



Department of Communications, Energy and Natural Resources
An Roinn Cumarsáide, Fuinnimh agus Acmhainní Nádurtha



Appendix 1

Terms of Reference for EPA/DCENR/NIEA Research Programme related to the Environmental Impacts of Unconventional Gas Exploration & Extraction (UGEE)

This invitation to tender is being administered by the Environmental Protection Agency, on behalf of the Department of Environment, Community and Local Government, the Department of Communications, Energy and Natural Resources and the Northern Ireland Environment Agency



Terms of Reference for an EPA/DCENR/NIEA Research Programme on Environmental Impacts of Unconventional Gas Exploration & Extraction (UGEE).

This document sets out the Terms of Reference for an EPA/DCENR/NIEA Research Programme on Environmental Impacts of Unconventional Gas Exploration & Extraction (UGEE).

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TERMS of REFERENCE for an EPA/DCENR/NIEA Research Programme on Environmental Impacts of Unconventional Gas Exploration & Extraction (UGEE)

1. Background - Unconventional Gas Exploration & Extraction

In the context of the proposed Research Programme outlined in this document, Unconventional Gas Exploration & Extraction (UGEE) refers both to the use and full life-cycle of high volume hydraulic fracturing (fracking) of low permeability rock to permit the extraction of natural gas on a commercial scale from unconventional sources such as shale gas deposits, coal seams and tight sandstones. The environmental impacts of UGEE projects/operations to be considered are those arising from UGEE projects/operations in their totality, not just from fracking activities. All stages of UGEE projects/operations must be considered (i.e. including construction, commissioning, operation, decommissioning and aftercare, as well as off-site and other developments).

Hydraulic fracturing, or 'fracking', is a method used by drilling engineers to stimulate or improve fluid flow from rocks in the subsurface. In brief, the technique involves pumping a water-rich fluid into a borehole until the fluid pressure at depth causes the rock to fracture. The pumped fluid contains small particles known as proppant (often quartz-rich sand) which serve to prop open the fractures. After the rock has been fractured, the pressure in the well is dropped and the water, containing released natural gas, flows back to the well head at the surface. The boreholes themselves are often deviated away from the vertical, into sub-horizontal orientations, to ensure better and more efficient coverage of the targeted shale gas reservoir. The fracking fluid also contains chemical additives such as acid (to help initiate fractures), corrosion and scale inhibitors (to protect the borehole lining) and gelling agents (to alter the fluid viscosity¹).

The European Commission issued a Guidance Note² in 2011 confirming that the exploration and exploitation of unconventional hydrocarbons has to comply with the requirements of EU legislation. A comprehensive EU legislative framework on environmental protection and non-discriminatory access to hydrocarbon resources is already in place and applies to all hydrocarbons, conventional and unconventional, from planning to the aftercare of sites following exploitation.

The Commission Guidance Note states that exploration and exploitation of unconventional hydrocarbons fall within the scope of the Environmental Impact Assessment (EIA) Directive (2011/92/EU), which plays a central role in the assessment of the environmental effects of proposed UGEE projects/ operations before development consent can be granted. The Directive ensures that the environmental implications of projects are taken into account in the permitting process, before the final decisions are made. Any application for an exploration licence that includes hydraulic fracturing would be subject to environmental assessment in accordance with the requirements of the EIA Directive (Refer to [Section 4.2.3](#)). Such an assessment would entail consideration of the potential impacts of the project on population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors. The specific requirements of the Directive are outlined in more detail in [Section 4.2.3](#). Examples of other key EU environmental legislation likely to impact on the assessment of unconventional hydrocarbon projects are provided in [Annex 1](#).

¹ http://www.epa.ie/downloads/pubs/research/sss/UniAberdeen_FrackingReport.pdf

² http://ec.europa.eu/environment/integration/energy/uff_news_en.htm



In addition, the Commission published, in September 2013, an assessment of the use of certain substances in hydraulic fracturing of shale gas reservoirs under REACH³, as well as a study⁴ on the regulatory provisions governing key aspects of unconventional gas development in eight Member States (study conducted on the basis of information collected between October 2012 and April 2013).

With the adoption of its Work Programme for 2014 on the 23rd October 2013, the European Commission puts a very strong focus on results. As part of the Annex II of the EC Work Programme 2014⁵, Item 4 deals with a Framework for safe and secure unconventional hydrocarbon extraction. The aim is to ensure that opportunities to diversify energy supplies and improve competitiveness, including by production of unconventional hydrocarbon, can be safely and effectively taken up in those Member states that choose to do so. The framework would target clarity and predictability for both market operators and citizens including for exploration projects, full consideration of greenhouse gas emissions and management of climate and environmental risks, including to health, in line with public expectations.

2. Unconventional Gas Exploration & Extraction on the Island of Ireland

At present (i.e. November 2013), there is no UGEE project/operation underway that has reached either the exploratory or commercial drilling stage.

In the **Republic of Ireland**, the Department of Communications, Energy and Natural Resources (DCENR) announced in February 2011 that it was offering Onshore Petroleum Licensing Options to:

- (i) Tamboran Resources PTY Ltd over 986 km² in the Northwest Carboniferous Basin;
- (ii) Lough Allen Natural Gas Company Ltd over 467 km² in the Northwest Carboniferous Basin; and
- (iii) Enegi Oil Plc over 495 km² in the Clare Basin.

These 'options' were valid for a period of up to a maximum of 24 months and gave the holder the first right, exercisable at any time during the period of the Option, to an Exploration Licence over all or part of the area covered by the Option. The licensing options awarded were preliminary authorisations and were designed to allow the companies assess the shale gas potential of the acreage largely based on desktop studies of existing data. Exploration drilling, including drilling that would involve hydraulic fracturing, was not allowed under these Licensing Options. Two of the three companies, which had been granted on-shore licensing options in February 2011, have submitted applications for a follow-on exploration licence. DCENR initially evaluated these applications, focussing on the technical rationale underpinning the applications, along with the corporate information provided. Where the outcome of this stage of the evaluation is positive, further consideration of the application will then be put on hold until after the findings of this Research Programme have been published. It is not proposed to consider applications for exploration authorisations in respect of other onshore areas until this Research Programme has concluded. Should the findings of the EPA/DCENR/NIEA research support a conclusion that hydraulic fracking could be carried out in an environmentally compliant manner, any application proposing the use of this technology would be subject to a full Environmental Impact Assessment and Appropriate Assessment (Screening).

As in the rest of the UK, Northern Ireland petroleum licences grant exclusivity within the licence area for oil and gas exploration and production, and no distinction is made between conventional and unconventional

³http://publications.jrc.ec.europa.eu/repository/bitstream/11111111/29386/1/req_jrc83512_assessment_use_substances_hydraulic_fracturing_hale_gas_reach.pdf

⁴<http://ec.europa.eu/environment/integration/energy/pdf/Final%20Report%2024072013.pdf>

⁵<http://ec.europa.eu/atwork/key-documents/>



oil and gas. There are four current petroleum licences in Northern Ireland. In one of these cases, the Licensee is focussing on shale gas targets, where Tamboran Resources PTY Ltd. has secured a Petroleum Licence from the Department of Enterprise, Trade and Investment (DETI), to explore for shale gas reserves over 746 km² of the Northwest Carboniferous Basin in Co. Fermanagh. The licence runs from 1st April 2011 for 5 years and has a 'drill or drop' work programme. In the first three years, the company is expected to carry out pre-drilling exploration (although this may include the drilling of stratigraphic boreholes) and, before the end of Year Three (i.e. end of March 2014), either commit to drilling an exploration well within the following two years or relinquish the licence. Additional consents are required before the company can drill the exploration well and any operations involving hydraulic fracturing would require an Environmental Impact Assessment. All applications submitted in relation to UGEE projects/operations will be screened against the requirement for an EIA. Where hydraulic fracturing is proposed an EIA will always be required. Other activities will be screened against the thresholds set out in the EIA Regulations. However, the Department of the Environment of Northern Ireland (DOENI) has the power to direct that any development, regardless of the thresholds, is determined as EIA development, thus requiring an Environmental Statement to be submitted with any planning application.

