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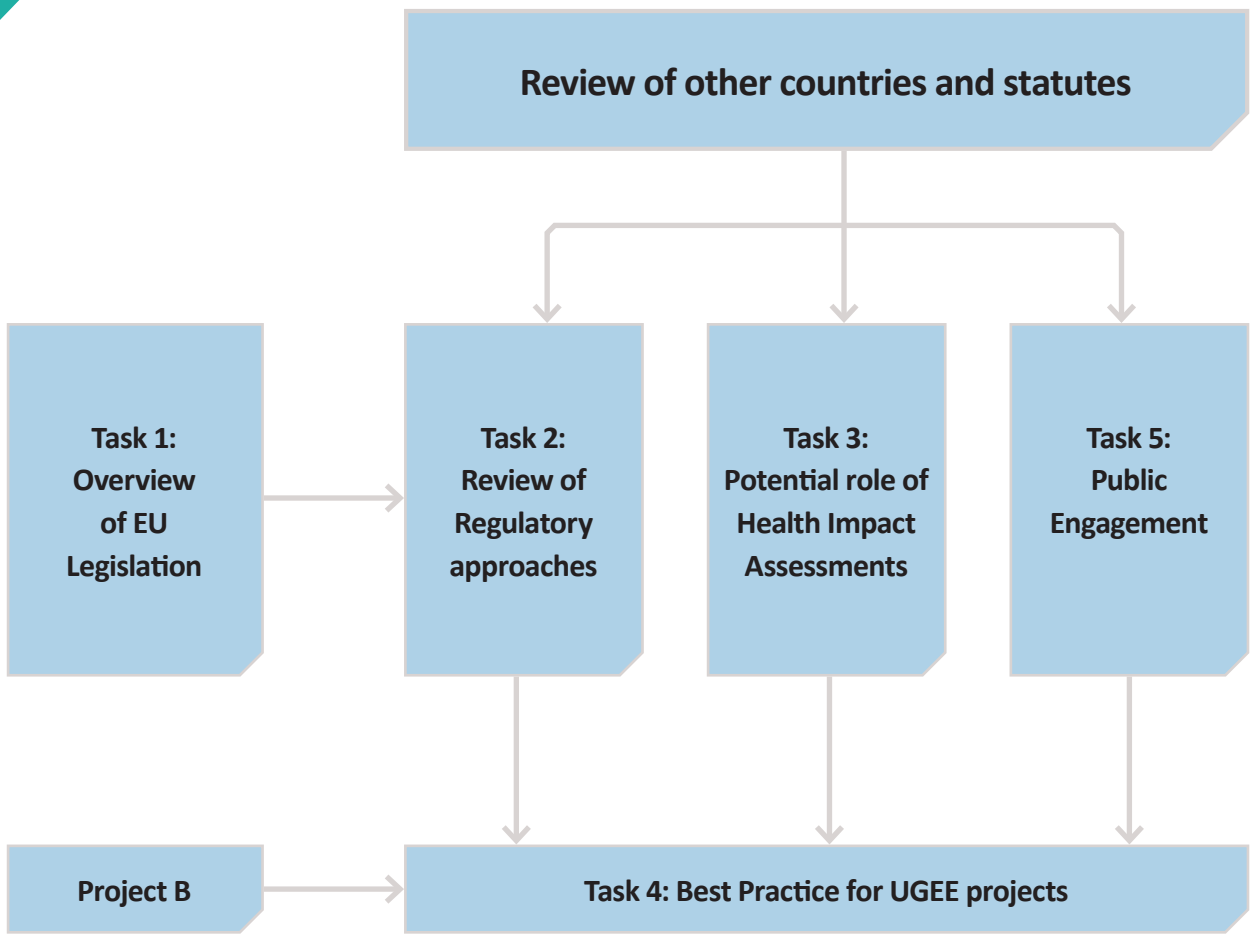
Unconventional Gas Exploration and Extraction (UGEE) Joint Research Programme

Summary Report 5: Regulatory Framework for Environmental Protection

Authors: Juan Calero, Araceli De Carlos, Ben Fretwell, Jack Pugsley, Daren Luscombe, Alex Melling and Alice Whitaker



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UGEE Joint Research Programme

Environmental Impacts of Unconventional Gas Exploration and Extraction

(2014-W-UGEE-1)

Summary Report 5:

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by

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DISCLAIMER

References to government departments (DCENR and DCELG) throughout the report use the names of these departments prior to July 2016. References to the Department for the Economy (DfE) throughout the report use the name of its predecessor, the Department of Enterprise Trade and Investment (DETI), the department responsible for petroleum licensing in Northern Ireland until May 2016.

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1 More details available at: http://www.epa.ie/pubs/reports/research/ugeejointresearchprogramme/ugeejrptasksorganisations.html

Contents

Acknowledgements ii

Disclaimer ii

Project Authors iii

Project C Partners iv

Project C Internal Review Panel iv

List of Tables and Boxes vii

Executive Summary ix

1 Introduction 1

1.1 Background 1

1.2 Aims and Objectives of Project C 1

1.3 Methodology and Information Sources 2

2 The European Environmental Legislative Framework Applicable to UGEE 3

2.1 Introduction 3

2.2 Findings 3

3 Regulatory Approaches in Other Countries 7

3.1 Introduction 7

3.2 Findings 7

3.2.1 Europe 7

3.2.2 United States of America 8

3.2.3 Cross-border aspects 8

3.3 Conclusions 8

4 The Potential Role of Health Impact Assessment in Regulation of UGEE 10

4.1 Introduction 10

4.2 Case Study Analysis 10

4.2.1 Case study analysis summary 10

4.3 Findings 12

4.4 Conclusions 13

5 Best Practice for UGEE Projects/Operations 15

5.1 Introduction 15

5.2 Findings 15
5.3 Conclusions 16
6 Case Studies of Public Engagement in UGEE 17
6.1 Introduction 17
6.2 Method 17
6.3 Case Study Analysis 17
6.4 Findings 17
6.4.1 Scope 17
6.4.2 Duration and timing 17
6.4.3 Stakeholders and consultees 18
6.4.4 Process design and delivery 18
6.4.5 Process evaluation 18
6.5 Conclusion 19
7 Conclusions 20
References 21
Abbreviations 22
Glossary 23

List of Tables and Boxes

Tables

Table 2.1.	Summary of where key EU legislation may impose requirements during the lifecycle of a UGEE project	4
Table 2.2.	Mapping of UGEE Stages used in Project B to those used in Project C	5
Table 4.1.	Overview of HIA case studies	11
Table 4.2.	Scope of HIA case studies	12

Boxes

Box 4.1.	Guiding principles for HIA of UGEE in Ireland and Northern Ireland	13

Executive Summary

Unconventional gas exploration and extraction (UGEE) involves hydraulic fracturing 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 sandstone. The Environmental Protection Agency (EPA), the Department of Communications, Energy and Natural Resources (DCENR) and the Northern Ireland Environment Agency (NIEA) awarded a contract in August 2014 to a consortium led by CDM Smith Ireland Limited to carry out a 24-month research programme looking at the potential impacts on the environment and human health of UGEE projects and operations (including construction, operation and aftercare).

The UGEE Joint Research Programme (JRP)[1] is composed of five interlinked projects and involves field studies (baseline monitoring of water and seismicity), as well as an extensive desk-based literature review of UGEE practices and regulations worldwide. The UGEE JRP has been designed to produce the scientific basis that will assist regulators – in both Ireland and Northern Ireland – in making an informed decision about whether it is environmentally safe to allow hydraulic fracturing. As well as research in the island of Ireland, the UGEE JRP is looking at, and collating evidence from, other countries.

