Unconventional Oil and Gas Development in Scotland

Decommissioning, Site Restoration and Aftercare – Obligations and Treatment of Financial Liabilities
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Introduction

The Scottish Government commissioned AECOM to produce a study on the decommissioning, restoration and aftercare of unconventional oil and gas (UOG) developments in Scotland. This study is one of a number commissioned by the Scottish Government with the aim of improving the evidence base for informed decision-making in relation to potential UOG developments in Scotland. The studies follow the publication of the Independent Expert Scientific Panel report on Unconventional Oil and Gas in July 2014 (Independent Scientific Expert Panel, 2014) and the subsequent moratorium on environmental and planning consents for the development of all UOG extraction in Scotland in January 2015.

The broad aims of this research are to:

- better understand the regulatory measures which are needed to ensure that decommissioning, site restoration and aftercare of UOG developments is undertaken in a way that minimises impacts on communities and the environment; and
- identify and explore different models of financial guarantee that provide robust security against environmental liabilities and improve understanding of associated costs.

For the purposes of this report, UOG includes shale oil/shale gas developments and the exploitation of coalbed methane. The report highlights any differences between them that are relevant to the aims of the study.

Although this report identifies options for the regulation of and financial guarantees for UOG development in Scotland, it does not make recommendations to the Scottish Government. The direction of future policy or potential changes to the regulatory framework is a decision for Scottish Ministers to take following public consultation on this report and the other evidence based research projects commissioned by the Scottish Government.

This executive summary summarises the key conclusions of the report based on AECOM’s assessment and analysis of the available evidence. A summary of the issues, uncertainties and options discussed in the report is set out in Table 1.
Environmental Issues

Sub-Surface Development

Decommissioned oil and gas wells are unlikely to leak gases (including methane) or other fluids from the sub-surface to groundwater or to the atmosphere if constructed and abandoned to comply with international standards and industry best practice. Minimisation of emissions is required to protect human health, ecosystems, groundwater, and surface water quality. Methane is also a greenhouse gas and contributes to man-made climate change. Poorly constructed wells may also allow sub-surface leakage between groundwater bodies such as aquifers, which can affect water quality.

The key to preventing leaks from the sub-surface is ensuring well integrity in both the short and long-term. Experience in the United States, Canada and the UK suggests that long-term well integrity can be achieved by implementing best practice during well construction and abandonment operations under a strong regulatory regime.

However, there is a risk that a small proportion of wells may fail – mainly due to cement shrinkage and that in most cases failure will occur a few years after decommissioning. However, for leakage to occur from a failing well a source of hydrocarbons is required together with a driving force for the gas or oil to migrate. The oil or gas in shales or the gas in coals that are targeted by UOG wells are not under abnormal pressure and there is therefore generally no driving force for leakage. The risk of leakage from abandoned UOG wells is therefore likely to be very low. However, in those UOG wells where there are permeable rocks overlying the target shales or coals that contain hydrocarbons under pressure, there remains a residual risk of leakage if there is a failure of well integrity.

For this reason, it is appropriate to monitor for leakage from decommissioned UOG wells for as long as the regulator, the Scottish Environment Protection Agency (SEPA) consider necessary. Where leaks are identified, the need for remedial action by the UOG Operator should be based on a risk assessment with remedial action undertaken in accordance with the steps that SEPA consider necessary.

Surface Development

Decommissioning and restoration of surface UOG development may also require the management of leaks from surface installations e.g. tanks and pipework, that could potentially contaminate the ground and potentially affect the quality of groundwater and surface water. The key to preventing surface spillages and leakage is a combination of good design in accordance with pollution control legislation and implementation of an accredited environmental management system. In the event that surface spillages or leakages occur there is appropriate legislation already in place in Scotland to ensure remediation if required following decommissioning and prior to restoration.
Current Regulatory Framework

We consider that Scotland, in common with the rest of the UK, has a framework for the regulation and control of decommissioning and aftercare of UOG development comparable with good regulatory systems in other countries.

The oil and gas licensing system, which is currently operated by the Oil and Gas Authority (OGA), grants petroleum exploration and development licences (PEDLs) for the exploration or production of hydrocarbons to operators. The OGA’s petroleum licensing powers in Scotland are to be devolved to the Scottish Government in accordance with the Scotland Act 2016.

Operators awarded a licence for UOG development must first demonstrate that they are technically competent, financially capable and that they have appropriate safety management systems in place. As part of the licensing process, operators must demonstrate understanding of the environmental risks (including risks to human health), associated with the full life cycle of UOG exploration, production and decommissioning in their licence area.

The OGA also issues consents to drill. These should only be granted to a licence holder if there is a valid planning permission for UOG development, all the necessary environmental authorisations are in place, there is a system for monitoring conditions and emissions and if the Health and Safety Executive (HSE) is satisfied with the well design as assessed by an independent, competent well examiner.

SEPA regulates aspects of UOG development through granting of environmental authorisations including risks to the water environment, risk of major accidents, environmental liability and some operational activities. SEPA also regulates the management and disposal of non-extractive waste arising from decommissioning (including naturally occurring radioactive materials).

Well abandonment can only be undertaken if the well abandonment plan is approved by the HSE. Following well abandonment and decommissioning, environmental authorisations can only be surrendered with the agreement of SEPA. Before accepting the surrender of any authorisation, SEPA must be confident that there would be no significant adverse impact on the water environment. This ensures that there will also be no unacceptable impact from surface pollution or from well leakage. Post-operation monitoring by the operator required by SEPA should be of sufficient duration to demonstrate this.

Planning authorities control the restoration and aftercare of surface development at UOG sites through conditions attached to planning permissions. These conditions can include a requirement to remediate any land contamination arising from oil and gas activities. Planning Agreements between the Planning Authority and the operator may also be used to secure financial contributions covering surface restoration and aftercare liabilities.
Lessons on Robust Decommissioning, Restoration and Aftercare

We have examined the lessons that can be drawn from the monitoring and regulatory frameworks for UOG in other countries and of other industries in Scotland.

Regulation of UOG in Other Countries

A review of the monitoring and regulatory frameworks for UOG development has been undertaken for a number of European countries where UOG development is at an early stage (Denmark, Poland and Spain) and for a number of countries outside Europe where there is a mature UOG industry (United States, Canada and Australia).