3. Previous Research on Unconventional Gas Exploration & Extraction

In May 2012, the Environmental Protection Agency (EPA) released the report from a preliminary study "[*Hydraulic Fracturing or 'Fracking': A Short Summary of Current Knowledge and Potential Environmental Impacts*](#)⁶". This short desk study was conducted for the EPA by the University of Aberdeen and provided an introduction to the environmental aspects of UGEE projects/operations including a review of regulatory approaches used in other countries and areas for further investigation and research.

In brief, some of the key findings of the study were:

- The importance of adequate knowledge of local geology in order to assess potential impacts on groundwater quality and the possibility of induced seismic activity;
- The importance of well integrity for preventing groundwater contamination;
- The uncertainty regarding the "carbon footprint" of shale gas in comparison to conventional natural gas. This is an important climate change issue;
- Baseline studies are needed before drilling begins (surface water; groundwater; seismic); and
- This is a relatively new area of research (i.e. only a limited number of published, peer-reviewed, scientific studies are available in this area).

Further research is required to fully understand the potential impacts on the environment and human health⁷ from UGEE projects/operations.

⁶ <http://www.epa.ie/pubs/reports/research/sss/epa-strivesmallscalestudyreport.html>

⁷ please refer to [Section 4.2.4](#)



4. Scope of the Research on Environmental Impacts from UGEE projects/operations

The information provided by the preliminary research project (Refer to [Section 3.](#)) was used along with other sources, such as European Commission reports⁸, to develop the Terms of Reference for a more comprehensive Research Programme, which is being co-funded by the EPA, DCENR and the Northern Ireland Environment Agency (NIEA).

4.1. Public Consultation

Between the 11th January and 8th March 2013, the EPA administered a Public Consultation⁹ in relation to the draft Terms of Reference¹⁰ for this Research Programme. Submissions¹¹ were assessed and relevant comments taken into account, when finalising this document. The Response document to the Public Consultation is also available for download from the EPA website¹².

4.2. Scope of the Research Programme

This section sets out the scope and remit of the Research Programme. Research projects described in the document should be read in the context set out in this section.

4.2.1. Key Research Questions

The key questions, this Research Programme needs to answer are:

1. Can UGEE projects/operations be carried out in the island of Ireland whilst also protecting the environment and human health?
2. What is 'best environmental practice' in relation to UGEE projects/operations?

This research (especially [Project C](#)) has been designed to produce outputs, which will assist regulators (North and South) in fulfilling their statutory roles regarding this activity.

4.2.2. Geographical Scope

While elements of the research will relate to specific regions where petroleum licensing options or licences have been granted from the DCENR/DETI (i.e. Projects [A1](#) & [A2](#)), it is the intention that the research will generally be applicable to the island of Ireland. The Irish environment (island of Ireland) is different to the environments in which many UGEE projects/operations are taking place worldwide, and this should be taken into account when making reference to and comparing with experience in relation to UGEE projects/operations in other countries.

4.2.3. Environmental Impacts Scope

In the island of Ireland, the Environmental Impact Assessment (EIA) Directive (2011/92/EU) will apply for UGEE projects/operations where fracking is proposed. The scope of the proposed research (specifically [Project B](#)) includes the identification of the possible impacts of UGEE projects/operations, including but not limited to, impacts falling under the remit of the EIA Directive. This Directive aims to provide a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation of projects with a view to reduce their environmental impact. EIAs ensure public participation in decision-making and thereby strengthen the quality of decisions. The Directive requires the

⁸ http://ec.europa.eu/energy/studies/energy_en.htm

⁹ <http://www.epa.ie/newsandevents/news/previous/2013/january/name.51286.en.html>

¹⁰ <http://www.epa.ie/pubs/consultation/ugeeresearchconsultation.html>

¹¹ <http://www.epa.ie/researchandeducation/research/striveprogramme/water/ugee%20research/>

¹² <http://www.epa.ie/researchandeducation/research/striveprogramme/water/ugee%20research/>



assessment of the direct and indirect effects of particular projects on human beings¹³, flora and fauna, soil, water, air, climate, the landscape¹⁴, material assets¹⁵, cultural heritage, and the interaction between these effects. Such an assessment should also address impacts of relevance to other EU Directives (refer to [Annex 1](#)).

4.2.4. Impacts on Human Health

In the EPA Acts (1992, 2003), environmental pollution is defined as: *“The direct or indirect introduction to an environmental medium, as a result of human activity, of substances, heat or noise which may be harmful to human health or the quality of the environment...”*.

The Water (Northern Ireland) Order 1999 states that “the Department shall, in exercising its functions in relation to the conservation of water resources and the cleanliness of water, have regard to <...> the protection of public health”. A person commits an offence if he/she discharges or deposits poisonous, noxious or polluting matter so that it enters a waterway or water contained in any underground strata.

The wording “human/public health” throughout this document refers specifically and is limited to potential health impacts deriving from impacts on environmental media (e.g. exposure to chemicals, vibration, light, noise, and pollution of environmental media (i.e. soils, air & water). In addition, the wording “protecting human health” refers and is limited to preventing environmental factors from degrading human health.

5. Programme of Further Research

In order to assist government bodies in making informed decisions about future licensing and management of UGEE projects/operations on the island of Ireland, comprehensive knowledge of the potential impacts of this process on the environment and human health is required. This knowledge will be generated from a number of sources including EU and international research and through this programme of research.

The aim of the Research Programme is to further our understanding of the potential impacts on the environment and human health from UGEE projects/operations. Projects [A1](#) and [A2](#) cover baseline characterisation of groundwater, surface water and associated ecosystems¹⁶, as well as baseline characterisation of seismicity, which are required to assess potential impacts. [Project-A3](#) will assess the requirements and needs for additional Air Baseline Monitoring in the context of providing guidelines for Environmental Impact Statement(s) (EIS). This research (especially [Project C](#)) has been designed to produce outputs, which will assist regulators (North and South) in fulfilling their statutory roles regarding this activity.

