

## UGEE Joint Research Programme: Breakdown of Organisations per Tasks

Projects	Tasks	Description of Tasks (as per Terms of Reference)	Organisations involved in the tasks	Organisations involved in the Consortium's Internal <sup>1</sup> review process
A1	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.	CDM Smith Ireland Ltd	British Geological Survey, Queen's University Belfast, Independent reviewer (Irish University)
A1	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.	CDM Smith Ireland Ltd Supported by Geological Survey of Northern Ireland	British Geological Survey, Queen's University Belfast, Independent reviewer (Irish University)

<sup>1</sup> Internal review process within the consortium before submission to the UGEE JRP Steering Committee for review

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A1	3	Preparation of a technical specification for a sub-regional baseline monitoring programme 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.	CDM Smith Ireland Ltd	British Geological Survey, Queen's University Belfast, Independent reviewer (Irish University)
A1	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:		
A1	4a	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. <b><u>The Steering Committee will review these specifications and may request amendments/clarifications (within 21 days).</u></b> The technical specification shall outline the parameters which should be analysed, including the reasons for selection, test methods and required limits of detection.		

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A1	4b	Tender evaluation, tender recommendations to Steering Committee and administration including the issue of sub-contract award documentation <b><u>following approval (within 21 days) to award the contract from the Steering Committee.</u></b>		
A1	4c	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.		
A1	4d	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.		
A1	4e	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.		
A1	4f	The successful framework operator will be responsible for negotiating with landowners to:		
A1	4f i	Obtain permissions to enter onto lands suitable for the installation of the additional monitoring points; and		

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A1	4f ii	Use and have access to the additional monitoring points as well as making any payments arising to land owners in respect of loses/inconvenience incurred by them as a result of the operation of monitoring points on their land.		
A1	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.	CDM Smith Ireland Ltd	British Geological Survey, Queen's University Belfast, Independent reviewer (Irish University)
A1	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.		

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A1	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.	CDM Smith Ireland Ltd Supported by Geological Survey of Northern Ireland	British Geological Survey, Queen's University Belfast, Independent reviewer (Irish University)
A1	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.	CDM Smith Ireland Ltd	British Geological Survey, Queen's University Belfast, Independent reviewer (Irish University)
A1	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.	CDM Smith Ireland Ltd	British Geological Survey, Queen's University Belfast, Independent reviewer (Irish University)
A1	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.		

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A1	GTS	Groundtruthing Survey	CDM Smith Ireland Ltd	N/A
A2	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.	British Geological Survey	University College Dublin, University of Ulster
A2	2	Evaluate methodologies, such as InSAR, EDM, tiltmeters and GPS, or their equivalent for the monitoring of ground deformation that may be associated with UGEE projects/operations.	British Geological Survey	University College Dublin, University of Ulster
A2	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.	British Geological Survey	University College Dublin, University of Ulster

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A2	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 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).	University of Ulster	University College Dublin, British Geological Survey
A2	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.	University College Dublin	British Geological Survey, University of Ulster

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A2	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:		
A2	6a	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. <b><u>The Steering Committee will review these specifications and may request amendments/clarifications (within 21 days)</u></b> . The technical specification shall outline the parameters which should be analysed, including the reasons for selection, test methods and required limits of detection.		
A2	6b	Tender evaluation, tender recommendations to Steering Committee and administration including the issue of sub-contract award documentation <b><u>following approval (within 21 days) to award the contract from the Steering Committee.</u></b>		

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A2	6c	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.		
A2	6d	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.		
A2	6e	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.		
A2	6f	The successful framework operator will also be responsible for negotiating with landowners to:		
A2	6f i	Obtain permissions to enter onto lands suitable for the installation of the additional monitoring points; and		
A2	6f ii	Use and have access to the additional monitoring points as well as making any payments arising to land owners in respect of loses/inconvenience incurred by them as a result of the operation of monitoring points on their land.		

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A2	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 ongoing 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.		
A2	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.	British Geological Survey	University College Dublin, University of Ulster

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A2	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.	University Of Ulster	British Geological Survey, University College Dublin
A2	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.	British Geological Survey	
A2	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.		
A3		Review of existing air monitoring data including naturally occurring radioactive materials (NORM).	CDM Smith Ireland Ltd	CDM Smith Inc.
A3		Review of requirements and experience of Air Baseline characterisation in countries where UGEE projects/operations have taken or are taking place.	CDM Smith Ireland Ltd	CDM Smith Inc.

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A3		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).	CDM Smith Ireland Ltd	CDM Smith Inc.
A3		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.		
B	1	Water Impacts and Mitigation Measures: 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.	CDM Smith Ireland Ltd	Independent reviewer (German University), AMEC Foster Wheeler

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B	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.	CDM Smith Ireland Ltd, CDM Smith Inc.	Independent reviewer (German University), AMEC Foster Wheeler
B	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.	CDM Smith Inc.	Independent reviewer (German University), AMEC Foster Wheeler

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B	4	Other Potential Impacts and Mitigation Measures <sup>1</sup> : 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. CO <sub>2</sub> , including fugitive emissions) impacts, climatic factors, landscape, material assets, cultural heritage, as well as the interaction between these areas. Mitigation measures to address these potential impacts should be critically reviewed and presented.	CDM Smith Inc., CDM Smith Ireland Ltd	Independent reviewer (German University), AMEC Foster Wheeler
B	5	Life-Cycle Assessment: A comprehensive assessment of the cumulative environmental impact of UGEE projects/operations should be conducted supported by a literature review and experience from other jurisdictions and compared with similar published assessments of other energy sources.	CDM Smith Ireland Ltd	CDM Smith Inc., Independent reviewer (German University), AMEC Foster Wheeler
B	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.	CDM Smith Inc.	Independent reviewer (German University), AMEC Foster Wheeler

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B	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.	CDM Smith Inc.	Independent reviewer (German University), AMEC Foster Wheeler
B	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 measures effectiveness, and of impacts on the receiving environment).	CDM Smith Inc., CDM Smith Ireland Ltd	CDM Smith Inc., Independent reviewer (German University), AMEC Foster Wheeler
B	9	Examination of validity and range of existing and potential monitoring and mitigation techniques, to include but not be limited to geophysical techniques (down-hole and surface) for use in monitoring, control, horizon selection, and injection management.	CDM Smith Inc. Supported by British Geological Survey	Independent reviewer (German University), AMEC Foster Wheeler
B	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 considered.	CDM Smith Inc.	

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B	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.		
C	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.	AMEC Foster Wheeler Supported by Philip Lee Solicitors	AMEC Foster Wheeler, Philip Lee, CDM Smith Ireland Ltd
C	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.	AMEC Foster Wheeler	AMEC Foster Wheeler, CDM Smith Inc.
C	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.	AMEC Foster Wheeler Supported by Philip Lee Solicitors	AMEC Foster Wheeler, Philip Lee Solicitors, CDM Smith Inc.

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C	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.	AMEC Foster Wheeler Supported by CDM Smith Inc.	AMEC Foster Wheeler, CDM Smith Inc
C	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.	AMEC Foster Wheeler Supported by Philip Lee Solicitors and CDM Smith Inc.	AMEC Foster Wheeler, Philip Lee solicitors, CDM Smith Ireland Ltd
C	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 considered.	AMEC Foster Wheeler	
C	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.		