This report summarises the findings of Project C, the overall purpose of which was to provide evidence to support the future development of appropriate regulatory requirements and to identify operational best practice for environmental protection in the context of the island of Ireland. Project C was undertaken as five discrete tasks, described below.

Task 1: an overview of the European Union (EU) environmental legislation applicable to UGEE projects/operations. This task assessed EU legal instruments in terms of the extent to which they address environmental risks from UGEE. It found a comprehensive EU framework but also potential gaps, as most directives and regulations do not specifically address UGEE projects. This legislation has been implemented on the island of Ireland and forms the regulatory framework for oil and gas activities, including UGEE. The legislative framework does not explicitly address the deep underground environment. The European Commission (EC) Recommendation on minimum principles for the exploration and production of hydrocarbons (such as shale gas) using high-volume hydraulic fracturing indicates how gaps should be addressed. The EC is reviewing the scope of the best available techniques (BAT) reference document (BREF) regarding the Mining Waste Directive and is also considering the development of a BREF focused on hydrocarbon exploration and production that would encompass UGEE.

Task 2: a review of the regulatory approaches of other countries. Regulatory approaches in Denmark, Germany, the United Kingdom (UK) and the United States of America (USA) (Pennsylvania and Colorado) were reviewed. It was found that an EU-wide approach to well integrity standards and compulsory Environmental Impact Assessment (EIA) would be of benefit. Specific legislation would clarify issues where variation in interpretation across Europe may lead to different approaches. Public engagement may need development in the EU countries analysed (except Denmark, where EIA, which necessitates public consultation, is compulsory for UGEE). The US states provide examples of how a mature, rule-based system leads to specific controls and guarantees related to UGEE; however, it is inefficient because each state has different controls, requirements and competent authorities. The UK “roadmap” of the permitting and permissions process for exploratory work in oil and gas development onshore was found to be a beneficial guide.

Task 3: an assessment of the potential role of Health Impact Assessment (HIA) in the regulation of UGEE projects/operations. HIA provides a framework for the assessment of the potential effects of UGEE on the health of a population and the distribution of those effects. Case study analysis found that HIA can raise awareness among stakeholders of health implications and be an aid to transparent decision-making. It also ensures that assessments are evidence based. HIA can be a tool to engage stakeholders and support the identification of mitigation measures. A potential

1 www.ugeeresearch.ie

disadvantage of HIA is the absence of a legal basis, which may limit its influence. HIA can also be resource intensive and have a long duration. There is also limited and mixed experience of HIA on the island of Ireland and a lack of baseline data. The need for HIA for UGEE requires careful consideration; it may not be appropriate in all circumstances. It is also of note that there may be duplication between HIA and other types of assessment such as EIA, which should be avoided where possible.

Task 4: identifying best practice for UGEE projects/ operations. The regulatory enforcement requirements and best operational practices for UGEE projects and operations in Ireland and Northern Ireland were examined. Extensive use was made of an earlier study for the EC, which identified 237 risk mitigation measures. The analysis of measures considered whether they were definitely required by EU legislation or only may be required. It also considered whether regulation on the island of Ireland would definitely require some measures that only may be required by EU legislation. Those measures not definitely required by EU or island of Ireland legislation but which may be required could be applied through land use planning; petroleum authorisation or licensing conditions issued by DCENR (Ireland) and the Department of Enterprise, Trade and Investment (Northern Ireland); and conditions set in EPA licences (Ireland) or environmental permits and licences (Northern Ireland). Such measures may cover discharges to groundwater; water abstraction; waste management; pollution prevention; radioactive substances; protection of conservation areas; and typical industry practice, which would include measures likely to be adopted by operators regardless of legislation or regulatory requirements. A work programme for each stage of UGEE projects and operations, as required in the UK, is a potentially useful means of incorporating specific conditions included in, for example, planning permission. Best-practice guidance should be adopted or developed for UGEE operations in Ireland. The guidance should, as a minimum, address all the points raised in the EC Recommendation.

Task 5: public engagement. Case studies of public engagement processes for UGEE projects were reviewed to identify good practice and potential areas for enhancing engagement. The key findings were that the geographical scope, duration and scale of the consultation should be relevant to the scale of the plan or programme being consulted on; stakeholder input is required at all stages; a broad range of stakeholders and consultees should be engaged; the consultation process should be managed by advocates of the consultation and engagement process; and evaluation of the consultation process needs to be an integral part of the whole process and should be continuous and responsive to change.

1 Introduction

1.1 Background

Unconventional gas exploration and extraction (UGEE) involves hydraulic fracturing 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 sandstone. The Environmental Protection Agency (EPA), the Department of Communications, Energy and Natural Resources (DCENR) and the Northern Ireland Environment Agency (NIEA) awarded a contract in August 2014 to a consortium led by CDM Smith Ireland Limited to carry out a 24-month research programme looking at the potential impacts on the environment and human health of UGEE projects and operations (including construction, operation and aftercare).

The UGEE Joint Research Programme (JRP) is composed of five interlinked projects and involves field studies (baseline monitoring of water and seismicity), as well as an extensive desk-based literature review of UGEE practices and regulations worldwide.

- Project A1 (Groundwater, Surface Water and Associated Ecosystems) dealt with the baseline characterisation of groundwater, surface water and associated ecosystems, which is required to enable potential impacts to be assessed.
- Project A2 (Seismicity) dealt with the baseline characterisation of seismicity, which is required to enable potential impacts to be assessed.
- Project A3 (Air Quality) dealt with the requirements and need for additional air baseline monitoring (frequency, location and types of pollutants to be covered) in the context of environmental impact statements.
- Project B (UGEE Projects/Operations: Impacts and Mitigation Measures) covered the identification and a detailed examination of the potential impacts on the environment and human health of UGEE projects/operations, 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.
- Project C (Regulatory Framework for Environmental Protection) aimed to identify all regulatory requirements, including gaps in existing regulations and best operational practices associated with the establishment and operation of UGEE projects/ operations in an island of Ireland context.

The UGEE JRP has been designed to produce the scientific basis that will assist regulators – in both Ireland and Northern Ireland – in making an informed decision about whether it is environmentally safe to allow hydraulic fracturing. As well as research in Ireland, the UGEE JRP is looking at, and collating evidence from, other countries.

1.2 Aims and Objectives of Project C

The aim of Project C is to progress the identification of regulatory requirements and the identification of operational best practice for environmental protection in the context of the island of Ireland. This was achieved through the following scope of work:

- Task 1: provision of an overview of European Union (EU) environmental legislation applicable to UGEE, including legislation that relates to projects and operations from the planning of to the cessation of activities, including aftercare requirements.
- Task 2: examination of the regulatory approaches of other countries that have experience with UGEE.
- Task 3: examination of the potential role of Health Impact Assessment (HIA) in the regulation of UGEE projects and operations, based on experiences in other countries, and formulation of recommendations on developing an HIA protocol in the island of Ireland context.
- Task 4: examination of best practice for UGEE projects and operations through examining regulatory requirements and best practices in relation to aspects such as water resource management; waste management; emissions control; risk quantification and management; avoidance or mitigation of detrimental seismic events; use of chemicals;

well construction; well and site remediation; air emissions management; and financial provisions.

- Task 5: examination of public engagement in the context of UGEE through assessment of case studies of public engagement in UGEE projects and operations (or other similar projects) to identify best practices and make recommendations on the island of Ireland's approach.

