

## 8 ELECTROMAGNETIC FIELDS (EM-FIELDS)

### 8.1 INTRODUCTION

COWRIE EM-Fields studies have previously been undertaken by CMACS Ltd to investigate the modelling and measurement of the E (electric) and B (magnetic) emission from a typical offshore subsea cable. A desk and laboratory study was completed in 2003 and in 2005 a review of existing information on the impacts of EM-Fields took place including proposals for strategies on future research and monitoring. The key findings of the COWRIE 1 and COWRIE 1.5 reports are provided in the FEPA Report for the period 2003/4 (June 2005).

A summary of the 2005 FEPA report EM-Fields chapter is set out below.

The COWRIE 1 report concluded that the current state of knowledge regarding the EM-Fields emitted by undersea power cables is too variable and inconclusive to make an informed assessment of any possible environmental impact of EM-Fields in the range of values likely to be detected by organisms sensitive to electric and magnetic fields.

As stated in the 2003/4 FEPA Report, the COWRIE report attempted to define the likely range of sensitivity of elasmobranchs to E-fields. The following summarises the present state of knowledge; however, it must be stressed that there is very little rigorous, experimentally based evidence to support such generalisations at present.

Elasmobranch sensitivity:	0.5 – 1000 $\mu\text{V/m}$
Potential range of attraction:	0.5 – 100 $\mu\text{V/m}$
Potential range of repulsion:	> 100 $\mu\text{V/m}$

In relation to North Hoyle, the modelling undertaken for the COWRIE EM-Fields report is relevant. This predicted that the E-field on the sea bed adjacent to a 1m buried industry standard three-core power cable would be 91  $\mu\text{V/m}$ . This value therefore lies on the boundary of emissions that are expected to attract and those that repel elasmobranchs.

### 8.2 LATEST PROGRESS

COWRIE has recently produced a consultation document named “COWRIE 2: Electromagnetic Fields (EMF) Phase 2. Stage 1 Project Plan.” report details the proposed research programme to meet the objectives of the first stage of COWRIE Phase 2.0.

The Environmental Technical Working Group (ETWG) of COWRIE has identified as priority research an experimental mesocosm study of the response of electromagnetic sensitive organisms to controlled electromagnetic fields (EMF) with the characteristics and magnitude of EMF associated with offshore wind farm power cables.

The research is to be addressed through COWRIE Phase 2.0 which has the specific aim to definitively determine whether electroreceptive elasmobranchs respond to anthropogenic EMFs of the type emitted by offshore wind farm sub-sea cables.

Four main components of the research project were considered:

- Simulation of wind farm type EM-Fields
- Design, construction and siting of mesocosms
- Study species considerations
- Home Office licensing

Simulations based on up to date research has been carried out previously (COWRIE 1 and 1.5). A number of options for a mesocosm experiment are outlined in the 2006 consultation document with respective risks and costs outlined.

Once a suitable mesocosm experiment and site location have been chosen the mesocosms will be constructed on site and assessed over a period of two to three weeks for potential problems such as movement, gaps, effects of tidal regime and fouling. In addition, daily baseline measurements of tidal range, tidal direction, background E field, Background B field will be taken.

The EM-Fields production equipment will also be introduced and tested. The equipment will be placed down the middle of the mesocosm. This will ensure that there is a sector of the mesocosm that fish can move to if they need to avoid the area of the cable when energised. This aspect will be included in the application to the Home Office.

An EM-Fields sensor and datalogger will then be used to characterise the EM-Fields at different states of the tide and with different voltages and currents.

The project specification names two species, *Raja clavata* (thornback ray) and *Scyliorhinus canicula* (lesser spotted dogfish/smallspotted catshark), to be studied within the mesocosm experiment, although the final choice of species to be tested will be subject to agreement with COWRIE.

Based on previous experiments in laboratory conditions it is anticipated some 75% of dogfish would respond to E fields over the course of the study. From the limited studies on ray behavior to E fields this figure is likely to be greater owing to their greater sensitivity to E fields. The mesocosm study will also record movements of the fish during the night which is the most active time for elasmobranchs.

Statistical power analysis to estimate sample size for a study of behavioral response to E fields in the laboratory gives a value of between 46 and 58 individuals with 80% power. The number of fish of each species proposed is 60.

Home Office Inspectors have determined that a license would be required for the study under the Animals Scientific Procedures Act 1984 and is related to specific focus on the tagging of fish. The exposure to the EM-Fields is not deemed to be harmful or detrimental to the elasmobranchs, however as the tagging is a necessary part of the wider study the whole project will require a full application to be written and submitted.

### 8.3 SUMMARY

A further COWRIE study (Stage 2) is expected to be commissioned that will investigate the specific biological significance for electrosensitive fish species of EM-Fields. This study will focus on all effects of EM-Fields on elasmobranch (adverse, neutral or positive) objectively and shall comprise experimental behavioural investigations of fish response to underwater power cables. Findings of this study will be related to the North Hoyle site as they become available. Therefore no site specific monitoring will be proposed for North Hoyle. In addition, results of the SEAS study at Rødsand, Denmark should become available within the period of FEPA monitoring for North Hoyle.

Following the assessment of the significance of any impacts the priorities for further research will be laid out if deemed appropriate. The benefit to the wind farm industry of such research will also be considered. The aim would be to provide COWRIE and the wider marine renewables industry with a specific set of research priorities and a statement of their benefits and limitations.

NWP Offshore Ltd proposes that the findings of this continued COWRIE research and any subsequent monitoring protocol forms the basis of any future monitoring strategy imposed under the conditions of the FEPA Licence, if such research suggests that deleterious impacts may result on electro-sensitive species. It is felt that the COWRIE research is currently addressing this area and as such no site specific monitoring is proposed for North Hoyle.