¹³ *Impacts on human beings such as Economic Activity (will the development stimulate additional development and/or reduce economic activity, and if either, what type, how much and where?), Social Consideration (will the development change patterns and types of activity and land use?), Employment, Settlement Patterns, Land-use (will there be severance, loss of rights of way or amenities, conflicts, or other changes likely to ultimately alter the character and use of the surroundings?) and Health and Safety (will there be risks of death, disease, discomfort or nuisance?).*

¹⁴ Light pollution or glare may be dealt with under the topic of landscape (2003 EPA Advice on Environmental Impact Statement)

¹⁵ Infrastructure, including impacts on transportation, is covered under Material Assets

¹⁶ Including areas of a particular environmental importance, such as European Sites and areas designated pursuant to the Birds Directive or the Habitats Directive



5.1. Administration of the Research Programme

5.1.1. Funding Organisations

The **Environmental Protection Agency** (EPA) is an independent statutory body, established under the Environmental Protection Agency Act with a wide range of responsibilities including regulation of large scale industrial and waste facilities, monitoring and reporting on the state of the environment, overseeing local authorities' environmental responsibilities, coordinating environmental research in Ireland, promoting resource efficiency and regulating Ireland's greenhouse gas emissions. Through the **Department of Environment, Community and Local Government** (DECLG), the EPA has provided funding for environmental research since 1994. The current Research Programme 'STRIVE'¹⁷ has been running since 2007. The purpose of the STRIVE Programme is to address key environmental management issues through the provision of high quality scientific knowledge generated through a vibrant, competitive programme of research.

The **Department of Communications, Energy and Natural Resources** (DCENR) has responsibility for the Telecommunications, Broadcasting and Energy sectors. It regulates, protects, develops and advises on the Natural Resources of Ireland. Of particular relevance is the role of the **Petroleum Affairs Division** (PAD) to maximise the benefits to the State from exploration for and production of indigenous oil and gas resources, while ensuring that activities are conducted safely and with due regard to their impact on the environment and other land/sea users. The **Geological Survey of Ireland** (GSI) is also within DCENR and provides advice and guidance in all areas of geology including geohazards and groundwater and maintains strong connections to geoscience expertise in Ireland.

The **Department of the Environment of Northern Ireland** (DOENI) aims to protect and improve the environment, promote well-being, and deliver a strong and effective local government to support a thriving economy. As an executive agency of DOENI, the **Northern Ireland Environment Agency** (NIEA) seeks to safeguard the quality of the environment as a whole through effective regulation of activities that have the potential to impact on the environment. UGEE projects/operations are considered by the Agency to be such an activity.

5.1.2. Administration of the Research Programme and Steering Committee

This Research Programme is being administered by the EPA and steered by a committee with representatives from DCENR, DECLG, the Commission for Energy Regulation (CER), An Bord Pleanála (ABP), the Geological Survey of Ireland (GSI), the Northern Ireland Environment Agency (NIEA), the Geological Survey of Northern Ireland (GSNI), as well as a Health representative nominated by the Health Service Executive (HSE).

The role of the Steering Committee encompasses the drafting and finalisation of these Terms of Reference, the review and evaluation of tenders received as a result of this Invitation to Tender process, as well as overseeing and providing advice to the successful Tenderer throughout the project. The Steering Committee will critically review the work during significant stages of the research and the completion of the final reports. External experts may be used if deemed necessary by the Steering Committee. The successful Tenderer shall take into account directions and comments from the Steering Committee.

The lead organisation of the successful Tenderer shall take into account the emerging results from all five projects within this Research Programme and oversee the integration and linkages between the different elements of the Research Programme (Refer to [Section 6](#). for more details).

¹⁷ Science, Technology, Research and Innovation for the Environment



5.2. Research Projects

The successful Tenderer will be required to undertake research in three areas, namely: *Baseline Characterisation, Impacts & Mitigation Measures* and *Regulatory Framework*, as described in this section.

It is anticipated that the total cost associated with this tender (**excluding** VAT and the costs of Tasks 4 and 6 for Project A1 and Tasks 6 and 7 for Project A2) will be in the region of € 700,000. **A Supplementary Tender will be required at a later stage for some or all aspects of Tasks 4 & 6 for Project A1 and Tasks 6 & 7 for Project A2.** These research projects must build on findings and recommendations from past & current relevant activities and research projects.

5.2.1. Projects A1, A2, A3: Baseline Characterisation

Geology is the science comprising the study of solid Earth, the rocks of which it is composed, and the processes by which it evolves. Hydrogeology is the area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust (commonly in aquifers). A comprehensive understanding of both these topics is a basic requirement in order to make an informed decision in relation to the potential impacts on the environment and human health which UGEE projects/operations may present.

The subject of water contamination is one of the most contentious local environmental issues relating to UGEE projects/operations. The risks to groundwater include those coming from the injected fluid, natural gas, the surface storage/management of flowback and formation water and other substances, such as radioactive materials (including Radon gas) and metals that may naturally occur within, and could potentially be released by the fracking process from the rock formations. The risks to surface water and ecosystems include those to groundwater via the groundwater discharge to surface water as well as via the overland pathway. The risks not only relate to these potential contaminants, but also to additional subsurface preferential flow pathways that may be created during the fracking process. In addition, information on existing water resources is required as large volumes of water are needed to carry out the process and sourcing such volumes could have major implications for local, regional or national surface water and groundwater resources (both for potable/commercial/agricultural use and ecological considerations). Reduction in water quantity and flow may impact water quality and associated ecosystems.

Hydraulic fracturing inherently involves geomechanical risks – i.e. the injection of large volumes of pressurised water at depth will, by design, alter the in-situ stress state and change the propensity of existing fractures to open or faults to slip, and possibly result in seismic activity (i.e. earthquakes).

In Ireland, the EPA manages the national ambient air quality monitoring network, which measures the levels of a number of atmospheric pollutants as set out in EU Directives¹⁸. In addition, the Radiological Protection Institute of Ireland (RPII) has carried out a National Radon Survey of indoor radon levels in homes in Ireland between 1992 and 1999, and additional c. 42,000 dwellings were surveyed up to December 2012¹⁹. Furthermore, the National Radon Control Strategy, which is being developed by a Government-led Inter Agency Group, will recommend that updated baseline values be established.

¹⁸ The European Commission set down the principles to this approach in 1996 with its Air Quality Framework Directive. Four "daughter" directives lay down limits for specific pollutants (Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead; 2nd Daughter Directive: Carbon monoxide and benzene; 3rd Daughter Directive: Ozone; 4th Daughter Directive: Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air). The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published in May 2008

¹⁹ <http://www.rpii.ie/Your-Home/Radon-in-your-home/Radon-results-by-country.aspx>



In order to improve air quality for all citizens in Northern Ireland (NI), Local Authorities are responsible for reviewing the state of air quality in their districts. To assist them with this process an Air Quality Strategy²⁰ has been devised for the UK. This sets down standards and objectives for the air quality pollutants causing problems and allows Local Authorities to review air quality in their area against these. NI departments also have a responsibility to ensure limit values, target values and alert thresholds for specified pollutants are not exceeded.

In order to make an informed decision in relation to the potential impacts on the environment and human health, which UGEE projects/operations may present, the Research Programme (specifically [Project-A3](#)) will assess the requirements and needs for additional Air Baseline Monitoring in the context of providing guidelines for Environmental Impact Statement(s) (EIS), including a comprehensive analysis of air quality and testing for air-pollutants.

This research shall be framed in the island of Ireland context such that the resulting methodologies can be applied to other locations on the island of Ireland. The three areas (Co. Clare, Co. Leitrim & Co. Fermanagh), previously referred to in [Section 2.](#), shall be used as 'case studies areas', through which the methodologies can be developed, applied and evaluated for the Research Projects [A1](#) & [A2](#), described below.

