APPLICATION FOR THE CONSENT TO CONDUCT MARINE SCIENTIFIC RESEARCH IN AREAS UNDER NATIONAL JURISDICTION OF THE UNITED KINGDOM

Date: 20.01.2012

1. General information

1.1 Cruise name and/or number: CE12010

1.2 **Sponsoring institution:**

Name: Marine Institute

Address: Rinville
Oranmore
Co. Galway
Ireland

Name of Chief Executive: Dr. Peter Heffernan

1.3 **Scientist in charge of the project:**

Name: Dr. Peter Linke

Address: GEOMAR | Helmholtz Centre for Ocean Research Kiel
Wischhofstr. 1-3, D-24148 Kiel, Germany

Telephone: +49 431 600-2115
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1.4 **Scientist(s) from UNITED KINGDOM involved in the planning of the project**

Name(s): Dr. Rachael H. James (NOCS), Dr. Alan Judd, Dr. David Long (BGS)
Address: National Oceanography Centre, Southampton, University of Southampton
Waterfront Campus, European Way, Southampton SO14 3ZH

1.5 Submitting officer:

Name and address:
Rinville
Oranmore
Co. Galway

Country: Ireland

Telephone: 00 353 91 387200

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2. Description of project (Attach additional pages as necessary)

2.1 Nature of objectives of the project:

The proposed research cruise will be an integral part of the field activities within the EU project ECO2. ECO2 brings together the leading experts of three large scientific communities in Europe: ocean acidification, CCS, and natural seepage, but ECO2 also involves colleagues from the legal, economic, and social sciences. Ship time is provided by the EU-project EUROFLEETS.

On the cruise we wish to investigate the Sleipner CO_2 storage site operated by Statoil and the natural shallow water CO_2 seep offshore Juist Island in the Southern German North Sea. On the transit between these 2 major working areas are the prominent gas (methane) seep area Tommeliten and the blowout crater in the UK sector of the North Sea, which will be explored as reference sites. We intend to quantify fluxes of key chemical parameters and potentially toxic metals and study the mechanisms determining the migration of CO_2, CH_4, and formation waters through the sedimentary overburden by a variety of novel monitoring techniques. Included in the study are investigations of seawater chemistry together with the near-field dispersion processes as key input parameters for our environmental studies and numerical model simulations. We will also carry out the assessment of the distribution of sensitive megafauna and will use fingerprinting of microbial community diversity as a key indicator of environmental impacts.

2.2 Relevant previous or future research cruises:

Detailed surveys of North Sea pockmarks and seepages have been undertaken during cruises with the vessels Skandi Ocean in 1983, Lador in 1985 (Hovland & Judd 1988), Challenger in 1991 (Dando et al. 1994) and a number of cruises of the Geological and the Hydrographic Services Norway during 1991 and 1995 (e.g. Rise et al., 1999). More recent research cruises have been conducted (R/V Heincke HE-169, and HE-180; RV Alkor 259/290) to study gas and fluid emissions in the Norwegian EEZ (Tommeliten and Gullfaks; Niemann et al., 2005; Schneider v. Deimling et al., 2007, 2010, 2011) and in the EEZ of the UK (Fladen Ground, blow out und UK pock marks, Hovland & Judd, 1988, Judd & Hovland, 2007). In 2008 and 2009, two cruises to seep sites in the Southern German North Sea were conducted (Alkor 328; Celtic Explorer 0913) to perform tests of new monitoring equipment in the frame work of an industry-funded project (Linke et al., 2009, 2010). The sites were selected after the evaluation of deep and shallow seismic data in search for gas/fluid migration pathways in the sediment. Over a natural salt dome 30 km north of the East Frisian Island Juist a natural CO_2 seep was discovered with levels ~10 – 20 times over background (McGinnis et al., 2011). In 2011, the first monitoring cruise (Alkor 374) in the frame work of the ECO2 project was conducted at the Sleipner storage complex and the blow out crater using successfully the same monitoring techniques (Linke et al., 2011) which will be used on cruise CE12010.