1.3 Methodology and Information Sources

The preparation of *Final Report 5: Regulatory Framework for Environmental Protection* (and, by extension, this summary report) involved desk-based work, including:

- a review and assessment of the key aspects of the EU and island of Ireland legislation potentially related to UGEE;
- case study analysis of:
  - how different countries regulate UGEE
  - the application of HIA
  - public participation;
- a literature review to support the analysis of the use of HIA;
- a review of enforcement and best operational practice guidance for UGEE operations.

2 The European Environmental Legislative Framework Applicable to UGEE

2.1 Introduction

Task 1 was an overview of the EU environmental legislative framework applicable to UGEE projects and operations. It included an assessment of key legal instruments of the existing *acquis communautaire* (i.e. the accumulated legislation, legal acts and court decisions that constitute the body of EU law) in terms of the extent to which they address the environmental risks associated with UGEE.

The starting point for the regulatory analysis was the European Commission (EC) Recommendation (2014/70/EU) on minimum principles for the exploration and production of hydrocarbons (such as shale gas) using high-volume hydraulic fracturing of 22 January 2014 (the Recommendation) (EC, 2014). The Recommendation is not legally binding on Member States or operators; however, the minimum principles are to be applied as a common basis for hydrocarbon exploration and production activities in the EU that may involve the use of high-volume hydraulic fracturing (HVHF). The Recommendation establishes minimum requirements and is complementary to the *acquis communautaire*.

For the purposes of the analysis, the lifecycle of a UGEE project was divided into stages because of the different scales and types of activity involved at each stage. These were:

- pre-development;
- exploration;
- pad, infrastructure and wellhead development;
- production; and
- decommissioning, closure and post-closure.

The analysis then mapped where key items of the EU *acquis* may impose requirements for each of these stages (Table 2.1).

Table 2.2 maps the stages of UGEE development used in Project C to those used in Project B. In general, the same terminology has been used; however, there are some variations that reflect the emphasis on operations in Project B and on regulatory frameworks in Project C.

2.2 Findings

The review found that there is a comprehensive framework at EU level addressing UGEE activities from the planning process up to and including the closure/decommissioning phase. As UGEE is an activity that has the potential to have a significant impact on the environment, it is subject to requirements for the adoption of mitigation measures in various articles of legislation [e.g. the Strategic Environmental Impact Assessment Directive (SEAD), the Environmental Impact Assessment Directive (EIAD), the Mining Waste Directive (MWD), the Water Framework Directive (WFD) and the Groundwater Directive (GWD)]. This legislation has been implemented on the island of Ireland and forms the regulatory framework for oil and gas activities, including UGEE. There are, however, potential gaps in the scope of the EU *acquis* relating to the environmental risks presented by UGEE, as most directives and regulations do not specifically address UGEE projects and thus do not impose specific measures or requirements for these types of projects. In addition, the legislative framework does not explicitly address the deep underground environment and, therefore, may not adequately cover the geological, hydrogeological and induced seismicity aspects of UGEE.

In view of this, the EC published its Recommendation on minimum principles (EC, 2014). Member States should refer to the Recommendation where particular issues or risks associated with UGEE are not specifically addressed by or are subject to interpretation under the EU legislative framework. To ensure “harmonised provisions for the protection of human health and the environment apply across all Member States”, the Recommendation introduced an overarching framework that can be referred to by Member States on a voluntary basis where gaps in the legislation emerge. As the Recommendation is non-binding, the gaps in the EU legislative framework need not

Table 2.1. Summary of where key EU legislation may impose requirements during the lifecycle of a UGEE project

Stage	Description and activities	UGEE Recom	BPR	EIAD	ELD	GWD	HD/BD	HLD	IED	MWD	REACH	SEAD	Seveso II and III	SHIPWEI	WFD
Pre-development	Preparation and planning	■		■		■	■					■	■		■
	Studies	■		■		■	■					■	■		■
	Licence and permit applications	■		■		■	■					■	■		■
	Consultations	■		■		■	■					■	■		■
Exploration	Identification of resource through review of information									■				■	■
	Exploration licensing									■				■	■
	Non-intrusive exploration (no drilling) to understand underground environment									■				■	■
	Intrusive exploration (with drilling) to collect core samples and evaluate hydrocarbon presence/productivity									■				■	■
Appraisal	Mobilisation, well pad construction, drilling, casing installation, well completion/fracturing, flowback management, flow testing	■	■	■	■	■	■	■		■	■			■	■
	Evaluation of technical and economic viability	■	■	■	■	■	■	■		■	■			■	■
	Development of plans for production and associated permit and licence applications	■	■	■	■	■	■	■		■	■			■	■
Development and Production	Multiple well pad construction, drilling, casing installation, well completion/fracturing, flowback management	■	■	■	■	■	■	■	■	■	■		■	■	■
	Infrastructure development	■	■	■	■	■	■	■	■	■	■		■	■	■
	Gas production	■	■	■	■	■	■	■	■	■	■		■	■	■
Decommissioning/ closure/post-closure	Decommissioning of equipment and infrastructure	■		■	■	■	■		■	■				■	■
	Plugging of wells	■		■	■	■	■		■	■				■	■
	Removal of well pads	■		■	■	■	■		■	■				■	■
	Monitoring	■		■	■	■	■		■	■				■	■

Notes: Mid-blue shading indicates where key EU legislation may impose requirements during the lifecycle of a UGEE project. For definitions of abbreviations, refer to the abbreviations list; full details of directives and other regulations referred to are provided in the glossary.

Table 2.2. Mapping of UGEE Stages used in Project B to those used in Project C

Project B		Project C	
Stage	**Activities**	**Stage**	**Activities**
Pre-development: exploration, well pad identification and initial site access	Site identification and selection Site characterisation (baseline conditions for air, water, land, geology/deep-ground conditions) Initial evaluation of potential environmental impacts Initial development of geological conceptual model and geological risk assessment Drilling of exploratory boreholes for evaluation of geology and the reserve Seismic surveys Obtaining development and operation permits Exploratory drilling is performed to identify if gas can be produced profitably May include pad construction and site preparation (e.g. construction of roads and water storage structures)	Pre-development	Preparation and planning Studies Licence and permit application Consultations
		Exploration	Identification of resource through review of information Exploration licensing Non-intrusive exploration (no drilling) to understanding underground environment Intrusive exploration (with drilling) to collect core samples and evaluate hydrocarbon presence/productivity
Well design and construction, hydraulic fracturing and well completion	Pilot well drilling Initial horizontal wells drilled to determine reservoir properties and required well completion techniques Further development of geological conceptual model following test fractures Wellhead and well design and construction (drilling, casing, cementing, integrity testing) Multi-stage hydraulic fracturing (injection of fracture fluid and management of flowback and produced water and emissions) Well completion	Appraisal	Mobilisation, well pad construction, drilling, casing installation, well completion/ fracturing, flowback management, flow testing Evaluation of technical and economic viability Development of plans for production and associated permit and licence applications
Production (gas extraction): the commercial production of shale gas	Well pad expansion for HVHF facilities including storage tanks, impoundments and secondary containment Provision and establishment of equipment, water and chemical additives at the site Horizontal drilling is followed by hydraulic fracturing and gas production	Development and production	Multiple well pad construction, drilling, casing installation, well completion/fracturing, flowback management Infrastructure development Gas production
Project cessation, well closure and decommissioning: the well is decommissioned once it reaches the end of its productive life	Sections of the well are filled with cement to prevent gas flow into water-bearing zones or the surface Well is capped Site returned to satisfactory state Post-completion monitoring	Decommissioning, closure and post-closure	Decommissioning of equipment and infrastructure. Plugging of wells Removal of well pads Monitoring

be dealt with by reference to the Recommendation and are “subject to open interpretation”. The requirement that the Recommendation be implemented at a national level within 6 months of publication was also a non-binding best-practice requirement.

