further detailed, and more expensive, exploration methods. It has long been recognised that oil and gas reservoirs may seep into overlying rock horizons and show up as microscopic traces of hydrocarbons or as characteristic geochemical signatures in the soil. In the Lough Neagh Basin there are no obvious signs of hydrocarbons seepage at the surface but oil staining and gas traces in previous exploration wells and geochemical surveys in the 1980’s have revealed evidence of oil and natural gas. The applicant proposes to carry out new soil sampling and use updated analytical techniques to pinpoint any indicators of subsurface oil or gas. The applicant also proposes to survey across known fracture zones, fault and significant geological boundaries.

Following the initial assessment, the proposed Work Programme would then focus on the most promising areas for follow-up geochemistry and geophysical surveys. Both passive electromagnetic (EM) and seismic reflection methods are proposed to image the subsurface geological structures in these areas. These relatively non-invasive geophysical methods are commonly used exploration tools in the pre-drilling phase. The objective of these surveys is to understand the structure of the rocks at depth and to identify one or more areas where oil or gas might be trapped in the sandstone reservoir rocks. If analysis of such structures resulted in the applicant identifying one or more drilling targets then they would inform DfE of their intention to drill one or more exploration wells in the second part of their Work Programme.

Should the applicant wish to proceed to drill one or more sites they would need to plan and design the well programme, obtain access to a suitable drilling location and obtain all the necessary permits (planning, environmental, operational etc) and comply with the relevant regulations before work could commence. The applicant has indicated that, at this stage, they would favour the use of slimhole drilling techniques to minimise the footprint and operational impact of an exploration well.

**Summary of proposed Work Programme**

**Years 1 – 3 (Part I)**

- Analysis and modelling of existing exploration data and the results of Tellus airborne geophysics and ground geochemical surveys.
- Reconnaissance geochemical surveys over whole Licence area.
- Geophysical surveys;
  - EM surveys,
  - 2D seismic acquisition 300 – 450 line kms.
- Further modelling and analysis of new data.
Before the end of year three the company must decide whether to proceed with the drilling programme or to relinquish the Licence. This is known as “Drill or Drop.” The applicant will then inform DfE of its intention to proceed to Part II of the Work Programme or relinquish the Licence.

**Years 4 – 5 (Part II)**

- Plan and design the exploration well(s).
- Application to drill (planning, technical, environmental).
- Subject to obtaining all necessary permits, drill exploration well.
- Analyse results.
- Plug and abandon well, restore wells site or, if successful, complete well for possible future production

Depending on the results from the exploration well, the applicant would inform DfE of their intention to proceed to the Second Term of the Licence, to appraise the drilling results, or relinquish the Licence.

In any event the applicant would be required by DfE to relinquish at least 50% of the Licence area. This is outlined in the following legislation-