2.3 Previously published research data relating to the project:

Chadwick, RA, P Zweigel, U Gregersen, GA Kirby, S Holloway, PN Johannessen (2004) Geological reservoir characterization of a CO2 storage site: The Utsira Sand, Sleipner, northern North Sea. Energy 29: 1371-1381.

Hovland M & A Judd (1988) Seabed Pockmarks and Seepages. Graham and Trotman, London, 293 pages.

Judd A., Hovland M. (2007) Seabed Fluid Flow – The Impact on Geology, Biology, and the Marine Environment. Cambridge University Press, Cambridge, UK, 475 pages.

Linke, P. et al. (2009) Fluid- and gas seepage in the South German North Sea (SDNS). Third Progress Report, IFM-GEOMAR, Kiel, 110 pages.

Linke, P., Schmidt, M., and Onboard Scientific Party (2010) Celtic Explorer 0913 Cruise Report. IFM-GEOMAR Report 36, Kiel, 90 pages.

Linke, P. and AL374 cruise participants (2011) Cruise Report AL374, IFM-GEOMAR Report 51, Kiel, 55 pages.

McGinnis DF, Schmidt M, DelSontro T, Themann S, Rovelli L, Reitz A, Linke P (2011) Discovery of a natural CO2 seep in the German North Sea: Implications for shallow dissolved gas and seep detection. Journal of Geophysical Research, 116, C03013, doi:10.1029/2010JC006557

Niemann H, Elvert M, Hovland M, Orcutt B, Judd A, Suck I, Gutt J, Joye S, Damm E, Finster K, Boetius A, (2005). Methane emission and consumption at a North Sea gas seep (Tommeliten area). Biogeosciences, 2, 335–351.

Rise L et al (1999) Sea-bed pockmarks related to fluid migration from Mesozoic bedrock strata in the Skagerrak offshore of Norway. Marine and Petroleum Geology 16: 619-631.

Schneider von Deimling, J., Brockhoff, J., Greinert, J. (2007) Flare imaging with multibeam sonar systems: data processing for seep bubble detection Geochemistry, Geophysics, Geosystems, 8 (6). Q06004. DOI 10.1029/2007GC001577.

Schneider v Deimling J, Greinert J, Chapman NR, Rabbel W, Linke P (2010) Acoustic imaging of natural gas seepage in the North Sea: Sensing bubbles under control of variable currents. Limnology and Oceanography: Methods 8:155-171, doi:10.4319/lom.2010.8.155

Schneider v Deimling J, Rehder G, Greinert J, McGinnis DF, Boetius A, Linke P (2011) Quantification of seep-related methane gas emissions at Tommeliten, North Sea. Continental Shelf Research 31: 867-878, doi:10.1016/j.csr.2011.02.012

Wegener G, Shovitri M, Knittel K, Niemann H, Hovland M, and Boetius A (2008) Biogeochemical processes and microbial diversity of the Gullfaks and Tommeliten methane seeps (Northern North Sea). Biogeosciences 5, 1127–1144.

3. Methods and means to be used

3.1 Particulars of vessel

Name: Celtic Explorer
Nationality: Irish

Owner: Marine Institute

Overall length: 65.5m
Maximum draught: 5.7m
Net tonnage: 727
Propulsion: 2 x 1530 KW, 1000Rpm, 1 x 1020 KW, 1000 Rpm
Cruising speed: 10 Kts
Call sign: EI GB
Method and capability of communication –
Vsat Satellite Broadband
Imarsat –c
HF
VHF
Mini –M

Name of master: Antony Hobin/Denis Rowan
Number of crew: 15
Number of scientists on board: 19

3.2 Aircraft or other craft to be used in the project: N

3.3 Particulars of methods and scientific instruments

Types of samples and data	Methods to be used	Instruments to be used
Acoustic data	Single, multibeam echo-sounders	Kongsberg Simrad EK60 Kongsberg Simrad EM1002
Video data	On-line video recording	ROV Kiel6000
Water, dissolved gases	Winckler titration, gas chromatography, membrane inlet mass spectrometry (MIMS)	Pump CTD/Rosette water sampler connected to a MIMS on board the vessel
Sediments, pore water	Push corer, pore water extraction	ROV Kiel6000