The Recommendation leaves open the option to adopt legally binding requirements in the short term. The EC has indicated that it may decide to put forward legislative proposals with legally binding provisions on the basis of the results of a review. The EC has also initiated the development of an overall best available techniques (BAT) reference document (BREF) on hydrocarbon exploration and production that addresses UGEE practices.

Some of the EU regulations and directives relevant to the regulation of UGEE relate to specific aspects of operations or protect individual parts of the environment, while others apply more widely to the operation of a facility (i.e. they have a horizontal nature).

Of particular importance at the plan and project levels are the EIAD, the Birds and Habitats Directives, and the MWD, as these determine the requirements for operational permits and for conditions throughout the project lifecycle, from pre-development to closure/

decommissioning. In addition, requirements for zoning or buffer zones may be implemented indirectly through a Strategic Environmental Assessment (SEA) process as well as through a project-specific Environmental Impact Assessment (EIA). The WFD is also important because of its potential to determine operational practice within permits and impose regulatory and economic obligations in relation to activities such as water abstraction. Currently, there is no licensing system in place for water abstraction in Ireland except where an abstraction is connected with Integrated Pollution Control (IPC)/ Industrial Emissions Directive (IED) licensed activities. This is a gap in the legislation.

The Aarhus Convention is as relevant to UGEE as it is to any other activity that is likely to affect the environment. The SEAD and the EIAD incorporate provisions for public participation, to ensure early and effective engagement with the public in relation to environmental decision-making. The EIAD, the Waste Directive (WD) and the IED also incorporate access to justice provisions, providing members of the public and environmental non-governmental organisations with a right of access to a court or other judicial tribunal to appeal or review environmental decision-making.

3 Regulatory Approaches in Other Countries

3.1 Introduction

Task 2 was a review of case studies of the regulatory approaches relevant to UGEE in three EU Member States (Denmark, Germany and the United Kingdom) and in the United States of America (USA) (in Colorado and Pennsylvania).

The value of the analysis of EU countries is that they have to comply with the common EU legislative framework also governing Northern Ireland and Ireland. Regulatory practice in these countries will be affected by decisions taken, or specific requirements drafted, at EU level.

Most of the regulations that apply to conventional activities also apply to unconventional sources. EU Member States with a long history of conventional hydrocarbon exploitation have a mature and reasonably comprehensive legislative framework that is able to address a number of issues associated with UGEE. There are, however, a number of differences between conventional hydrocarbon exploration and production on the one hand and UGEE on the other that can result in gaps in existing legislation, principally:

- The extensive use of horizontal drilling to access the resource.
- The use of HVHF to open up the rock to release oil or gas. This requires large volumes of water and can generate large volumes of waste water.
- The large area of the resource and the large area over which exploitation takes place.
- The greater density of the wells required to exploit a resource.

Two US states were selected for review because the primary legislation affecting UGEE in the USA is made at state rather than federal level (hence each state has a different approach to regulating UGEE). UGEE is also a mature industry in these states and, therefore, regulation is well developed compared with other countries.

3.2 Findings

3.2.1 Europe

Within the EU countries, there are various practices that could be considered best practice and that go beyond what is required by the relevant EU directives:

- **Rural zone permit system (Denmark)**, which includes a legally binding plan to protect rural areas from significant changes that may arise from UGEE activities. It provides for a consultation process and public participation by affected stakeholders. Ireland could benefit from this additional level of protection and consideration for rural populations, given the rural characteristics of the proposed exploration areas.
- **Fracturing plan (UK and Denmark)** that provides a means of setting out the requirements for equipment, materials and issues arising from hydraulic fracturing. This can be used to set out mitigation measures to reduce the environmental and health-related risks of UGEE. Such a plan may be useful in communicating how risks are managed.
- **Public participation (Denmark):** local authorities provide public and stakeholder participation within a permitting system. In addition, although local authorities grant licences, they must be approved by a parliamentary committee. This provides both local and state-wide protection for the environment and the population. Landowners must agree to activities conducted on their property and the public must be informed of incidents or inspections.
- **Baseline monitoring (UK and Denmark)**, including monitoring and reporting of water quality, air quality, noise and seismicity.
- **Monitoring plan (Denmark):** when hydraulic fracturing is used, a monitoring plan is included in the EIA.
- **Operational plan, licence and separate permits for each stage (Germany and Denmark):** this ensures that there is continuous monitoring of how activities are conducted. The authorities ensure

that operators comply with requirements that are specific to each stage of development and can reject planning and permit applications if operators do not comply with good practice. In addition, this monitoring ensures that operators comply with the agreed timescales.

- **EIA for all hydraulic fracturing (Denmark, proposed in Germany).**
- **SEA for licensing rounds (UK)**, which considers the activity at a national level and takes into account synergies and the combined effects of all the activities in all the available concessions, which is essential to take preventative action. Individual EIAs may be suitable at local/regional level, but they may disregard cumulative effects. SEA also promotes early public engagement. Note that Northern Ireland and Ireland do not operate licensing rounds.
- **Regulatory roadmap (UK):** the Department of Energy and Climate Change (DECC) roadmaps (DECC, 2013) provide clarity on regulatory requirements at different stages for operators, regulators and other stakeholders.
- **Induced seismicity management (UK):** the use of a simple "traffic light" system provides a clear method of managing and mitigating risks of seismic activity.
- **Financial guarantee and fund:** these provide financial guarantees in case of an adverse event. The specific requirements for financial guarantees are not prescribed in the EU countries. In contrast, in Colorado and Pennsylvania there are specific and detailed requirements based on the activity undertaken and/or equipment used.

3.2.2 United States of America

Best practice identified in Colorado and Pennsylvania included:

- **Baseline monitoring (Colorado)** in advance of drilling, which may include water quality, air quality, noise and seismicity.
- **Comprehensive drilling plan (voluntary) (Colorado):** to reduce the administrative burden, all the documentation provided by operators when the plan is submitted will not be requested again by the authorities.
- **Water management plan (Pennsylvania):** requires approval from the authorities and ensures that operators' withdrawals from streams and groundwater are sustainable. It also includes a reuse plan for fluids used in hydraulic fracturing operations.
- **Buffer and setbacks (Colorado and Pennsylvania):** each state sets setback and zoning restrictions. These focus on protection of groundwater, but they are rule-based rather than risk-based.
- **Liability as an incentive (Pennsylvania):** baseline monitoring is not specifically required but is usually conducted by companies to reduce the risk of liability.
- **More mature reporting system (Colorado and Pennsylvania):** these states have been some of the more active in the USA and have mature conventional and unconventional hydrocarbon industries. The basis of the system is a set of prescriptive rules.
- **Financial guarantees (Colorado and Pennsylvania):** operators are required to give financial guarantees related to a variety of activities, from which they are released when the well is properly plugged or transferred.

The review found that regulatory structures in Colorado and Pennsylvania have been developed to address gaps in their regulatory frameworks and address issues specific to UGEE that were not otherwise addressed.

3.2.3 Cross-border aspects

Dedicated measures were not identified for addressing cross-border issues between Ireland and Northern Ireland or between other countries. Implementation of the EIAD, the SEAD, the WFD and the Habitats Directives necessitates, at the very least, transboundary consultation where impacts have the potential for effects of a transboundary nature. Specific cross-border procedures are not prescribed between Ireland and Northern Ireland; cross-border processes are part of the normal statutory consultation process.