Project-A1 (Groundwater, Surface Water and Associated Ecosystems)

Baseline characterisation of groundwater, surface water and associated ecosystems²¹ is required to enable potential impacts to be assessed. Therefore, particular **research issues** for consideration in this area would, *inter alia*, include:

- The importance of geology and hydrogeology in environmental protection and considerations of human health (e.g. drinking water);
- Assessment of existing baseline monitoring in order to inform best practice in the island of Ireland context;
- Increasing geological and hydrogeological knowledge and developing a conceptual understanding, in the context of the three case study areas;
- Evaluation of the connectivity between the shale gas source rocks and the groundwater in the overlying groundwater bodies; and
- Evaluation of the water requirements of UGEE projects/operations (for an individual, typical pad and for each permit area) and if the local catchments could meet these requirements without adverse environmental impacts.

Based on the above, **specific tasks** relating to groundwater, surface water and associated ecosystems are required as follows:

²⁰ <https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-2>

²¹ Including areas of a particular environmental importance, such as European Sites and areas designated pursuant to the Birds Directive or the Habitats Directive



- Task-1. Assessment of existing baseline monitoring (best) practices including water quality aspects, the location of existing monitoring points with specific regard to geological/hydrogeological conditions to inform best practice for an island of Ireland geological context. Any limitations and/or knowledge gaps should be expounded. This assessment should also outline/make reference to the legislative requirements to develop an environmental monitoring programme.
- Task-2. Development of sub-regional geological/hydrogeological characterisation and conceptual model based on all of the available existing data for the case study areas. This model should be further refined when data are acquired through Tasks 3, 5 and 6. General principles of data requirements, acquisition and assessment should enable application in the context of the existing water management arrangements for the island of Ireland.
- Task-3. Preparation of a technical specification for a sub-regional baseline monitoring study that will be informed by the geological and hydrogeological characteristics of the case study sites, i.e. taking specific regard of the conceptual understanding of local/regional groundwater flow regimes in these areas. This should identify and take into consideration any existing or potential monitoring infrastructure and identify if, and where, additional monitoring points are required.
- Task-4. **Some or all aspects of this task will be part of the Supplementary Tender referred to in Section 5.2: If additional monitoring points are required**, the successful Framework operator will be asked to submit a supplementary tender for Task 4 a-f inclusive and will then be responsible for the whole procurement process for a sub-contract for the installation and commissioning of the additional monitoring points, in accordance with EU and National Procurement procedures. This sub contract will include but not be limited to:
- a. The preparation of all tender documentation for the sub-contract including the provision of specifications for monitoring installations, which shall be in line with best practice and to an appropriately high standard. **The Steering Committee will review these specifications and may request amendments/clarifications (within 21 days)**. The technical specification shall outline the parameters which should be analysed, including the reasons for selection, test methods and required limits of detection.
 - b. Tender evaluation, tender recommendations to Steering Committee and administration including the issue of sub-contract award documentation **following approval (within 21 days) to award the contract from the Steering Committee**.
 - c. Management, supervision and administration of sub contract for the provision of additional monitoring points, as well as attendance upon the sub-contractor. This task will include ensuring that any additional monitoring points are installed to the agreed specification and with full hydrogeological supervision.
 - d. The successful tenderer will be required to fulfil the role of Project Supervisor Design Process (PSDP) and/or designer under the Safety, Health and Welfare at Work (Construction) Regulations 2006 and Amendment Regulations 2008 to 2013 and will be required to ensure full compliance with these regulations.
 - e. The successful tenderer will be required to prepare the Final Account for the sub-contract and to produce the Final Report on the provision of the additional monitoring points.
 - f. The successful framework operator will be responsible for negotiating with landowners to:
 - i. Obtain permissions to enter onto lands suitable for the installation of the additional monitoring points; and



- ii. Use and have access to the additional monitoring points as well as making any payments arising to land owners in respect of losses/inconvenience incurred by them as a result of the operation of monitoring points on their land.

This task is subject to change. Should this task be required, the successful framework operator will be furnished with comprehensive service requirements as part of the supplementary tender.

- Task-5. Identification of potential surface water and associated ecosystem receptors, highlighting areas that have been designated as having a particular environmental importance, which should be included in baseline monitoring.
- Task-6. **This task will be part of the Supplementary Tender referred to in Section 5.2:** Baseline groundwater, surface water and associated ecosystems monitoring shall be undertaken for a minimum period of 12 months with provision for the on-going operation and maintenance of the network. Where appropriate, this shall use existing monitoring networks and points, and, if required, monitoring of correctly installed additional monitoring stations upon installation. Monitoring of potential existing monitoring points and any newly installed station(s) will require discussion with **the Steering Committee, which may request clarifications/amendments (within 21 days)**. As the monitoring results are collated, the network and procedures should be reviewed in discussion with the Steering Committee.
- Task-7. Geological assessment of the existing fracture networks and networks that are likely to be produced by fracking operations and the implications for water flow and pollutant transport, with specific reference to overlying groundwater bodies.
- Task-8. Quantitative assessment of a) water requirements for UGEE projects/operations (for an individual, typical pad and for each permit area) and b) groundwater and surface water resource availability. The assessment should identify the potential UGEE projects/operations water usage impacts on local and catchment water requirements. These requirements include, but are not limited to, direct abstractions (groundwater and surface water) and flows/inputs for surface water and ecosystems.
- Task-9. Recommendations for baseline monitoring requirements. Assessment as to which elements of baseline monitoring, could be undertaken by the state versus by the industry. The assessment should include co-ordination and quality assurance requirements, and make reference to best practice for other similar industrial activities on the island of Ireland and other EU countries.
- Task-10. Ensure effective dissemination of the research findings in accordance with the overall dissemination plan of the Research Programme, which will be agreed with the Steering Committee.

The conceptual model and technical specifications for monitoring should be further refined when data are acquired through Tasks 3, 5 and 6 (**in discussion and agreement with the Steering Committee**).

Outputs (subject to gaining appropriate land access for monitoring and installation if required):



- **Month-2²²**: Submission of an Interim Report (Interim Report A1-1) on existing baseline monitoring (best) practices, existing regional monitoring, technical specification for a baseline monitoring study.
- **Month-3²³**: Submission of:
 - Interim Report (Interim Report A1-2) on the sub-regional geological/hydrogeological characterisation and conceptual model; and
 - Interim Report (Interim Report A1-3) on the need and requirements for additional monitoring points.
- **After Month-3 (and where no objection has been received from the Steering Committee)**: Undertake procurement (if required) of the sub-contract for the provision of additional monitoring points.
- **Within 2 months of awarding the sub-contract and/or resolution of all issues related to access to land**:
 - Installation of additional monitoring points (if required); and
 - Commencement of monitoring (for a period of 12 months).
- **Month-12²⁴** – Submission of:
 - Interim Report (Interim Report A1-4) on the refined²⁵ conceptual model; and
 - Interim Report (Interim Report A1-5) on the monitoring carried out to-date (including a review of the network and procedures).
- **Within 15 months of awarding the sub-contract and/or resolution of all issues related to access to land**: Submission of
 - Final Technical Report²⁶ covering all elements of Project A1 (Final Report-1) including the monitoring data; and
 - Short **Summary-type Report**²⁷ which shall be written in a style accessible to non-technical readers (Summary-1).
- The findings shall also be disseminated to key stakeholders via an **approved Dissemination Plan**²⁸ in the context of Task-9

This project must be completed **within 15 months of awarding the sub-contract and/or resolution of all issues related to access to land**. Applicants are requested to outline their Dissemination Plan as part of their proposal.