This review has shown that there is a generally similar approach to regulation in the countries or jurisdictions examined. All require licensing of hydrocarbon exploration and production (including UOG development) and provision of some kind of financial guarantee from operators to manage the environmental liabilities from decommissioning. There is generally either guidance or regulations relating to the design of wells and well abandonment with the objective of minimising risk of well failure and leakage. Ideally, there should be mandatory monitoring throughout the life cycle of a well. In Scotland, baseline monitoring before drilling commences is considered good practice and is likely to be required by SEPA. Operational and post-decommissioning monitoring is required by SEPA.

The robustness of the regulatory regimes in the countries studied varies. The level of financial guarantees required can vary significantly; well construction and abandonment plans do not always require detailed review and approval before being implemented and baseline, operational and post-decommissioning monitoring are not always mandatory. Only a few of the jurisdictions studied have funds for the management of orphaned wells - for which no one has legal responsibility.

Regulation of other Industries in Scotland

The study has also reviewed the regulatory systems relating to landfill sites and opencast coal mining in Scotland to see if there are lessons to be learnt and applied to the betterment of UOG regulation. For both industries, restoration responsibilities are regulated by planning authorities whilst environmental compliance is regulated by SEPA. Where the two industries differ is in the treatment of financial guarantees. In the case of landfill development, SEPA requires that the operator must have made adequate financial provisions to meet its obligations (including aftercare). In the case of opencast coal mining, planning authorities can control the performance, restoration and aftercare of opencast coal sites through financial guarantees attached to legal agreements between the planning authority and the operator.

Restoration Benefits

Restoration can deliver positive benefits for former UOG sites and the wider community. Planning permissions for UOG development normally set out restoration requirements for sites, typically requiring restoration to a site’s original land use or to another beneficial use.
The proposed community benefits package put forward by UOG operators could also be used to provide wider community benefits. Using the landfill tax credit regime as an example, this could be through land reclamation and restoration, funding of community based projects or groups, maintenance of public parks or other amenity, nature conservation, and the preservation of buildings or archaeological sites.

Lessons for Scotland

Because of the long-history of oil and gas regulation in the UK, both onshore and offshore, Scotland has a mature regulatory system for the decommissioning and aftercare of UOG developments, which is equal to best practice examined in other countries or to regulation of other comparable industries in Scotland. This includes requirements for decommissioning and abandonment of wells, which, with appropriate regulatory oversight and monitoring, are sufficient to manage risks of well leakage consistent with the aim of providing suitable protection for communities and the environment. The devolution of the OGA's petroleum licensing powers to the Scottish Government provides an opportunity to fine-tune the licensing system to the particular requirements of Scotland. For example, it may be possible to strengthen the powers relating to the provision of financial guarantees by operators that already exist under the petroleum licensing system.

Decommissioning, restoration, and aftercare costs and the treatment of financial liabilities

Whilst Operators are Licensed

It is essential that UOG operators have sufficient funds available to cover liabilities associated with the abandonment and decommissioning of wells. As the licensing authority, the OGA (and the Scottish Government in future under devolved powers) can currently test the financial robustness of operators during licence applications, if a licence changes hands or before a well consent is issued. The licensing authority also has powers to compel the supply of further financial information once operations commence, and to require a company to “take action” if the OGA (or Scottish Government) is not confident that there are sufficient funds to cover its liabilities.

There is potential for improvement in these existing provisions. There is currently no power to require specific arrangements for on-shore well decommissioning and aftercare if a company proves to be failing the financial tests after a well consent is awarded by either the OGA or the future Scottish licensing authority. A relatively simple solution could be for the licensing authority to re-apply the existing financial strength tests regularly for operators and to ensure that the well costs used in the tests include sufficient allowance for the operator’s sub-surface decommissioning and restoration liabilities.

If a company fails the financial strength tests, under the existing regulations the future petroleum licensing authority in Scotland would have the power to compel operators to take specific further action. This could include provision of Parent Company Guarantees,
insurance, bonds or letters of credit or payment into escrow accounts - depending on the reasons for failing the tests. It is clear that both the liabilities for individual wells and the financial robustness of individual operators will vary. The licensing authority therefore needs to be able to compel specific action to match the individual circumstance.

There is a low risk of post-decommissioning well failure, but should it occur it is most likely to happen within a few years of well abandonment and decommissioning. It could therefore be expected that the licensing authority should only accept surrender of the PEDL when all environmental authorisations and restoration obligations have been satisfied. During this period, the licensing authority could continue to apply the financial tests and require specific financial action should significant liabilities be identified by the regulators.

**After Licence Surrender**

The likelihood of long-term failure of decommissioned UOG wells, which are well constructed and abandoned, is considered to be low. In the event that a failure does occur after licence surrender, long-term insurance products could cover such risks. Alternatively, a mutual fund could be established to cover the costs of repairing leaking orphaned wells in the future. As an example, an annual levy on consented wells raised through the licence fee on each PEDL could be used for this purpose.

**Impact on the Cost of Delivery of Regulation in Scotland**

The additional regulatory powers that may be necessary for the future petroleum licensing authority in Scotland are not likely to be significant in the context of the overall economic costs and benefits of UOG development in Scotland.
<table>
<thead>
<tr>
<th>Key Issue</th>
<th>Uncertainties</th>
<th>Options</th>
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<tbody>
<tr>
<td><strong>Management of Risks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well Integrity</td>
<td>How can risks of emissions from failed wells be minimised?</td>
<td>Wells, which are designed, constructed and abandoned to a high standard in a strong regulatory environment, are considered to be at low risk of leakage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Well construction plans approved by an independent well examiner. Regular well inspections by independent well examiner. Well abandonment plans approved by independent well examiner.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baseline, operation and post decommissioning monitoring with the later continued as long as required by SEPA.</td>
</tr>
<tr>
<td>Near Surface contamination</td>
<td>How can risks of surface contamination and shallow groundwater contamination be minimised?</td>
<td>Managed through planning conditions and if necessary Scottish contaminated land regime. Operator's environmental liability insurance.</td>
</tr>
<tr>
<td>Surface restoration</td>
<td>How can risks of sites remaining unrestored be minimised?</td>
<td>Restoration conditions in planning permission, enforced and supported by financial provisions through legal agreement.</td>
</tr>
<tr>
<td><strong>Regulatory System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Licensing</td>
<td>How does the Scottish petroleum licensing system compare to that other countries or industries?</td>
<td>Comparable to good practice in EU and worldwide. Opportunities to modify and improve under devolved powers particularly in relation to regulation of financial instruments.</td>
</tr>
</tbody>
</table>
### Key Issue