3.3 Conclusions

An EU-wide approach to well integrity standards and compulsory EIA would be of benefit for a suitable implementation of the industry in the EU. This would imply common environmental standards and a level playing field across Europe. Specific legislation would clarify

certain issues where interpretation across Europe could lead to different approaches (e.g. with regard to fluid re-injection). Public engagement may need development in the EU countries analysed (except Denmark, where EIA, which necessitates public consultation, is compulsory for UGEE). If experts, activists and the general public are able to express their views and learn more about the advantages and drawbacks of the technologies involved in UGEE, the whole process will be better understood and companies will also be incentivised to disclose information on how the technology works and the chemicals that are used.

Colorado and Pennsylvania provide good examples of how a more mature, rule-based system leads to specific controls and guarantees related to UGEE. However, it is inefficient to have states with slightly different controls and requirements. For instance, the zoning restrictions of Colorado and Pennsylvania provide a similar outcome but are not exactly the same, which has to be taken into account by companies that operate in various US states. Litigation and administrative procedures may also be inefficient if each US state has its own rules, methods of enforcement and competent authorities.

The DECC in the UK has issued a “roadmap” document for Northern Ireland (and for other UK countries) that is intended as a first point of reference for anyone seeking to understand the permitting and permissions process for exploratory work in onshore oil and gas development (DECC, 2013). It is noted that the roadmaps were produced to clarify requirements across the UK. If it were the case that Ireland developed a position supporting UGEE in the future, it might be beneficial for a similar roadmap and guide to be developed to inform those interested in understanding the regulatory and permitting process.

4 The Potential Role of Health Impact Assessment in Regulation of UGEE

4.1 Introduction

Task 3 considered the extent to which HIA is an appropriate tool to assess the health impacts that may arise from UGEE. The examination considered whether the application of HIA to UGEE projects on the island of Ireland would be beneficial; when HIA might be undertaken; who might be responsible for HIA; and the scope of HIA, including specific methodological requirements in the context of UGEE.

HIA is "a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population and the distribution of those effects within the population" (WHO and ECHP, 1999). This means that HIA is a management tool used to assess complex societal decisions that may have health implications and to provide options for managing health effects.

HIA can contribute to improved health by raising awareness among decision-makers of the relationship between health and the physical, social and economic environments; demonstrating how a proposal may affect the health of a population; and providing recommendations on how a proposal could be modified to maximise opportunities for health gain and minimise chances of health loss (IPHI, 2009).

HIA is not a statutory requirement in Northern Ireland or Ireland and the need for such an assessment of UGEE must be considered in the context of the EU legislative framework, in particular the EIAD and the SEAD. These already require an assessment of the impacts of proposed plans and projects on topics that include human health. In addition, there are a range of challenges to successful and effective HIA including the resources required; data availability; and lack of knowledge and expertise.

In addition to HIA, other tools are available that could be used to identify and assess the health impacts of UGEE, including EIA and SEA.

The evaluation was based on a high-level review of literature on the potential health impacts of UGEE; an overview of the regulatory framework that relates to health impacts arising from UGEE; case study analysis of health assessments (both HIA and non-HIA) undertaken in respect of UGEE to help determine the scope and effectiveness of HIA and to identify lessons that could be applied to the context of the island of Ireland; and a review of existing guidance on HIA in Ireland and Northern Ireland.

4.2 Case Study Analysis

Seven case studies were considered as part of the analysis. Case studies were sought that drew on experiences in the USA (where UGEE has advanced to the production stage and where potential health impacts have been experienced, measured and reported) and the UK (where the industry is in its infancy) at national, regional (i.e. basin) and local (i.e. project) levels. An overview of the case studies considered in the analysis, together with the rationale for their selection, is provided in Table 4.1.

The review identified only a limited number of examples of UGEE-related HIA. It was, therefore, necessary to expand the reach of the case study analysis to include other assessments of UGEE that considered health impacts but which were not formal HIA (such as SEA, EIA and public health reviews).

In Ireland and Northern Ireland, the practice of HIA is limited and the process underdeveloped, which may undermine its robustness and effectiveness when applied to UGEE. The need for separate HIA in the context of UGEE, therefore, requires careful consideration; it may not be appropriate in all circumstances.

4.2.1 Case study analysis summary

Table 4.2 summarises the health issues considered in the case studies.

The health issues or hazards most commonly considered in the case studies were air quality, water quality (including naturally occurring radioactive materials),

Table 4.1. Overview of HIA case studies

Case study[a]	Year	Commissioning body (author)	Scale	Assessment type (e.g. HIA, SEA or EIA)	Rationale for selection
1. Public Health England (PHE) Review of the Potential Public Health Impacts of Exposures to Chemical and Radioactive Pollutants as a Result of the Shale Gas Extraction Process	2014	PHE	National	Public health review	This was not a formal, comprehensive HIA, but it is an example of a review of health impacts at a national level. It considered the potential public health impacts of direct emissions of chemicals and radioactive material from the extraction of shale gas. Other aspects [e.g. climate change and greenhouse gas emissions, water resources, nuisance issues, traffic (apart from vehicle exhaust emissions), occupational health and visual impact] were not considered. The review did not consider the socio-economic benefits or impacts of shale gas extraction.
2. Strategic Environmental Assessment (SEA) for Further Onshore Oil and Gas Licensing	2013	DECC (Amec Environment & Infrastructure UK Ltd)	National	SEA	An example of how health impacts are considered at the national/strategic scale and at the plan level as part of the SEA process.
3. Marcellus Shale Public Health Study	2014	Maryland Department of Health and Mental Hygiene	Regional	Public health study	An example of an assessment of health impacts at a regional level. Widely cited in academic literature.
4. New York State Public Health Review	2014	New York State Department of Health	Regional	Public health review	An example of an assessment of health impacts undertaken at a regional level. Widely cited in academic literature.
5. HIA of Proposed Shale Gas Exploration Sites in Lancashire	2014	Lancashire County Council	Local	HIA	A project-level example of HIA undertaken by the consenting authority.
6. Roseacre Wood and Preston New Road EIAs	2014	Cuadrilla Resources (Arup)	Local	EIA	An example of how health impacts are taken into account in EIA.
7. Battlement Mesa HIA (2nd Draft)	2011	Garfield County Board of County Commissioners (Colorado School of Public Health)	Local	HIA	An example of HIA at a local level on behalf of a regulator.

[a]**NORM, naturally occurring radioactive materials.**

Table 4.2. Scope of HIA case studies

Case study	Air quality	Water/soils	NORM[a]	Transport	Noise	Greenhouse gases	Seismicity	Lighting	Community facilities	Physical activity	Economy/ employment	Social and mental Health	Occupational health
1. PHE Review of the Potential Public Health Impacts of Exposures to Chemical and Radioactive Pollutants as a Result of the Shale Gas Extraction Process	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
2. DECC SEA for Further Onshore Oil and Gas Licensing	Y	Y	Y	N	Y	N	N	Y	N	N	N	Y	Y
3. Marcellus Shale Public Health Study	Y	Y	Y	Y	Y	N	Y	N	Y	N	N	Y	Y
4. New York State Public Health Review	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N
5. HIA of Proposed Shale Gas Exploration Sites in Lancashire	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N
6. Roseacre Wood and Preston New Road EIAs	Y	Y	Y	N	Y	N	N	N	N	Y	N	Y	N
7. Battlement Mesa HIA (2nd Draft)	Y	Y	N	Y	Y	N	N	Y	Y	N	Y	Y	N

Note: Green shading indicates that the health issue is considered in the case study.