The lead organisation of the successful Tenderer will be required to ensure **full integration and linkages** between the different elements of the Research Programme (i.e. Projects A-C) **including the contribution of each to an integrated synthesis report (Synthesis) (refer to [Section 6](#))**.

²² from the start date of the project, which is to be agreed upon the award of the contract.

²³ from the start date of the project, which is to be agreed upon the award of the contract.

²⁴ from the start date of the project, which is to be agreed upon the award of the contract.

²⁵ Refer to Task-2, whereby the conceptual model is to be further refined when data are acquired through Tasks 3, 5 and 6.

²⁶ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

²⁷ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

²⁸ The overall dissemination plan of the research programme will be agreed with the Steering Committee (Refer to [Section 6](#).)



Project-A2 (Seismicity)

Baseline characterisation of seismicity is required to enable potential impacts to be assessed. Therefore, particular **research issues** for consideration in this area would, *inter alia*, include:

- A review of records of natural seismicity in the island of Ireland. An assessment of the nature and magnitude of induced seismicity associated with hydraulic fracturing operations worldwide.
- Review of seismic risk control regimes operated worldwide for UGEE projects/operations and make recommendations for systems applicable to the island of Ireland, with particular reference to the case study areas.
- Assessment of the capability of existing seismic monitoring network(s) to allow detection and three-dimensional location of seismic events down to target magnitude threshold.
- Assessment of micro-seismic monitoring methodologies to enable real-time monitoring of fracture growth during, and immediately after, UGEE projects/operations in order to minimise risks from induced seismicity associated with hydraulic fracturing. This assessment should review how the existing seismic network(s) can be integrated with any likely additional networks that would be required for this type of activity, what resources are required to analyse these existing data, and what regions/sub-regional monitoring locations would be required for the specific case study areas.
- Linking with [Project B](#) - Assessment of the success of pre-fracturing modelling techniques to predict the propagation (number and height) of fractures in the target horizon in order to predict induced seismicity and to predict the risk of fractures creating preferential pathways for pollutants.

Based on the above, **specific tasks** relating to seismicity are required as follows:

- Task-1. Assessment of existing baseline monitoring operated worldwide for UGEE projects/operations to inform best practice for an island of Ireland geological context. This assessment should also outline/make reference to the legislative requirements to develop an environmental monitoring programme.
- Task-2. Evaluate methodologies, such as InSAR²⁹, EDM³⁰, tiltmeters and GPS³¹, or their equivalent for the monitoring of ground deformation that may be associated with UGEE projects/operations.
- Task-3. Assessment of existing data on natural seismicity in the island of Ireland. This assessment should include an analysis of magnitude of natural earthquakes with regard to actual damage caused, including the potential to cause damage to the integrity of oil and gas wells, as well as the public perception of this (potential) damage.
- Task-4. Assessment of the magnitude and physical effects of induced seismicity that may be associated with UGEE projects/operations in the island of Ireland (including hydraulic fracturing and re-injection). This will include a review of induced seismicity related to

²⁹ Interferometric synthetic aperture radar (InSAR)

³⁰ Electronic Distance Measurement'

³¹ Global Positioning System



existing operations elsewhere in the world but will also assess the relationship between event magnitude and physical effects applicable to the geology of the case study areas in Ireland. The actual and perceived impacts of induced seismicity from potential UGEE projects/operations in the island of Ireland should be related back to the findings of Task 3 (i.e. assessment of existing data on natural seismicity).

Task-5. Preparation of a technical specification for a sub-regional baseline monitoring with appropriate conceptual model(s) that will be informed by the geological/seismological characteristics of the case study sites taking into consideration existing monitoring infrastructure and identify if, and where, additional monitoring stations are required relating back to the area-specific geological/seismological conceptual understanding.

Task-6. **Some or all aspects of this task will be part of the Supplementary Tender referred to in Section 5.2: If additional monitoring points are required**, the successful Framework operator will be asked to submit a supplementary tender for Task 4 a-f inclusive and will then be responsible for the whole procurement process for a sub-contract for the installation and commissioning of the additional monitoring points, in accordance with EU and National Procurement procedures. This sub contract will include but not be limited to:

- a. The preparation of all tender documentation for the sub-contract including the provision of specifications for monitoring installations, which shall be in line with best practice and to an appropriately high standard. **The Steering Committee will review these specifications and may request amendments/clarifications (within 21 days)**. The technical specification shall outline the parameters which should be analysed, including the reasons for selection, test methods and required limits of detection.
- b. Tender evaluation, tender recommendations to Steering Committee and administration including the issue of sub-contract award documentation **following approval (within 21 days) to award the contract from the Steering Committee**.
- c. Management, supervision and administration of sub contract for the provision of additional monitoring points, as well as attendance upon the sub-contractor. This task will include ensuring that any additional monitoring points are installed to the agreed specification and with full hydrogeological supervision.
- d. The successful tenderer will be required to fulfil the role of Project Supervisor Design Process (PSDP) and/or designer under the Safety, Health and Welfare at Work (Construction) Regulations 2006 and Amendment Regulations 2008 to 2013 and will be required to ensure full compliance with these regulations.
- e. The successful tenderer will be required to prepare the Final Account for the sub-contract and to produce the Final Report on the provision of the additional monitoring points.
- f. The successful framework operator will also be responsible for negotiating with landowners to:
 - i. Obtain permissions to enter onto lands suitable for the installation of the additional monitoring points; and
 - ii. Use and have access to the additional monitoring points as well as making any payments arising to land owners in respect of losses/inconvenience incurred by them as a result of the operation of monitoring points on their land.

This task is subject to change. Should this task be required, the successful framework operator will be furnished with comprehensive service requirements as part of the supplementary tender.



- Task-7. **This task will be part of the Supplementary Tender referred to in Section 5.2:** Seismic monitoring shall be undertaken for a minimum period of 12 months with provision for the on-going operation and maintenance of the network. Where appropriate, this shall use existing monitoring networks and points, and, if required, monitoring of correctly installed additional monitoring stations upon installation. Monitoring of potential existing monitoring points and any newly installed station(s) will require discussion with **the Steering Committee, which may request clarifications/amendments (within 21 days)**. As the monitoring results are collated, the network and procedures should be reviewed in discussion with the Steering Committee.
- Task-8. Examination of global experience of seismic events stimulated by or otherwise related to fracking and other UGEE projects/operations with assessment of likely impacts and recommendations for appropriate mitigation measures within the geological context of the island of Ireland.
- Task-9. Linking with [Project B](#) - Assessment of the success of pre-fracturing modelling techniques to predict the propagation (number and height) of fractures in the target horizon in order to predict induced seismicity and to predict the risk of fractures creating preferential pathways for pollutants.
- Task-10. Assessment of what baseline monitoring could be undertaken by the state versus by the industry. This assessment should include co-ordination and quality assurance requirements, and make reference to best practice for other similar industrial activities on the island of Ireland and other EU countries.
- Task-11. Ensure effective dissemination of the research findings in accordance with the overall dissemination plan of the Research Programme, which will be agreed with the Steering Committee.