3.4 Indicate whether harmful substances will be used: N

3.5 Indicate whether drilling will be carried out: N

3.6 Indicate whether explosives will be used N

4. Installations and equipment

Details of installations and equipment (dates of laying, servicing, recovery, exact locations and depth):

N/A

5. Geographical areas

5.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude):

We intend to revisit the abandoned well site 22/4b (57°55’ N / 01°38’ E) in the EEZ of the UK about 110 nm off Peterhead.
Coordinates of the requested working area (Blowout):

57°45.8’N 1°24.8’E
57°45.8’N 1°55.2’E
58°02.1’N 1°55.2’E
58°02.1’N 1°24.8’E

Further details are presented on the map (see below). Intended working areas of the entire cruise are marked by red dots.

5.2 Attach chart(s) at an appropriate scale showing the geographical areas of the intended work and, as far as practicable, the positions of intended stations, the tracks of survey lines, and the locations of installations and equipment.

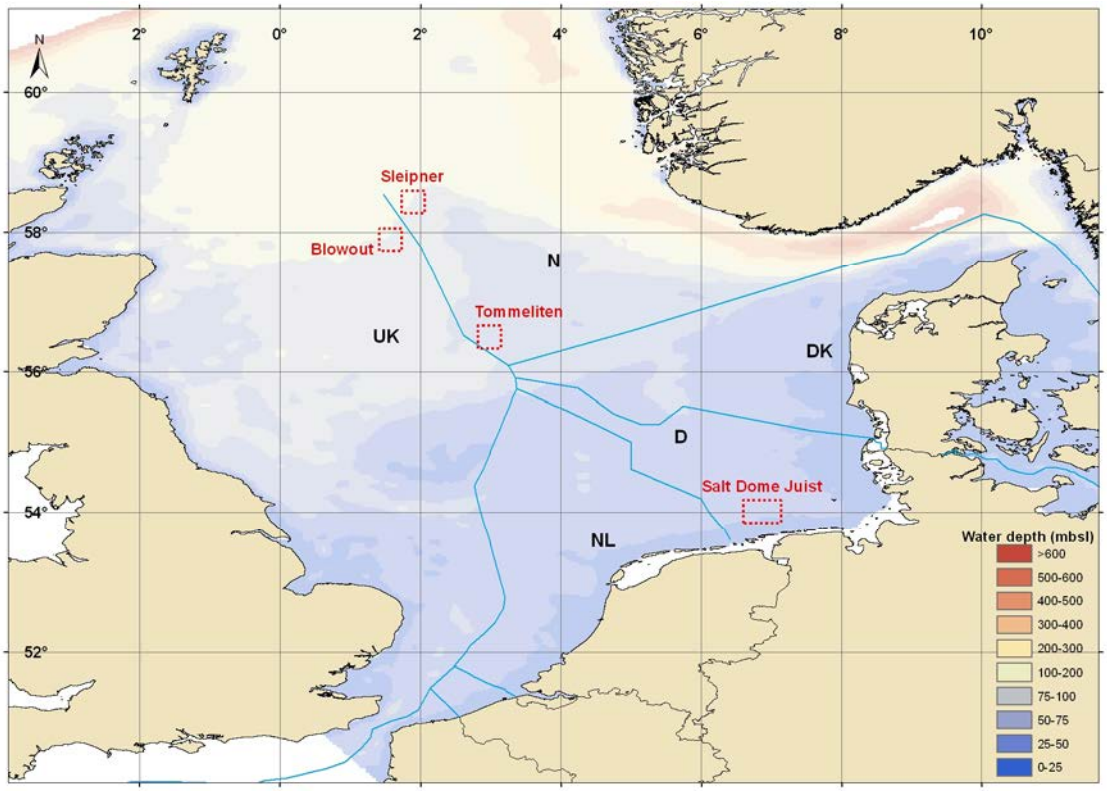

Chart of working areas during cruise CE12010. Requested working area in the EEZ of the UK is the abandoned well site 22/4b. EEZ borders of European countries are plotted as blue lines.