<table>
<thead>
<tr>
<th>Uncertainties</th>
<th>Options</th>
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<tbody>
<tr>
<td>Is planning system adequate to manage decommissioning particularly restoration?</td>
<td>Planning system robust and able to control surface restoration through planning agreements. Ability of local authorities to manage financial instruments will be improved if recommendations in Opencast Coal Task Force implemented across those authority areas with UOG development.</td>
</tr>
<tr>
<td>Is Scottish regulatory system adequate to manage decommissioning?</td>
<td>The regulatory system in Scotland is reported to be “generally well-coordinated between the main regulatory bodies” (Independent Scientific Expert Panel, 2014). The Panel has only identified one regulatory gap namely the absence of any mechanism requiring for long-term monitoring and responsibility for wells. However, this report considers that existing post-decommissioning monitoring required by SEPA should be sufficient to identify wells at risk of well integrity failure. In relation to long-term responsibility, the Expert Panel recognised that “operators have an open-ended liability to remediate any ineffective abandonment”.</td>
</tr>
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</table>

### Management of Financial Liabilities

<table>
<thead>
<tr>
<th>During licensing</th>
<th>Use of appropriate financial instruments to mitigate risks, e.g. bonds.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to manage risk of operators abandoning sites before decommissioned.</td>
<td></td>
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<tr>
<td>How to ensure post-decommissioning liabilities are managed by operators.</td>
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<tr>
<td>Key Issue</td>
<td>Uncertainties</td>
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<tr>
<td>Post licensing (not orphaned)</td>
<td>How to manage risks post-decommissioning where operator is in existence.</td>
</tr>
<tr>
<td>Post licensing (orphaned)</td>
<td>How to manage risks post-decommissioning where operator is no longer in existence.</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Aims

This study examines the decommissioning, restoration and aftercare of unconventional oil and gas (UOG) developments in Scotland. This study is one of a number commissioned by the Scottish Government with the aim of improving the evidence base for informed decision-making in relation to potential UOG developments in Scotland. The studies follow the publication of the Independent Expert Scientific Panel report on Unconventional Oil and Gas in July 2014 (Independent Scientific Expert Panel, 2014) and the subsequent moratorium on environmental and planning consents for the development of all UOG extraction in Scotland in January 2015.

The broad aims of this research are to:

- better understand the regulatory measures which are needed to ensure that decommissioning, site restoration and aftercare of UOG developments is undertaken in a way that minimises impacts on communities and the environment; and

- identify and explore different models of financial guarantee that provide robust security against environmental liabilities and to improve understanding of associated costs.

For the purposes of this report, UOG includes developments which exploit shale oil, shale gas and coalbed methane. The report highlights any differences between them that are relevant to the aims of the study.

Although this report identifies options for the regulation of and financial guarantees for UOG development in Scotland, it does not make recommendations to the Scottish Government. The direction of future policy or potential changes to the regulatory framework is a decision for Scottish Ministers to take following public consultation on this report and the other evidence based research projects commissioned by the Scottish Government.

1.2 Background

Recent experience with the management of post-closure liabilities of opencast coal sites in Scotland has highlighted the importance of having a robust decommissioning and restoration regime in place before any future UOG development in Scotland takes place.

The regulatory regime for UOG development in Scotland should be designed to ensure that UOG operators comply with their obligations and that sites are decommissioned and restored to an acceptable standard. This should be the case even if the UOG operator is...
no longer in a position to fund these activities and the site is orphaned, i.e. there is no entity with legal responsibility for the site.

It is the responsibility of UOG operators to ensure that decommissioning and site restoration obligations are met. This includes ensuring appropriate financial securities are in place to deal with environmental issues and that these securities provide a safeguard against changes of company structure (including company failure or site ownership.


The Independent Expert Scientific Panel Report highlighted potential gaps in aftercare and long-term monitoring requirements. In particular, once the operator has surrendered the relevant authorisations and met the Health and Safety Executive’s well-abandonment requirements and, later, when the post-production requirements in the Petroleum Exploration and Development Licence have ceased, there are no statutorily required long-term monitoring and control requirements to ensure that well integrity is retained and pollution does not occur. This study examines the Independent Expert Scientific Panel’s conclusions on monitoring and identifies whether the potential gap identified is significant or can be effectively managed.

This report explores these issues in more detail to ensure that, should the moratorium in Scotland be lifted, any future developments adhere to robust regulatory standards and that appropriate financial guarantees are in place to deal with any potential environmental risks and associated liabilities. In particular, in circumstances where the UOG operator lacks the financial means to manage such liabilities or cease to operate with the consequence that sites become effectively orphaned. This study therefore seeks to understand current good practice within the industry and identify what additional lessons can be learned from international examples.

Finally, this study also seeks to understand the relative advantages and disadvantages of the different financial guarantee mechanisms, and how these might affect the economic viability of any future projects. Difficulties in assessing costs can lead to under-provision for these liabilities. This was a key market failure in the opencast mining industry in Scotland, which prompted an Industry Taskforce to investigate restoration and aftercare guarantees (Scottish Government, 2015c). The work and recommendations of that Taskforce are a key consideration for this research project.

1.3 Scope

This study looks at the decommissioning of potential future UOG developments in Scotland; including shale gas, shale oil and coalbed methane developments. The brief also requires the study to look at both surface and sub-surface development.
Surface developments cover any surface infrastructure required by UOG developments, including the wellsite itself together with pipework connecting wellheads to the national grid. Planning permissions typically require that such surface developments be removed when sites are decommissioned and restored.

Subsurface developments are the wells themselves, which, minus the wellhead plugged with cement to prevent leaks, are left in-situ once the site is decommissioned and restored.