Outputs (subject to gaining appropriate land access for monitoring installation):

- **Month-3³²:** Submission of:
 - Interim Report³³ (on existing baseline monitoring practices, available seismological data, potential seismic effects from hydraulic fracturing, sub-regional geological/seismological characterisation and conceptual model(s), existing regional assessment of existing monitoring network(s)) (Interim Report A2-1); and
 - Interim Report on the need and requirements for additional monitoring points (Interim Report A2-2).
- **After Month-3 (and where no objection has been received from the Steering Committee)** undertake procurement (if required) of the sub-contract for the provision of additional monitoring points.
- **Within 2 months of awarding the sub-contract and/or resolution of all issues related to access to land:**
 - Installation of additional monitoring points (if required); and
 - Commencement of monitoring (for a period of 12 months).

³² from the start date of the project, which is to be agreed upon the award of the contract.

³³ Initial report based on the desk study elements of the project before any installations.



- **Month-6**³⁴ – Submission of an Interim Report (Interim Report A2-3) on the conceptual model(s).
- **Month-12**³⁵ – Submission of an Interim Report (Interim Report A2-4) on the monitoring carried out to-date (including a review of the network and procedures).
- **Within 15 months of awarding the sub-contract and/or resolution of all issues related to access to land:** Submission of
 - Final Technical Report³⁶ covering all elements of Project A2 (Final Report-2): including monitoring results of natural seismicity from the island of Ireland and locally enhanced networks; and
 - Short **Summary-type Report**³⁷ which shall be written in a style accessible to non-technical readers (Summary-2).
- The findings shall also be disseminated to key stakeholders via an approved **Dissemination Plan**³⁸ in the context of Task-11.

This project must be completed **within 15 months of awarding the sub-contract and/or resolution of all issues related to access to land**. Applicants are requested to outline their Dissemination Plan as part of their proposal.

The lead organisation of the successful Tenderer will be required to ensure **full integration and linkages** between the different elements of the Research Programme (i.e. Projects A-C) **including the contribution of each to an integrated synthesis report (Synthesis) (refer to [Section 6](#))**.

Project-A3 (Air Quality)

Potential air emissions from UGEE projects/operations may originate from sources, such as:

- Trucks and drilling equipment;
- Natural gas processing and transportation;
- Fugitive emissions;
- Evaporative emissions of chemicals from wastewater ponds;
- Spills and well blow-outs; and
- Post operation leakages from well.

Under Project-A3, it is proposed to assess the requirements and needs for additional Air Baseline Monitoring (frequency, location and types of pollutants to be covered) in the context of Environmental Impact Statement (EIS). The Environmental Impact Assessment Directive (2011/92/EU) refers to *Impacts on Air such as Air Quality*³⁹ (Pollutants, Suspended Particles); Odour; Noise; Vibration and Radiation. Existing sources of air pollution shall be identified and the components of any existing air pollution identified and

³⁴ from the start date of the project, which is to be agreed upon the award of the contract.

³⁵ from the start date of the project, which is to be agreed upon the award of the contract.

³⁶ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

³⁷ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

³⁸ The overall dissemination plan of the Research Programme will be agreed with the Steering Committee (Refer to [Section 6](#)).

³⁹ Radon may be dealt with under Air Quality (2003 EPA Advice on Environmental Impact Statement).



quantified. Potential emissions covered under Project-A3 should include but are not limited to monitoring requirements under the EIA Directive.

Based on the above, specific tasks relating to Air Quality are required as follows:

- Task-1. Review of existing air monitoring data including naturally occurring radioactive materials (NORM).
- Task-2. Review of requirements and experience of Air Baseline characterisation in countries where UGEE projects/operations have taken or are taking place.
- Task-3. Identify and make recommendations for guidelines on the extent of Air baseline monitoring (frequency, location and types of pollutants to be covered) that needs to be carried out for an Environmental Impact Statement (EIS) (i.e. on a project basis).
- Task-4. Ensure effective dissemination of the research findings in accordance with the overall dissemination plan of the Research Programme, which will be agreed with the Steering Committee.

Outputs:

- **Month-6**⁴⁰ – Submission of:
 - Final Technical Report⁴¹ covering all elements of Project A3 (Final Report-3) providing guidance on how to carry out Air baseline monitoring for an EIS; and
 - Short **Summary-type Report**⁴² which shall be written in a style accessible to non-technical readers (Summary-3);
- The findings shall also be disseminated to key stakeholders via an approved **Dissemination Plan**⁴³ in the context of Task-4.

This project must be completed within 6 months⁴⁴. Applicants are requested to outline their Dissemination Plan as part of their proposal.

The lead organisation of the successful Tenderer will be required to ensure **full integration and linkages** between the different elements of the Research Programme (i.e. Projects A-C) **including the contribution of each to an integrated synthesis report (Synthesis) (refer to [Section 6](#))**.

⁴⁰ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁴¹ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁴² The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁴³ The overall dissemination plan of the Research Programme will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁴⁴ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).



5.2.2. *Project-B: UGEE Projects/Operations: Impacts & Mitigation Measures*

This project should comprise the identification and a detailed examination of the potential impacts on the environment and human health, as well as successful mitigation measures to counteract these impacts, associated with UGEE projects/operations that have come to the fore worldwide using published reports and other sources. The assessment should take into account commercially probable scenarios. Where appropriate, findings should be accompanied by reference to experiences in other countries.

Specific research tasks to be addressed in the project are given below:

- Task-1. **Water Impacts and Mitigation Measures⁴⁵**: This task should examine the potential environmental impacts of UGEE projects/operations on groundwater and surface water bodies, including the potential migration of methane, chemicals and other contaminants, both from surface and subsurface sources. Findings should be informed by an objective assessment of the risks and hazards posed by UGEE projects/operations, supported by a literature review and experience from other jurisdictions. Mitigation measures to address water impacts (including but not limited to effluent management/treatment and well construction) should be critically reviewed and presented. This should include a review of the success of innovative developments within the industry to reduce water impacts.
- Task-2. An assessment of the direct (e.g. abstraction) and indirect impacts (e.g. drinking water, other receptors) of the use of local water sources for UGEE projects/operations and specifically, fracking. This should include a review of innovation within the industry to source water from existing industrial processes, such as cooling water, waste water treatment works effluent and innovation related to water-free fracking.
- Task-3. A comprehensive assessment should be conducted of experience with the level of use of recycled flowback water in UGEE projects/operations and the potential for increasing these levels. An assessment should be carried out of the scope for, and implications of, recycling the flowback water for reuse in further fracturing operations in the case study areas used for [Project A1](#), the results of which will inform potential impacts to other locations.
- Task-4. **Other Potential Impacts and Mitigation Measures⁴⁶**: This task should employ similar approaches to Task-1 to examine impacts from UGEE projects/operations on other areas, which shall include, but are not be limited to human beings, flora & fauna (including farm & domestic animals), air, both local and global (i.e. CO₂, including fugitive emissions) impacts, climatic factors, landscape⁴⁷, material assets⁴⁸, cultural heritage, as well as the interaction between these areas. Mitigation measures to address these potential impacts should be critically reviewed and presented.
- Task-5. **Life-Cycle Assessment**: A comprehensive assessment of the cumulative environmental impact of UGEE projects/operations should be conducted supported by a literature review

⁴⁵ i.e. a description of the measures envisaged in order to **avoid, reduce and, if possible, remedy** significant adverse effects (*Article 5.3(b) of the EIA Directive*)

⁴⁶ i.e. a description of the measures envisaged in order to **avoid, reduce and, if possible, remedy** significant adverse effects (*Article 5.3(b) of the EIA Directive*)

⁴⁷ Light pollution or glare may be dealt with under the topic of landscape (2003 EPA Advice on Environmental Impact Statement)

⁴⁸ Infrastructure (including impacts on transportation) is covered under Material Assets



and experience from other jurisdictions and compared with similar published assessments of other energy sources.