PHE, Public Health England.

noise, and social and mental health. Those topics that were less frequently considered were economic and employment impacts and physical activity.

4.3 Findings

The range of potential health impacts associated with UGEE is broad and cuts across many health determinants. Compared with many other types of development, UGEE projects are complex; they use technologies and involve activities that are novel in the Irish context and that are the subject of public concern. There are information gaps relating to the health impacts of UGEE projects. This suggests a lack of identification and assessment of the potential health impacts of UGEE.

There is a regulatory framework at EU and national levels to manage health impacts arising from UGEE projects, through SEA and EIA. Nonetheless, there is uncertainty with regard to the extent to which SEA and EIA are the most appropriate tools to assess the full range of health impacts that could arise from UGEE. On the island of Ireland, onshore UGEE licence applications are made on a case-by-case basis, so UGEE health impacts would not be considered at the plan (SEA) level. This implies that there is a case for the application of HIA in the context of UGEE on the island of Ireland.

The case study analysis found that HIA could:

- raise awareness of the health implications of UGEE among decision-makers, developers/operators, stakeholders and communities;

- aid transparency in the decision-making process;
- ensure that assessments of health impacts are evidence based;
- act as a vehicle for community and stakeholder engagement on health issues; and
- support the identification of measures for mitigating adverse health impacts and enhancing benefits associated with UGEE.

The review identified a number of potential disadvantages or challenges associated with HIA. In particular, in the absence of a legal requirement to undertake HIA, any assessment would be on a voluntary basis and its capacity to influence decisions may be limited. In addition, HIA can be resource intensive, can extend over prolonged periods and may result in the duplication of EIA.

There are a number of important methodological limitations to be addressed in order to ensure that health assessments are effective. In particular, the absence of data (including environmental baseline information) and information on health impacts arising from UGEE projects may be addressed only as projects come forward and schemes are monitored. Any HIA will need to be proportionate to the data and information available.

Existing guidance on HIA is generic both on the island of Ireland and in the oil and gas sector. The complexities of UGEE and the range of potential health impacts mean that there may be merit in developing sector-specific guidance on the application of HIA to UGEE. This guidance could be prepared with input from other regulatory, government and industry stakeholders and could specifically seek to address issues relating to assessment scope, baseline data gathering and data availability, setting out a common approach to the identification of significant health impacts, whether through a standalone HIA or an integrated impact assessment.

Based on the evaluation of the role of HIA in respect of UGEE, there are a number of possible approaches for taking forward health assessment on the island of Ireland. These include:

1. **No additional requirement for HIA for UGEE:** the assessment of health impacts would be through SEA (should licensing plans come forward) and EIA. This would probably require additional sector-specific guidance to ensure that assessments adequately consider health issues. This guidance should seek to ensure that HIA principles are incorporated into the SEA/EIA processes.
2. **Non-mandatory recommendation for HIA:** HIA would be recommended and encouraged through guidance, which could set out when HIA should be undertaken, taking into account the scale and location of proposals.
3. **Mandatory requirement for HIA** as a licence requirement: this approach might still require sector-specific guidance on HIA in the context of UGEE to ensure a consistent approach.

A number of guiding principles for HIA have been identified by the review (Box 4.1) and these might provide the basis for a protocol on the island of Ireland.

4.4 Conclusions

At this early stage in the development of UGEE and HIA in Ireland, incorporating HIA within EIA as a best-practice requirement is likely to be the best approach, as this will allow developments in the understanding of UGEE and in the practice of HIA to be accommodated. In addition, developments in HIA for UGEE in other countries should be tracked and the Irish approach adapted where improvements are identified.

Box 4.1. Guiding principles for HIA of UGEE in Ireland and Northern Ireland

At what scale should HIA be undertaken? HIA can be applied at the plan level or at the project stage. In the context of the island of Ireland, this would be likely to include sub-regional or basin-level assessments and individual project assessments.

When should HIA be undertaken? Prospective HIA should be undertaken in all cases; however, ongoing monitoring and assessment of health impacts during operation and at completion should be undertaken.

Box 4.1. Continued

Who should be responsible for HIA? The responsibility for HIA will be dependent on the plan or project. At the project stage, there is value in HIA being undertaken by the developer/operator and, potentially, independently by the regulator (on a voluntary basis). It is important that the assessment is undertaken by a competent specialist.

Who should be involved in the HIA process? Key stakeholders include public health bodies, potentially affected communities, relevant regulators and operators/developers. Consideration should be given to the establishment of a steering or advisory group to guide the HIA process from the outset.

What impacts/issues should HIA consider? The topics to be considered in HIA should be determined through a robust scoping process, which should include engagement with key stake holders, a review of the most recently available evidence on UGEE health impacts, and community profiles. The following topics are likely to be relevant: air quality impacts; drinking water contamination and reduced availability; surface water contamination and run-off; noise; mental health impacts; climate change effects; socio-economic impacts (such as job creation, pressure on services and facilities, crime and increased traffic); occupational impacts; and cumulative impacts.

HIA should consider health impacts across the principal stages of the lifecycle of an UGEE project.

It will be important to take into account resource availability and the timing of any assessment to ensure that the scope of the HIA is proportionate.

What should be the approach to HIA? The approach to HIA should follow the six stages outlined in the Institute of Public Health Ireland Guidance: (1) screening; (2) scoping; (3) appraisal; (4) reporting; (5) supporting decision-makers; and (6) monitoring and evaluation. The assessment itself could rank risks using pre-defined criteria to identify the most significant health impacts. The findings of the assessment, including proposals for mitigation and enhancement measures, should be widely disseminated to ensure transparency and that subsequent monitoring is undertaken.

What are the likely data requirements for HIA? Assessments should be based on the most recently available evidence, including baseline information concerning the specific characteristics of potentially affected communities; existing research and academic literature concerning the health impacts of UGEE in other localities; and, where possible, quantitative data drawn from, for example, EIA. Engagement can also be a useful information source. Where information gaps are identified, specific monitoring may be required.

5 Best Practice for UGEE Projects/Operations

5.1 Introduction

This task examined regulatory enforcement requirements and best operational practices for UGEE projects and operations. The assessment of regulatory enforcement requirements and best operational practices for UGEE was carried out through:

- mapping and classification of enforcement requirements and best operational practice (collectively identified as measures) through links to Project B and Task 1 of Project C and by reference to a previous assessment by the EC;
- determination of whether these measures are definitely required or only may be required by the existing EU and island of Ireland regulatory framework;
- determination of which measures may be applied either through regulation (e.g. permit requirements) or typical industry practice;
- links to BAT requirements under the MWD and other directives; and
- links to the EPA's existing and possible future requirements for financial provision.

The work made extensive use of earlier work by Amec Foster Wheeler (2014) for the EC ('the EC study'). This work is particularly useful and authoritative because it:

- identified a comprehensive list of measures that might be used to mitigate the risks from UGEE;
- examined the regulatory framework for UGEE at EU level to determine which measures are definitely required and which only may be required by EU legislation; and
- examined which measures constitute typical industry practice and their likely rate of uptake.

The EC study was undertaken by a group that included experts in EU legislation and UGEE. It was subject to extensive review within the EC and by external peer reviewers before publication. The results of the work were mapped onto island of Ireland regulations to consider whether these impose additional requirements.