1.4 Approach

This study:

- summarises the environmental issues that need to be addressed in effective decommissioning, site restoration and aftercare (Chapter 2);

- details the current regulatory framework that applies to the decommissioning of UOG developments in Scotland (Chapter 3);

- examines the lessons which can be drawn from the monitoring and regulatory frameworks of other countries and industries and how these lessons could be interpreted and applied in the context of regulation and monitoring in Scotland (Chapter 4);

- provides examples of how decommissioning and restoration can deliver innovative or positive community and/or environmental benefits (Chapter 5); and

- sets out are the current industry approaches and best practice for assessing decommissioning, restoration and aftercare costs and the advantages and disadvantages that different financial instruments present in terms of providing security against liabilities (Chapter 6).

1.5 Consultation

The Scottish Government is committed to gathering evidence on the potential effects of UOG developments, and giving stakeholders and the public the opportunity to consider the issues and express their views.

The project has been informed by discussions with representatives of the community, environment and industry in Scotland. The objective of the consultation has been to enable stakeholders to provide sources of information and highlight issues of concern that fall within the scope of this research.
The following organisations were consulted:

- **Scottish Environment Link** – The forum for Scotland’s voluntary environment organisations, with over 35 member bodies representing a range of environmental interests with the common goal of contributing to a more environmentally sustainable society.

- **Broad Alliance** - A coalition of Scottish communities opposed to onshore and near-shore unconventional oil and gas development.

- **The Convention of Scottish Local Authorities (COSLA)** - The representative voice of Scottish local government.

- **UK Onshore Oil and Gas (UKOOG)** - The representative body for the UK onshore oil and gas industry including exploration and production.

Engagement with the consultees was managed to ensure that all groups were given an equal opportunity to contribute. Consultation was via an information pack and questionnaire. All consultees were invited to an individual consultation event in Edinburgh in March 2016 and Scottish Environment Link, COSLA and UKOOG attended the event. All consultees responded in writing to the questionnaire (see Appendix A).
2 Environmental Issues

2.1 Introduction

This chapter provides a summary of the key environmental issues and associated hazards and risks associated with decommissioning and restoration of UOG developments. In particular, it considers the potential for leakages of gases or fluids from wells or surface equipment and the potential for impacts on water quality, air quality and by extension human health natural resources and ecosystems.

The focus of this report is on environmental issues during and following decommissioning of UOG developments. As such, it does not consider issues associated with well development and production except where they affect the potential for post-decommissioning environmental issues. For example, this assessment does not consider hydraulic fracturing operations (except where they affect well integrity post-decommissioning) or coal seam depressurisation in coalbed methane (CBM) wells. The assessment assumes that commissioning and operational maintenance requirements will have been met by well site operators.

2.2 Unconventional Oil and Gas Resources in Scotland

2.2.1 Shale Gas and Shale Oil

Sub-surface

Potential shale gas/oil resources in Scotland are concentrated in the Central Belt of Scotland between Edinburgh and Glasgow and are also found in Fife and Lothian. Rocks containing shale gas and shale oil are found in Scotland between 1.2 km and 5 km below ground level (BGS, 2014). The source rocks for shale gas and shale oil are generally similar to each other but those containing shale gas resources are found at greater depths. Shale gas and shale oil are accessed using very similar techniques, namely a combination of vertical and horizontal drilling to maximise the length of borehole through the shale and hydraulic fracturing to enable the gas/oil to be extracted.

Surface

On the ground surface, during drilling (and hydraulic fracturing operations if undertaken) there would be a well pad containing a number of wellheads on each site. Following drilling and hydraulic fracturing, the production site would contain both well head(s) and gas/oil collection equipment. Oil may be collected on-site in tanks before being taken off-site by tanker to an oil refinery. Gas may be collected and tankered from site or exported directly by pipeline. Gas may require processing to remove heavy hydrocarbons or impurities at an off-site processing plant before being exported to the national gas distribution network.
2.2.2 Coalbed methane

**Sub-surface**

Coalbed methane (CBM) resources in Scotland are located within the coalfields of the Central Belt of Scotland and in Ayrshire, Fife and Lothian. Coalbed methane development involves abstraction of gas from coal seams that are present at shallower depths than shale gas/shale oil resources (typically less than 1 km) (DECC, 2013c). Development uses similar directional drilling technologies to shale gas and shale oil development but involves drilling of both water abstraction wells to allow dewatering of coal seams and wells drilled horizontally within the coal seams to allow gas abstraction. CBM development does not normally involve hydraulic fracturing.

**Surface**

During well drilling, surface facilities will be similar to those for shale gas/shale oil developments. During production, a wellsite will contain a number of well head(s), gas collection/transmission facilities and wastewater treatment/disposal equipment. Gas will
be exported by pipeline via processing facilities if necessary (to remove heavy hydrocarbons or impurities) to gathering/pumping stations and then to the national gas distribution network.

2.3 Potential Environmental Effects

2.3.1 Surface

Planning permissions typically require that surface facilities are removed and that any surface or near surface contamination is remediated as part of the site restoration works, which should be defined through the conditions of planning consent. Any surface or below ground pipelines should also be removed and/or decommissioned as required by the planning permissions and relevant legislation.

2.3.2 Sub-Surface

The key environmental risk associated with decommissioning is that associated with poorly constructed or abandoned oil and gas wells. These may leak gases or other fluids from the sub-surface to groundwater or, in the case of methane and other gases, to the atmosphere. Uncontrolled emissions have the potential to affect human health, ecosystems and groundwater and surface water quality. Methane is also a greenhouse gas and contributes to man-made climate change. Poorly constructed wells may also cause sub-surface leakage between groundwater bodies such as aquifers.

Poorly constructed and decommissioned oil and gas wells can develop leaks along the casing after production has ceased and the well has been decommissioned. In certain circumstances, hydrocarbons or other well fluids can migrate out of the well and into the environment. Contamination of groundwater with methane associated with UOG development has been a concern, for example in Pennsylvania in the United States (Osborn, et al., 2011) and Alberta in Canada (Watson & Bachu, 2007).