- Task-6. Chemicals: Typically, chemicals such as biocides and dyes, among others, are used in UGEE projects/operations. This work package should examine techniques in UGEE projects/operations, including evidence of chemical-free UGEE projects/operations and the purposes of individual additives, to ascertain current and emerging practices in the context of avoidance of the use of additives that have the potential to harm the environment.
- Task-7. Identify and assess the success of treatment and disposal methods for flowback fluid identifying specific case studies from around the world, with specific reference to a European example. Linking with Task 6, identify the treatment technologies available to adequately treat typical chemicals, used in the process, in combination with likely constituents of produced water. Disposal options linked to the available treatment options should also be reviewed and assessed.
- Task-8. Linking with Projects [A1](#), [A2](#) and [A3](#): Research into identifying best practice for environmental monitoring of potential impacts arising from individual UGEE projects/operations sites (including emissions monitoring, monitoring of mitigation measures⁴⁹ effectiveness, and of impacts on the receiving environment).
- Task-9. Examination of validity and range of existing and potential monitoring and mitigation⁵⁰ techniques, to include but not be limited to geophysical techniques (down-hole and surface) for use in monitoring, control, horizon selection, and injection management.
- Task-10. Any other issues that become apparent in the course of the project and will contribute to the required knowledge base of this topic should be considered⁵¹.
- Task-11. Ensure effective dissemination of the research findings in accordance with the overall dissemination plan of the Research Programme, which will be agreed with the Steering Committee.

Outputs:

- **Month-12**^{52 53 54}: Submission of:
 - Final Technical Report (Final Report-4) on the issues listed above; and
 - Short **Summary-type Report** (Summary-4) which should be written in a style accessible to non-technical readers.

⁴⁹ i.e. a description of the measures envisaged in order to **avoid, reduce and, if possible, remedy** significant adverse effects (*Article 5.3(b) of the EIA Directive*).

⁵⁰ i.e. a description of the measures envisaged in order to **avoid, reduce and, if possible, remedy** significant adverse effects (*Article 5.3(b) of the EIA Directive*).

⁵¹ Additional work to be agreed in advance with the project steering committee

⁵² The format of the reports will be agreed with the Steering Committee (Refer to [Section 6.](#)).

⁵³ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6.](#)).

⁵⁴ The Final Report should include a comprehensive list of all chemicals known to have been used in UGEE projects/operations. If reference to chemical-free fracking is included in the research, it should be clearly pointed out where and for how long such methods have been used on a commercial basis, stating whether there are any peer-reviewed studies into the impacts associated with these methods to the environment and human health. The research should also include a comprehensive list of all substances other than water that may be used in such methods.



- The findings shall also be disseminated to key stakeholders via an approved **Dissemination Plan**⁵⁵ in the context of Task-11.

This project must be completed within 12 months⁵⁶. Applicants are requested to outline their Dissemination Plan as part of their proposal.

The lead organisation of the successful Tenderer will be required to ensure **full integration and linkages** between the different elements of the Research Programme (i.e. Projects A-C) **including the contribution of each to an integrated synthesis report (Synthesis) (refer to [Section 6](#))**.

5.2.3. Project-C: Regulatory Framework for Environmental Protection

Best environmental practice for UGEE projects/operations would entail using the most effective techniques in achieving a high general level of protection of the environment and human health as a whole, by demonstrating strict adherence with all relevant environmental legislation. The European Commission has indicated that Directive 2006/21/EC on the management of waste from the extractive industries applies to shale gas projects using UGEE projects/operations. As such, Article 4 of Directive 2006/21/EC places an obligation on Member States to ensure that competent authorities follow or are informed of developments in best available techniques. The European Commission may produce guidance for shale gas projects in the future and the successful Tenderer must take cognisance / build-on this work.

This project comprises a number of **research issues/tasks** listed below that should be undertaken and which will identify all regulatory requirements and best operational practices associated with the establishment and operation of “UGEE projects/operations” in an island of Ireland context.

- Task-1. An overview of the EU environmental legislation applicable to UGEE projects/operations. This should include environmental legislation that relates to all aspects of UGEE projects/operations from the planning to the cessation of activities, including aftercare requirements.
- Task-2. Detailed information on the regulatory approaches of other countries that have extensive experience with this activity. This should include where possible a review of case studies where UGEE projects/operations covered two jurisdictions (transboundary activities). A minimum of five countries (with at least two within the EU) should be examined including at least one country where a moratorium on unconventional gas exploration has been introduced.
- Task-3. The potential role of Health Impact Assessment in regulation of UGEE projects/operations should be considered based on the experience in other countries, and recommendations should be made towards developing a protocol in the island of Ireland context.

⁵⁵ The overall dissemination plan of the Research Programme will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁵⁶ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).



- Task-4. Best practice for UGEE projects/operations: This work package should examine all regulatory enforcement requirements and best operational practices for UGEE projects/operations, in relation to (but not limited to): water resources management, waste management, emissions control, risk quantification and management/minimisation, avoidance or mitigation of detrimental seismic events, use of chemicals, well construction, well and site remediation, air emissions management and residuals management, as well as financial provisions.
- Task-5. Public engagement: This work package should examine a minimum of five case studies of public engagement in UGEE projects/operations (or other similar projects) to identify best practices and recommend the most appropriate strategy in the island of Ireland context.
- Task-6. Any other issues that become apparent in the course of the project and will contribute to the required knowledge base of this topic should be considered⁵⁷.
- Task-7. Ensure effective dissemination of the research findings in accordance with the overall dissemination plan of the Research Programme, which will be agreed with the Steering Committee.

Outputs:

- **Month-12**^{58 59 60}: Submission of:
 - Final Technical Report (Final Report-5) detailing the findings from the research issues outlined under items 1-6 above, setting out best-practice approaches for management of UGEE projects/operations, to protect the environment and *inter alia* human health, complying in full with all relevant environmental legislation; and
 - Short **Summary-type Report** (Summary-5) which should be written in a style accessible to non-technical readers.
- The findings shall also be disseminated to key stakeholders via an approved **Dissemination Plan**⁶¹ in the context of Task-7.

This project must be completed within 12 months⁶². Applicants are requested to outline their Dissemination Plan as part of their proposal.

The lead organisation of the successful Tenderer will be required to ensure **full integration and linkages** between the different elements of the Research Programme (i.e. Projects A-C) **including the contribution of each to an integrated synthesis report (Synthesis) (refer to [Section 6](#))**.

⁵⁷ Additional work to be agreed in advance with the project Steering Committee.