The regulation of UGEE on the island of Ireland has been considered with reference to the national legislation identified in Task 1 and specific guidance on the regulation of UGEE in Northern Ireland.

Additional guidance on the likely requirements to be met in order to gain permits and authorisations was taken from the Environment Agency for England's *Onshore Oil and Gas Exploratory Operations: Technical Guidance* (2013) and the Scottish Environmental Protection Agency's *Regulatory Guidance: Coal Bed Methane and Shale Gas* (SEPA, 2012). The Environment Agency guidance is in the form of a consultation draft and is likely to be revised following an extensive consultation process.

5.2 Findings

Enforcement requirements and best operational practice for UGEE, which have been collectively identified as measures, were established through links to Project B and Task 1 of Project C and by reference to the EC study. Consideration was given to which of these measures are *definitely* required and which *may be* required by EU and island of Ireland legislation.

Those measures that are not definitely required by EU or island of Ireland legislation but may be required for the regulation of UGEE could be applied through:

- land use planning;
- petroleum authorisation or licensing conditions issued by DCENR (Ireland) and the Department of Enterprise, Trade and Investment (Northern Ireland);
- conditions set in EPA licences (Ireland) or environmental permits and licences (Northern Ireland) covering:
  - discharges to groundwater
  - water abstraction
  - waste management
  - pollution prevention
  - radioactive substances
  - protection of conservation areas; and

- typical industry practice, that is, measures that are likely to be adopted by operators regardless of legislation or regulatory requirements.

Many of the risks posed by UGEE at the surface can be addressed by a combination of regulation and typical industry practice. However, the analysis found an absence of a coherent and comprehensive approach to a number of UGEE issues.

The review found that there is a lack of clarity regarding the effectiveness of parts of the existing EU legislative framework, notably:

- Mining waste, because there is no BAT guidance covering UGEE. The existing MWD BREF does not cover UGEE, although work is in progress to revise the MWD BREF and also to develop a new hydrocarbons BREF that encompasses both UGEE and conventional oil and gas. However, until the revised MWD BREF or hydrocarbons BREF is available, BAT is subject to interpretation by regulators and operators.
- Whether EIA is required or not.
- Protection of air and water.

There are potential gaps in EU and national legislation with regard to underground risks because these have not previously been considered in detail. The EC Recommendation (2014/70/EU) and emerging best practice attempt to cover these gaps, but there is no guarantee that the proposed approaches will be required by regulators or adopted by industry, resulting in uncertainty and a lack of confidence about whether or not environmental protection issues will be effectively and coherently addressed. In addition, although the Recommendation lays down minimum principles as a common basis for UGEE in the EU, it is not legally binding on Member States.

5.3 Conclusions

Many of the potential uncertainties arising from the legislation could be resolved through guidance that clearly identifies how the legislation will be applied. Best-practice guidance should, therefore, be adopted or developed for UGEE operations in Ireland. The guidance should, as a minimum, address all the points raised in the EC Recommendation and in this project.

6 Case Studies of Public Engagement in UGEE

6.1 Introduction

This task reviewed case studies of public engagement processes carried out for UGEE projects to identify good practice and potential areas for enhancing engagement. It included a description and comparison of the methods and processes employed in the case studies. In addition, the legislation relating to public consultation on the island of Ireland was summarised.

6.2 Method

The task was delivered through:

- An initial review of 10 public engagement processes carried out in Europe and North America followed by discussion of the processes with the project board. Five case studies representing a range of project types and consultation approaches were shortlisted for more detailed review and assessment.
- A detailed review and assessment of the shortlisted case studies. Where possible, the co-ordinators of the consultation processes were contacted and interviewed to obtain further information and review the successes and failures of the processes to help define good practice.
- A review of the application of the Aarhus Convention and of the EIAD and the SEAD to proposed plans and projects involving UGEE was undertaken. This considered the stages in the planning and consent application process at which public information and participation are required, and how these requirements can best be implemented in the context of the Irish national regulatory framework and the development of a public consultation strategy in Ireland.
- Comments on the draft report were accommodated as the report progressed to ensure that the requirements of the brief were met.

6.3 Case Study Analysis

The five case studies shortlisted for analysis (see *Final Report 5: Regulatory Framework for Environmental Protection,* Appendix C) had sufficient scope and detail with regard to public consultation processes in the context of UGEE projects and operations to provide a wide range of approaches and experience. The selected case studies were all based within the EU and subject to the same EU legislation. Good practice has been drawn out from each of the case studies through evaluation and comparison.

In four out of the five case studies, a regulatory requirement for public engagement strongly influenced the structure and parameters of the public consultation; however, best practice can be found in those processes that went beyond the regulatory requirements. The case study not subject to regulation (Helmholtz Centre; see *Final Report 5: Regulatory Framework for Environmental Protection* for details) provides an example of a consultation outside the parameters of regulatory requirements in which it appears that stakeholders were free to engage and the process allowed for a much longer consultation period, including a 1-year pre-study consultation period.

6.4 Findings

6.4.1 Scope

The case studies demonstrate that the geographical scope of the consultation should be relevant to the scale of the plan or programme being consulted on and may need to include stakeholders across administrative boundaries where the plans approach those boundaries.

6.4.2 Duration and timing

The consultation should be of a sufficient duration to allow effective engagement with stakeholders. Regulations provide a minimum duration, but longer consultation periods may have the advantage of allowing time to address initial questions and to refine the scope of the consultation. However, the consultation process also needs to be efficient and effective in conveying information to and from stakeholders, as well as transparent and supported by robust and impartial evidence.

The specification of regulatory requirements regarding the period for consultation is required for practical reasons, but the consultation period should be of a length that allows an effective opportunity for consultation. The duration and scale of the consultation should be related to the scale of the plan or project subject to consultation.

Because the topics and impacts being assessed will vary, the terms of reference and scope of the consultation should be formulated with input from stakeholders at the start of the process, rather than the terms and scope being imposed on them.

6.4.3 Stakeholders and consultees

Stakeholders, whether statutory or otherwise, should:

- vary in scale, from local to national;
- be a mixed and balanced group;
- cover a broad range of subject matter, both objective and subjective; and
- provide consultation responses that are material to the plan or programme.

Different stakeholders and groups are likely to have different roles in the consultation process and so the proportions of different types of stakeholders should be balanced. Those managing the consultation process, and therefore engaging with stakeholders, should be:

- experienced in consultation and moderation with regard to planning and delivering the process;
- accepted by the stakeholders; and
- advocates of the consultation and engagement process, rather than taking a stance on the subject matter or having specific points of view.

Stakeholders should be assessed to identify relationships, hidden agendas or history between stakeholders. Assessment of stakeholders will help to avoid conflicts during consultation on topics and issues not pertinent to the subject or process.

6.4.4 Process design and delivery

The timing and duration of the consultation should take into account the availability of consultees to respond effectively. The format of the consultation should be driven by the stakeholders and consultees and be responsive to their needs.

Consultation should be sought as early as possible so that the outcomes can influence and guide the plan or project as it progresses. It should identify issues of concern and provide robust and impartial evidence before an evaluation of such issues is undertaken. The process should give stakeholders ownership of the process, as this will build trust and commitment. The consultation should be used to inform the context of the process as well as to gain an understanding of the views of stakeholders.

Continued consultation throughout the process will promote further discussion and additional feedback.

It is advisable that, before granting any licensing option or exploration licence (particularly where such a grant is part of a broader licensing round), the DCENR (Ireland) should first carry out SEA of the proposed licensing programme and engage in early and effective public participation as part of this process. SEA at this stage ensures compliance with the public participation requirements under the Aarhus Convention and SEAD. In Northern Ireland, the absence of a licensing round means that SEA is unlikely to take place. Note that SEA applies at the plan or programme level, whereas EIA applies at the project level.