The principal sources are hydrocarbon fluids (gas and/or oil) which may leak from the well bore or use the wellbore as a transmission pathway from depth to the near surface. The main receptors at risk from migration of hydrocarbons from wells are:

- shallow groundwater both as aquifers and also as a pathway for migration;
- groundwater bodies at greater depth (as defined by the Water Framework Directive);
- drinking water;
- people (through drinking water or gas migration into properties);
- ecosystems and habitats; and
- air quality (climate change impact).
The key to managing risks of leakage from UOG wells is the maintenance of well integrity in both the short and long-term (Hetrick, 2011).

2.4 Well Integrity

2.4.1 Introduction

Well integrity describes the application of technical, operational and organisational solutions to the construction, operation and decommissioning of wells. Maintaining well integrity prevents the uncontrolled release of fluids, solids and gases into the subsurface or surface environment over the full life cycle of the well (SCER, 2012). Well integrity is also defined by the Norwegian petroleum standards authority as the “application of technical, operational and organizational solutions to reduce risk of uncontrolled release of formation fluids throughout the life cycle of a well” (NORSOK, 2013).

2.4.2 Well Construction

Wells drilled for UOG development are constructed using standard oil and gas drilling and completion techniques. Wells are drilled in sections the diameter of which decrease with depth (Figure 2). Each section of the well is lined with steel casing, which is cemented in place prior to the drilling of the next. The main casing types and their uses are described in Table 2.

The primary objective of casing is to provide support to the well, to contain sub-surface pressures, and to provide isolation of different zones penetrated by the well (Dusseault, et al., 2000). Cementing creates both a good seal between the formation and the casing and provides support to the casing. The quality of the casing-cement-formation bond is assessed after the casing is set.

A high standard of well construction is critical to ensuring well integrity. In particular, the quality of casing and cementing is fundamental to ensuring environmental protection both during the operational life of a well and in the long-term by minimising risk of escape of well fluids (including hydrocarbons) (Hetrick, 2011).
Figure 2: Typical UOG Well Construction Details
Modified from Independent Scientific Expert Panel (2014)
(Forth railway bridge shown for scale only)
Table 2: Casing Types

<table>
<thead>
<tr>
<th>Casing</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor</td>
<td>Set into the ground to a depth of approximately 30 metres, the conductor casing serves as a foundation for the well and prevents caving in of surface soils.</td>
</tr>
<tr>
<td>Surface Casing</td>
<td>Drilled through any freshwater bearing zones (including drinking water aquifers) and sealed with a casing and extends all the way back to the surface. Cement is pumped down the wellbore and up between the casing and the rock it reaches the surface. The integrity of the surface casing is critical in preventing migration of hydrocarbon or fluids to the surface or the migration of fluids between groundwater bodies.</td>
</tr>
<tr>
<td>Intermediate Casing</td>
<td>Drilled and lined by an intermediate casing to isolate the well from non-freshwater zones that may cause instability or be abnormally pressurised. The casing may be sealed with cement typically either up to the base of the surface casing or all the way to the surface.</td>
</tr>
<tr>
<td>Production Casing (or Liner)</td>
<td>A final wellbore is drilled into the target rock formation containing UOG. This wellbore is lined with a production casing that may be sealed with cement either to a safe height above the target formation up to the base of the intermediate casing; or all the way to the surface, depending on well depths and local geological conditions.</td>
</tr>
</tbody>
</table>

Adapted from The Royal Society and The Royal Academy of Engineering (2012)

2.4.3 Decommissioning and Well Abandonment

Decommissioning involves the removal of surface equipment, the restoration of the ground surface and the permanent closure of any wells. The permanent closure of the well to prevent migration of well fluids, including hydrocarbons, into the environment or the surface is termed abandonment. All wells including dry exploratory wells and production wells that have reached the end of their commercial lifespan must be abandoned.
Well abandonment involves the placement of cement plugs in the well adjacent to rocks of low permeability and which overlie zones containing hydrocarbons. Cement is used as the primary sealant for plugging wells because of its similarity in behaviour to solid rock. Steel bridge plugs are used to provide physical support to the cement. Cement plugs are also used to isolate near surface groundwater bodies, including those used as aquifers, by sealing the base of the surface casing (Figure 3).

**Figure 3: Well Abandonment**
Adapted from Independent Scientific Expert Panel (2014) and HSE (2015)
2.4.4 Well Leakage

Leakage can only occur from a well if:

- there is a source of hydrocarbons or well fluids; and
- there is a driving force for hydrocarbons or well fluids to migrate; and
- there is a pathway for the leak to reach the near surface.

(Watson & Bachu, 2007).

Hydrocarbons below ground are the source of any leakage. The driving force is the pressure under which hydrocarbons are found within the rocks penetrated by the well or buoyancy driven by density differences. Leakage through the well is the means by which hydrocarbons under pressure may reach the near surface (see Figure 4).

The risk of leakage from wells penetrating rocks containing UOG is considered to be low. This is because the formation pressures in unconventional hydrocarbons are much lower than in conventional hydrocarbon reservoirs and there is little driving force to cause leakage (Thorogood & Younger, 2015). However, conventional hydrocarbons in permeable rocks such as sandstones or limestones which can overlie UOG resources in some wells do represent a potential source of leaks if a driving force such as high formation pressures exists (Darrah, et al., 2014) (Figure 4). In Scotland, permeable rocks that could contain hydrocarbons overlie the shales and coals that contain UOG resources (Read, et al., 2003) and may represent a source for potential leakages.

Migration of fluids between two or more sub-surface groundwater bodies (e.g. aquifers) can also occur if there is a pressure differential between the aquifers and if the well offers a pathway for fluid migration.

Good design and construction is required to minimise the risk of well leakage. In particular, the use of multiple barrier systems means that several barriers within a well need to fail for there to be a failure in well integrity and for a well to leak (Ingraffea, et al., 2014). Individual barriers within a well have a higher risk of failure than whole wells (King & King, 2013). This explains the high failure rates quoted in some studies. For example, barrier failure rates for the Norwegian Sector of the North Sea of between 13 and 19% for production wells and 37 – 41% for injection wells have been reported (Randhol & Carlsen, 2008).