6. Dates

6.1 Expected dates of first entry into final departure from research area of the research vessel:

24.07.2012 – 03.08.2012

6.2 Indicate if multiple entry is expected: **Yes**

7. Port calls

7.1 Dates and names of intended ports of calls in UNITED KINGDOM:

None

7.2 Any special logistical at ports of call:

N /A

7.3 Names/ Address / Telephone of shipping agent (if available)

8. Participation

8.1 Extent to which UNITED KINGDOM will be enabled to participate to be represented in research project:

Partners from the UK are involved and participate in the ECO2-research project.

8.2 Proposed dates and ports for embarkation / disembarkation:

20.07.2012 Bremerhaven / 06.08.2012 Bremerhaven, Germany

9. Access to data, samples and research results

9.1 Expected dates of submission to UNITED KINGDOM preliminary reports which should include the expected dates of submission of the final results:

A preliminary report will be available 6 weeks after the cruise; the final cruise report will be available 6 month after the cruise.

9.2 Proposed means for access by UNITED KINGDOM to data and samples:

Post-cruise data archival will be hosted by the information system PANGAEA at the World Data Center for Marine Environmental Sciences (WDC-MARE), which is operated on a long-term base by the Alfred-Wegener Institute (AWI) and the MARUM. The information system PANGAEA is operated as an Open Access library aimed at archiving, publishing and distributing geo-referenced data from earth system research. The system guarantees long-term availability of its content through a commitment of the operating institutions. Most of the data are freely available and can be used by referencing the related publication or the dataset citation. Each dataset can be identified, shared, published and cited by using a Digital Object Identifier (DOI). Data are archived as supplements to publications or as citable data collections. Citations are available through the portal of the German National Library of Science and Technology. Archiving follows the Recommendations of the Commission on Professional Self Regulation in Science for safeguarding good scientific practice. Authors submitting data to the Pangaea data library for archiving agree that all data are provided under a creative commons license.

9.3 Proposed means to provide UNITED KINGDOM with assessment of data, samples and research results or provide assistance in their assessment or interpretation:

The ship's station list and all metadata from sampling and observations will be stored in the WDC MARE data base PANGAEA (http://www.pangaea.de/), including ship tracks, within 6 months after the expedition. Further scientific data retrieved from observations, measurements and home-based data analyses will also be submitted to PANGAEA either upon publication, or with password protection by the individual P.I.s as soon as the data are available and quality-assessed. This includes oceanographic, physical, geological, chemical and biological data, for most of which parameters are already defined in PANGAEA.
For benthic images we will establish a video and photo database, which is presently under construction at GEOMAR. As many of the retrieved data will be needed for modeling and budgeting, we expect a constant flow of data between the multidisciplinary participants.

9.4 Proposed means of making research results internationally available:

Cruise Report will be published at a GEOMAR-Report and available by download from the institute's homepage. Results will be published in peer-reviewed scientific papers.

10. Scientific Equipment

COMPLETE THE FOLLOWING TABLE-
SEPARATE PAGE FOR EACH COSTAL STATE:

INDICATE YES OR NO

LIST SCIENTIFIC WORK BY FUNCTION	Water column including sediment sampling of the Seabed	Fisheries research within fishing limits	Research concerning the natural resources of the continental shelf or its physical characteris-tics	DISTANCE FROM COAST		
				Within 12nms	Between 12-200nms	(Continental shelf work only) Beyond 200nm but within the continental margin
ECHO SOUNDING	Yes	No	Yes	No	Yes	No
U/W TV	Yes	No	Yes	No	Yes	No
WATER SAMPLING	Yes	No	Yes	No	Yes	No
SEABED SAMPLING	Yes	No	Yes	No	Yes	No

(On behalf of the Principle Scientist)

Dated ----------