Under domestic legislation, DCENR (Ireland) may grant an exploration licence to an operator without first ensuring public participation and assessment in accordance with the EIAD. EIA is triggered when the operator submits a request to carry out specified activities, including well work and drilling. In certain circumstances, however, the grant of an exploration licence may be subject to the operator committing to a certain level of exploration activity under the licence. The environmental implications of such commitments should be assessed as part of the SEA process before the granting of individual exploration licences.

6.4.5 Process evaluation

Evaluation of the consultation process needs to be an integral part of the whole process. Evaluation should commence at the beginning of the process, run through delivery at appropriate points, and be performed and reported on at the conclusion. Adjustments to the

process should be made in response to this ongoing evaluation to optimise the process for all parties.

The evaluation should establish if the correct consultation techniques are being used and review their efficacy. The assessment of the effectiveness of the consultation process should examine whether or not the consulting organisation is achieving the overall aim of the consultation and also whether or not stakeholders' aspirations in relation to the consultation process are being met. These aims and aspirations are consultation process-related and should not be confused with whether stakeholders are for or against a proposal. Questions to be asked might include:

- Was it clear why the consultation was happening and how stakeholders' views would be taken into account?
- Were all relevant stakeholders involved, including hard-to-reach groups?
- Was there feedback to stakeholders that clarified how decisions and outcomes were reached?

Process evaluation outcomes should be made available to stakeholders and will provide information to improve the process as it progresses, as well as to inform future processes.

6.5 Conclusion

The task identified the requirements for effective public engagement with respect to UGEE. These should be taken into account when considering public engagement for UGEE plans and programmes in Ireland.

7 Conclusions

The gaps in legislation identified in Chapter 2 could be addressed through primary legislation or by adopting best practice (Chapter 4) as part of licensing or permit requirements for operators.

At this early stage in the development of UGEE and HIA in Ireland, incorporating HIA within EIA as a best-practice requirement is likely to be the best approach, as this will allow developments in the understanding of UGEE and in the practice of HIA to be accommodated. In addition, developments in HIA for UGEE in other countries should be tracked and the Irish approach adapted where improvements are identified.

Best-practice guidance should be adopted or developed for UGEE operations in Ireland. The guidance should, as a minimum, address all the points raised in the EC Recommendation.

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Abbreviations

BAT	Best available techniques
BD	Birds Directive
BPR	Biocidal Products Regulation
BREF	BAT reference document
DCCAE	Department of Communications, Climate Action and Environment
DCENR	Department of Communications, Energy and Natural Resources – Ireland
DECC	UK Department of Energy and Climate Change
DfE	Department for the Economy
EC	European Commission
EIA	Environmental Impact Assessment
EIAD	Environmental Impact Assessment Directive
ELD	Environmental Liabilities Directive
EPA	Environmental Protection Agency – Ireland
GWD	Groundwater Directive
HD	Habitats Directive
HIA	Health Impact Assessment
HLD	Hydrocarbon Licensing Directive
HVHF	High-volume hydraulic fracturing
IED	Industrial Emissions Directive
JRP	Joint Research Programme
MWD	Mining Waste Directive
PHE	Public Health England
SEA	Strategic Environmental Assessment
SEAD	Strategic Environmental Impact Assessment Directive
UGEE	Unconventional gas exploration and extraction
UGEE Recom	EC Recommendation (2014/70/EU) on minimum principles for the exploration and production of hydrocarbons (such as shale gas) using high-volume hydraulic fracturing
WFD	Water Framework Directive

Glossary

***Acquis communautaire* ("the *acquis*")**	The rights and obligations that EU countries share. Includes all EU treaties and laws, declarations and resolutions, and international agreements on EU affairs, as well as the judgments given by the Court of Justice. Candidate countries have to accept the *acquis* before they can join the EU and make EU law part of their own national legislation
Biocidal Products Regulation	Regulation (EU) No. 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (OJ L 167, 27.6.2012, p. 1–123)
Birds Directive	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. (OJ L 20, 26.1.2010, p. 7–25)
BREFs	BREFs are documents resulting from the exchange of information organised pursuant to Article 13 of the Industrial Emissions Directive. BREFs are drawn up for defined activities within a particular sector and describe, in particular, applied techniques, present emissions and consumption levels, techniques considered for the determination of BAT, and BAT conclusions, as well as any emerging techniques
Environmental Impact Assessment Directive	Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (OJ L 26, 28.1.2012, p. 1–21), as recently amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014
Environmental Liabilities Directive	Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage (OJ L 143, 30.4.2004, p. 56–75)
Groundwater Directive	Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (OJ L 372, 27.12.2006, p. 19–31)
Habitats Directive	Council Directive 1992/43/EC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.7.1992, p. 7–50)
Hydrocarbon Licensing Directive	Directive 94/22/EC of the European Parliament and of the Council of 30 May 1994 on the conditions for granting and using authorisations for the prospection, exploration and production of hydrocarbons (OJ L 164, 30.6.1994, p. 3–8)
Induced seismicity	Earthquake and tremor activity caused by human activity
Industrial Emissions Directive	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (OJ L 334, 17.12.2010, p. 17–119)
Mining Waste Directive	Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC (OJ L 102, 11.4.2006, p. 15–34)
REACH	Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No. 793/93 and Commission Regulation (EC) No. 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ L 396, 30.12.2006, p. 1–849)

Seveso II	Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances (OJ L 10, 14.1.1997, p. 13–33)
Seveso III	Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (OJ L 197, 24.7.2012, p. 1–37)
SHIPWEI	Council Directive 92/91/EEC of 3 November 1992 concerning the minimum requirements for improving the safety and health protection of workers in the mineral-extracting industries through drilling (eleventh individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) (OJ L 348, 28.11.1992, p. 9–24)
Strategic Environmental Impact Assessment Directive	Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (OJ L 197, 21.7.2001, p. 30–37)
Waste Directive	Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, pp. 3–30)
Water Framework Directive	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

Summary Report 5: Regulatory Framework for Environmental Protection

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Unconventional gas exploration and extraction (UGEE) involves 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 sandstone.

The UGEE Joint Research Programme (JRP) (**www.ugeeresearch.ie**) is composed of five interlinked projects and involves field studies (baseline monitoring of water and seismicity), as well as an extensive desk-based literature review of UGEE practices and regulations worldwide. The UGEE JRP was designed to provide the scientific basis that will assist regulators - in both Northern Ireland and Ireland - to make informed decisions about whether or not it is environmentally safe to permit UGEE projects/operations involving fracking. As well as research in Ireland, the UGEE URP looks at and collates evidence from other countries.

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List of Outputs:

- Final Report 1: Baseline Characterisation of Groundwater, Surface Water and Aquatic Ecosystems
- Summary Report 1: Baseline Characterisation of Groundwater, Surface Water and Aquatic Ecosystems
- Final Report 2: Baseline Characterisation of Seismicity
- Summary Report 2: Baseline Characterisation of Seismicity
- Final Report 3: Baseline Characterisation of Air Quality
- Summary Report 3: Baseline Characterisation of Air Quality
- Final Report 4: Impacts & Mitigation Measures
- Summary Report 4: Impacts & Mitigation Measures
- Final Report 5: Regulatory Framework for Environmental Protection
- Summary Report 5: Regulatory Framework for Environmental Protection
- UGEE Joint Research Programme Integrated Synthesis Report

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