Failure rates for whole wells and subsequent potential for leakage are much lower than for individual barriers, with failure rates for well-constructed wells being less than 1% (King & King, 2013). For example, a review of 316,000 wells in Alberta identified 4.6% as having “leaks” (i.e. failure of one or more barrier elements) but with gas migration occurring in only 0.6% (Watson & Bachu, 2007). Failure rates for poorly constructed wells were higher. Similarly, in Pennsylvania whilst the proportion of well barrier failures in recent wells range from 6.2% to 7.2% (Ingraffea, 2012), most well integrity issues do not currently result in gas migration (Brantley, 2015) and problematic wells represent only 0.1 to 1% of the UOG
wells drilled over the period 2008-2012 (Brantley, et al., 2014) indicating a much lower incidence of well integrity failures.

Figure 4: Potential Sources of Fluids that may Leak through a Hydrocarbon Well
Modified from Davies, et al. (2014)
Studies of well integrity failures have found that hydrocarbon and well-fluid migration issues in abandoned wells are directly related to casing and cementing operations during well construction. Wells where there is gas migration from depth to the surface prior to abandonment are likely to continue to have migration issues after decommissioning (Hetrick, 2011). In particular, well integrity issues result from of corrosion, joint failures, and inadequate cementing of casing. Fluid migration through cement can be via a number of pathways, which are usually associated with problems with the original cementing process (Figure 5). These include channelling, poor filter cake removal, shrinkage, and high cement permeability.

![Diagram of well integrity issues](image)

**Key**

1. Leakage between cement in annulus and wellbore
2. Leakage between cement in annulus and casing
3. Leakage between cement plug and casing
4. Leakage through cement plug
5. Leakage through cement in annulus
6. Leakage across cement in annulus and between cemented annulus and casing

**Figure 5: Potential Cement Leakage Pathways**
Modified from Celia, *et al.* (2005)
Some well integrity issues are specific to the horizontal wells used in UOG developments. Casing in the horizontal part of the well is subject to gravity making it more difficult to keep the casing properly centred to allow it to be effectively cemented in place. Repeated pressure changes along the horizontal length of pipe during hydraulic fracturing may also induce stress in the casing and cement and may cause the cement to debond from the casing and crack (Bachu & Valencia, 2014).

Shrinkage in cement plugs and in cement behind casing can lead to development of circumferential fractures in the cement in the longer term, after well construction and toward the end of, or after, the productive life of the well. Such fractures develop and propagate over time and with use of the well. This can be the case where the cement bond is assessed as being reasonable over substantial sections of the casing after cementing (Dusseauault, et al., 2000). Cement shrinkage leads to a residual risk that leakage may occur in some wells a few years after construction and/or abandonment (The Royal Society and The Royal Academy of Engineering, 2012).

2.5 Best Practice in Minimising Leakage

2.5.1 Construction

The regulatory system in Scotland is set out in Chapter 3. All operators in the UK holding Petroleum Exploration and Development Licences (PEDLs – see Section 3) are required by the Oil and Gas Authority (OGA) to be members of UK Onshore Oil and Gas (UKOOG) the onshore operators group. The Scottish Government will have the ability to maintain this requirement after the OGA’s petroleum licensing powers are devolved in accordance with the Scotland Act 2016.

Guidance produced by UKOOG (UKOOG, 2015a) requires all operators to comply with their duties under the relevant regulations (see Chapter 3). The UKOOG guidelines state that the “most important role of the well-operator is to ensure the integrity of its wells, barriers and the pressure containment boundary throughout the well life cycle from design to final abandonment”. The guidance confirms, “integrity can be assured by keeping adequate barriers between the hazards in the well and the surface. The selection, installation, monitoring, checking, testing, maintenance and repair of barriers are the most important aspects of well planning and operations.” To do this, the UOG operator will need a system for managing well integrity, which, as a minimum, should cover well design and construction, well operations/production, and well suspension and abandonment. UKOOG therefore requires its members to follow best practice in well construction as set out in the guidelines for well construction produced by Oil and Gas UK (OGUK) the UK offshore operator’s body (OGUK, 2014). UKOOG members are also required to follow Oil and Gas UK guidance on the competence of personnel involved in well operations including well construction and abandonment (OGUK, 2012).

The OGUK guidance for well construction is based on international standards such those produced by the as the American Petroleum Institute (API) (API, 2010; API, 2015) and
Standards Norway (NORSOK) (NORSOK, 2013). The API publishes a range of practice notes that are used to guide well construction and operations in many countries. The Norwegian petroleum industry developed the NORSOK standards to ensure adequate safety, benefit, and cost-effectiveness for petroleum industry developments and operations.

Corrosion can be minimised through selection of casing designed to resist corrosive subsurface environments. The risk of joint failure can be minimised by use of improved couplings on casing joints and use of appropriate methods for casing installation. Development of pathways through cement as a result of primary cementing can be minimised by good casing and cement programme design and material selection (Watson & Bachu, 2007).

Wells design must be approved by the Health and Safety Executive before development may proceed (see Section 3.3).

2.5.2 Abandonment

Operators are also expected by UKOOG to follow OGUK’s Guidelines for the Abandonment of Wells (OGUK, 2015a) which has been prepared to provide operators with guidance on the considerations that should be taken into account during well abandonment. The guidelines provide minimum criteria to ensure full and adequate isolation of formation fluids both within the wellbore and from the surface. The guidelines also help operators to comply with the relevant regulations (see Section 3.3) which lay down the minimum abandonment standards to be achieved by operators in the UK. OGUK guidance for well abandonment is also based on international standards (API, 1993; NORSOK, 2013).

Importantly, OGUK guidance requires that abandonment design should make allowance for the deterioration of casing, cement and plugging materials in the well over time and the possible recovery of hydrocarbon-bearing formations to natural pressure (and thereby having greater potential to leak). Reducing the risk of long-term cement shrinkage and cracking requires improvement in cement composition (Dusseault, et al., 2000) and new shrink resistant cement formulations have been developed (Bentz & Jensen, 2004). This is recognised by OGUK with their guidelines on materials for use in well abandonment, which require operators to consider alternative cements with lower shrinkage potential than the cements traditionally used for well abandonment (OGUK, 2015b).