⁵⁸ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁵⁹ The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁶⁰ The Final Report should include a comprehensive list of all chemicals known to have been used in UGEE projects/operations. If reference to chemical-free fracking is included in the research, it should be clearly pointed out where and for how long such methods have been used on a commercial basis, stating whether there are any peer-reviewed studies into the impacts associated with these methods to the environment and human health. The research should also include a comprehensive list of all substances other than water that may be used in such methods.

⁶¹ The overall dissemination plan of the Research Programme will be agreed with the Steering Committee (Refer to [Section 6](#)).

⁶² The format of the reports will be agreed with the Steering Committee (Refer to [Section 6](#)).



6. Management of Projects

6.1. Contact Point

A Contact Point will be appointed at the start of the contract and, with the Steering Committee, will monitor progress, guide the different phases of the work and comment on the quality of the work and timeliness of the deliverables.

6.2. Progress Updates & Meetings

It is anticipated that regular progress updates will be provided by email or telephone. In addition, the successful Tenderer (and consortium partners where relevant) will be required to attend meetings and liaise with the Contact Point and the Steering Committee on a regular basis to provide an overview of progress and outline plans to ensure all targets in relation to financial management and control are achieved. A schedule for meetings and the format of project review reports (additional to Interim, Final & Synthesis Reports) will be agreed with the successful Tenderer upon appointment.

6.3. Steering Committee

The Steering Committee will oversee and ensure the integration of all the research elements. The Steering Committee will critically review the work during significant stages of the research and the completion of the final reports. The successful Tenderer shall take into account directions and comments from the Steering Committee. The Steering Committee will, for example, review and may request clarifications/amendments (within 21 days) on the outcomes of Task 4, Project A1 and Task 6, Project A2 (i.e. tender documentation, contract award); review the monitoring results (Task 6, Project A1 and Task 7, Project A2), as well as review the conceptual models and technical specifications for monitoring.

6.4. Integration & Linkages

The successful Tenderer will be responsible for the integration of and the linkages between the different elements of the Research Programme including the contribution of each to an integrated synthesis report. It is also expected that the successful Tenderer will consult with the relevant stakeholders as appropriate to gain the maximum benefits for the success of the project.

6.5. List of Deliverables:

Research Programme	Project A1	Interim Report A1-1	Final Report-1	Summary-1	Dissemination	Synthesis
		Interim Report A1-2				
		Interim Report A1-3				
		Interim Report A1-4				
		Interim Report A1-5				
		Monitoring datasets				
	Project A2	Interim Report A2-1	Final Report-2	Summary-2		
		Interim Report A2-2				
		Interim Report A2-3				
		Interim Report A2-4				
		Interim Report A2-5				
		Monitoring datasets				
	Project A3		Final Report-3	Summary-3		
	Project B		Final Report-4	Summary-4		
	Project C		Final Report-5	Summary-5		

Research outputs and dissemination activities under each research project, will be integrated into an overall dissemination framework managed by the Steering Committee. To this effect, the dissemination



plan under each research project will need to be in agreement and complementary to the overall dissemination plan of the Research Programme; and the format of the projects outputs (data, etc.) and reports (i.e. Final Report, Synthesis Report and Summary-type Report) will need to follow an harmonised template between all the projects. The successful Tenderer will be required to ensure **full integration and linkages** between the different elements of the Research Programme (i.e. Projects A-C) **including the contribution of each to an integrated synthesis report (Synthesis)**. Both dissemination and final reporting requirements will be discussed and agreed with the Steering Committee. The research findings will be reviewed by the Steering Committee and by external experts (if deemed necessary by the Steering Committee). All datasets and resources (e.g. GIS layers, models, etc.) collated as part of the research programme should be submitted and will be made publicly available.

7. Indicative Timeframe

Jan – March 2013	Public Consultation on UGEE Research Programme
April/November 2013	Review and Assessment of Submissions
22nd November 2013	Invitation to Tender advertised via e-Tenders and OJEU
17th January 2014	Deadline for submission of Tenders
January/February 2014	Evaluation of Tenders completed
March/April 2014	Award of Contract



Annex 1 - Examples⁶³ of Key EU Environmental Legislation likely to impact on the Assessment of Unconventional Hydrocarbon Projects

- Directive on the management of waste from extractive industries (Mining Waste Directive) (2006/21/EC): *This directive is a comprehensive framework for the safe management of waste from extractive industries at EU level. Waste from extractive operations (i.e. waste from extraction and processing of mineral resources) is one of the largest waste streams in the EU. It involves materials that must be removed to gain access to the mineral resource, such as topsoil, overburden and waste rock, as well as tailings remaining after minerals have been largely extracted from the ore.*
- Directive establishing a framework for Community action in the field of water policy (Water Framework Directive) (2000/60/EC): *The Water Framework Directive (WFD) is a framework for EU water policy. The WFD aims to improve and prevent the deterioration of all waters (groundwater, rivers, lakes, transitional waters (estuaries), coastal waters and wetlands). The WFD is complemented by additional legislation regulating specific aspects of water use. These include the Groundwater Directive (GWD) (2006); the Environmental Quality Standards Directive (EQSD) (2008). Previous and related legislation include the Urban Wastewater Directive (UWWD) (1991); the Nitrates Directive (1991); the Bathing Water Directive (BWD) (2006) and the Drinking Water Directive (DWD) (1998).*
- Regulation on the registration, evaluation and authorisation of chemicals (REACH) (1907/2006/EC): *REACH is the European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances.*
- Directive on the placing of biocidal products on the market (Biocidal Products Directive) (98/8/EC): *The Biocidal Product Directive aims to harmonise the European market for biocidal products and their active substances. At the same time it aims to provide a high level of protection for humans, animals and the environment.*
- Directives on the conservation of natural habitats and of wild fauna and flora (Habitats) (92/43/EC): *The Habitats Directive (together with the Birds Directive) forms the cornerstone of Europe's nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection. All in all the directive protects over 1,000 animals and plant species and over 200 so called "habitat types" (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.*
- Directive on the conservation of wild birds (Birds Directive) (2009/147/EC): *This directive creates a comprehensive scheme of protection for all wild bird species naturally occurring in the Union. It was adopted as a response to increasing concern about the declines in Europe's wild bird populations resulting from pollution, loss of habitats as well as unsustainable use. It was also in recognition that wild birds, many of which are migratory, are a shared heritage of the Member States and that their effective conservation required international co-operation.*
- Directive on environmental liability with regard to the prevention and remedying of environmental damage (Environmental Liability Directive (ELD)) (2007/35/EC): *This directive establishes a*

⁶³ This list is not exhaustive.



*framework based on the **polluter pays principle** to prevent and remedy environmental damage. The polluter pays-principle is set out in the Treaty on the Functioning of the European Union (Article 191(2) TFEU). As the ELD deals with the "pure ecological damage", it is based on the powers and duties of public authorities ("administrative approach") as distinct from a civil liability system for "traditional damage" (damage to property, economic loss, personal injury).*

- *Air Quality Framework Directive (2008/50/EC): This directive establishes ambitious, cost-effective targets for improving human health and environmental quality up to 2020. In order to protect our health, vegetation and ecosystems, EU directives set down air quality standards and the other member states for a wide variety of pollutants. Four "daughter" directives (i.e. 1st Daughter Directive: Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead; 2nd Daughter Directive: Carbon monoxide and benzene; 3rd Daughter Directive: Ozone; 4th Daughter Directive: Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air) lay down limits for specific pollutants.*