In operational wells, flows of gas causing rising pressures within the casing can indicate barrier problems anywhere in the well. Gas accumulating inside the casing leads to pressure build-up at the wellhead, also known as sustained casing pressure (SCP) (Bachu & Valencia, 2014; Bruffato, et al., 2003). In production wells, the presence of elevated SCP may indicate the potential for gas migration between different zones in the well and therefore should be taken into account during the abandonment design (Ingraffea, et al., 2014). For exploration wells, the lack of SCP monitoring data means that abandonment design for exploratory wells may need to be more conservative than for production wells to ensure that migration of any hydrocarbons that may be present does not occur.
Notwithstanding the above guidance, well abandonment plans must be approved by the Health and Safety Executive before sites are decommissioned proceed (see Section 3.3).

2.5.3 Impact of Regulation

Regulation is instrumental in ensuring that wells are constructed to high standards and that the risk of leakage is minimised. A review of factors controlling well failure and leakage in Alberta (Watson & Bachu, 2007) identified regulation as having the greatest impact on reducing well leakage; overriding factors such as well type, location or age. Recent wells were found to be the least likely to develop problems because of improved construction and barrier standards and more stringent regulatory requirements. Wells constructed earlier, however, were vulnerable to leakage (Bachu & Valencia, 2014).

A review of environmental impacts associated with drilling in the Marcellus Shale in Pennsylvania concluded that “the number of environmental violations and subsequent environmental events that caused some physical impact on the environment [has] steadily declined […] in conjunction with actions by state regulators” (Considine, et al., 2012).

In the UK, drilling for and production of conventional hydrocarbons on-shore has taken place for around a century with over two thousand wells having been drilled (Davies, et al., 2014). Around two-thirds of these wells have been abandoned to standards, considered comparable to those currently in force (Boothroyd, et al., 2016). There have been only two recorded pollution incidents due to well integrity failure in the UK. Both of these were from conventional oil wells (Davies, et al., 2014). In a recent study of fugitive emissions of methane from conventional oil and gas exploration and production wells in the UK (Boothroyd, et al., 2016), approximately one third of the wells monitored exhibited low rates of emissions of methane gas at the soil surface. The presence of methane indicates that leakages had occurred in these wells, however, the monitored methane emissions were low and comparable to the rates of emission from the type of agricultural activities commonly used on decommissioned well sites (sheep grazing for example). In contrast, methane emissions from a well, which had not been decommissioned to modern standards, were found to be significantly higher.

The evidence therefore suggests that the environmental impact of existing decommissioned conventional oil and gas wells in the UK, which have been abandoned to contemporary standards, is unlikely to lead to significant impacts on people or the environment. For the reasons set out in Section 2.4, the environmental impact of future UOG developments would be anticipated to be similar or lower than this.

2.5.4 Monitoring

In order to assess whether wells leak and to determine whether leakage is sufficient to require remedial action or other migration requires monitoring. Monitoring for hydrocarbon or fluid migration should be undertaken during the:

- operational stage – during drilling and completion but also production; and
• post-decommissioning stage.

Both are required by SEPA (see Section 3.5) with post-abandonment monitoring continuing until relevant environmental authorisations are surrendered.

Monitoring of baseline conditions before drilling or well construction commences is not currently a legal requirement in Scotland but is regarded as best practice by UKOOG (UKOOG, 2015b) and is likely to be required by SEPA before a licence for to drill a deep borehole can be awarded. Baseline monitoring in soil and groundwater allows background values of methane, for example, to be assessed and subsequently allows operational monitoring to be put in context. Baseline and operational monitoring for methane can also be benchmarked against the results of the British Geological Survey’s National Methane Baseline Survey of UK Groundwaters (BGS, 2016).

Post-decommissioning monitoring is critical in the assessment of the long-term risk of leakage from wells because evidence shows that, where they occur, leaks start relatively soon (within several years) following well abandonment (Boothroyd, et al., 2016; Watson & Bachu, 2007). For this reason, monitoring for leakage from decommissioned UOG wells is required for as long as deemed necessary by SEPA to allow environmental authorisations to be surrendered. Where leaks are identified, the need for remedial action by the UOG Operator should be based on a risk assessment with remedial action undertaken in accordance with the steps that SEPA consider necessary.

2.6 Conclusions

The principal environmental issues associated with unconventional oil and gas in Scotland that require managing are those associated with the risk of long-term well leakage or of migration of fluids between aquifers.

Poorly constructed and decommissioned oil and gas wells may leak gases or other fluids from the sub-surface to groundwater or to the atmosphere. Such uncontrolled emissions have the potential to affect human health, ecosystems and to groundwater and surface water quality. Methane is also a greenhouse gas and contributes to man-made climate change.

The key to preventing leaks from the sub-surface is ensuring well integrity in both the short and long-term. Experience in the United States, Canada and the UK suggests that long-term well integrity can be achieved by implementing best practice during well construction and abandonment operations under a strong regulatory regime.

Despite this, there is a risk that a small proportion of wells may fail – mainly as a result of cement shrinkage. However, for leakage to occur a source of hydrocarbons is also required together with a driving force for the gas or oil to migrate. The oil or gas in shales or the gas in coals that are targeted by UOG wells are not under abnormal pressure and there is therefore generally no driving force for leakage. The risk of leakage from abandoned UOG wells is therefore likely to be very low. However, in those UOG wells
where there are permeable rocks overlying the target shales or coals that contain hydrocarbons under pressure, there remains a residual risk of leakage if there is a failure of well integrity. In Scotland, permeable rocks that could contain hydrocarbons overlie the shales and coals that contain UOG resources (Read, et al., 2003).

For this reason, it is appropriate to monitor for leakage from decommissioned UOG wells for as long as is required by the regulator, the Scottish Environment Protection Agency (SEPA). Where leaks are identified, the need for remedial action by the UOG Operator should be based on a risk assessment with remedial action undertaken in accordance with the steps that SEPA consider to be necessary.

Decommissioning and restoration of surface UOG development may also require the management of leaks from surface installations e.g. tanks and pipework, that could potentially contaminate the ground and potentially affect the quality of groundwater and surface water. The key to preventing surface spillages and leakage is a combination of good design in accordance with pollution control legislation and implementation of an accredited environmental management system. In the event that surface spillages or leakages occur there is appropriate legislation already in place in Scotland to ensure remediation if required following decommissioning and prior to restoration.
3 Regulatory Framework in Scotland

3.1 Introduction

The focus of this chapter is to outline the current legislative framework for regulating the decommissioning process associated with UOG developments in Scotland. This includes a general discussion of the regulations, planning system and guidelines, codes of practice and the organisations responsible for enforcement and monitoring. In order to set the context, an overview of the regulatory framework and associated interactions at each of the four key stages (exploration, development, production, decommissioning) involved in UOG developments is provided, however the specific focus is on decommissioning and restoration.

The following sections of the report identify the key statutory authorities involved in UOG development, outlining their responsibilities and the associated consenting regimes:

- Oil and Gas Authority (OGA);
- the planning system;
- Health and Safety Executive (HSE); and
- the Scottish Environment Protection Agency (SEPA).

A regulatory route map is shown on Figure 6.

3.2 Oil and Gas Authority

Onshore and offshore oil and gas is regulated in the UK by the Oil and Gas Authority (OGA), an executive agency of the Department of Business, Energy and Industrial Strategy (BEIS), a UK government department that is responsible for a range of functions relating to the UK energy sector (BEIS, 2016).


The OGA is responsible for issuing PEDLs. This licence confers exclusivity in a defined area as against other exploration companies, but does not exempt the company from
other legal/regulatory requirements. The OGA therefore has a role to play throughout the UOG development lifecycle and critically at the start, by issuing licences and giving consent prior to drilling taking place on site. The licensing and consenting process managed by the OGA is explored further below. It should be noted that the responsibilities of the OGA in relation to onshore oil and gas in Scotland are to be devolved to the Scottish Government under the Scotland Act 2016. For the purposes of this report, it has been assumed that the same licensing procedure will be adopted by the Scottish government until such time as it makes any decision on the need for reform.

3.2.1 Petroleum Exploration and Development Licence

Obtaining a PEDL forms the first step in gaining the necessary permissions to undertake UOG development.

In order to obtain a PEDL, the OGA requires applicants to submit information outlining that the operator is technically competent, financially capable and has appropriate safety management systems in place. A well examination scheme is also required, as well as an environmental awareness statement; a requirement introduced in the most recent (14th) landward licensing round.

Operators must also have clearly defined operational and environmental management systems in place in order for a licence to be awarded.

3.2.2 Environmental Risk Assessment

The environmental risk assessment is a first-stage risk assessment conducted specifically for proposed shale gas operations that involve hydraulic fracturing. In such cases UOG operators are required by the OGA to carry out an overview assessment of environmental risks, including risks to human health, covering the full cycle of the proposed operations (including well abandonment) with the participation of stakeholders (including local communities). One of the key purposes of this process is to inform the preparation of applications for planning permission and any accompanying Environmental Impact Assessment.

3.2.3 Consent to drill

Drilling consents will only be granted when the OGA has assessed operator competency and financial stability and once data reporting and monitoring methods for seismicity have been agreed. Where hydraulic fracturing is proposed, the Operator must also include the submission of a hydraulic fracturing plan for approval.

The following key provisions must also be in place prior to the OGA issuing consent to drill:

- the local planning authority has granted permission to drill and the relevant planning conditions have been discharged (see Section 3.3);
• all the necessary permits required by SEPA are in place, with a system for monitoring conditions and emissions (see Section 3.5); and

• the Health and Safety Executive (HSE) has had notice of and is satisfied with the well design (21 days’ notice must be provided) and the operator has arranged an examination of the well design by an independent, competent well examiner (see Section 3.3).

The locations of all wells including abandoned wells are held by the OGA and are publically available (OGA, 2016). It is anticipated that those parts of the database relating to Scotland will be maintained and updated once the OGA's powers are devolved to the Scottish Government.

3.2.4 Surrendering and Determination of PEDL

Upon completion of production, there are two ways in which a UOG operator can give up, or “surrender”, all or part of a licence (DECC, 2015). A licensee may ‘surrender’ part of the licensed area while the licence continues over the remaining area, or ‘determine’ the entire licence. ‘Determine’ refers to the licensee giving up the entire acreage covered by the licence.

These processes require the completion of a Licence Determination Form, which includes information relating to the location and condition of the area to be surrendered or determined. Information on the status of the work programme and status of any wells within the area is required, including any plans for plugging and abandoning of wells (OGA, 2015a).

Surrender of a licence requires the submission of a ‘Relinquishment Report’, which should be completed at any point that a licence is to be determined. The report must adhere to DECC guidance, the ‘Revised Guidelines for Licence Relinquishment Reports’ (DECC, 2014) and must contain the following information:

• licence synopsis - Including the work obligations and any licence extensions agreed, and an outline of the prospectivity identified at the time of application and any undeveloped discoveries analysed;

• work programme summary – including details of seismic surveys and new wells drilled;

• prospectivity update - review of prospectivity following seismic and/or drilling work;

• any further technical work undertaken; and

• resource and risk summary - a summary of recoverable resources associated with the remaining undrilled prospects.
3.3 The Health and Safety Executive

The Health and Safety Executive (HSE) monitors oil and gas operations in relation to site safety and safe working practices, as required under the Health and Safety at Work etc. Act 1974, and regulations made under the following legislation:

- **The Borehole Site and Operations Regulations 1995** – These regulations are primarily concerned with the health and safety management of the site for onshore wells. The regulations place a duty on operators of petroleum borehole sites to ensure that no operations that would make a significant alteration to the well or involve a risk of accidental release of fluids from the well are carried out unless they have notified the HSE at least 21 days in advance; and

- **The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996** – This applies to all drilling regardless of whether they are onshore or offshore and are primarily concerned with well integrity and well control. The HSE will serve an improvement notice requiring modifications to the plan (well design and operation plan) if they are not satisfied with the well design and changes must be made before drilling operations can commence.

The objective of regulation by HSE is to prevent risks to health and safety associated with uncontrolled release of hydrocarbons potentially leading to risks of fire or explosion. This requires well construction to follow industry best practice (see Section 2.4) which also minimises the risk that fluids leak into the environment. The HSE also requires that wells are designed and constructed with well abandonment in mind.

HSE works closely with SEPA (see Section 3.5) and the OGA (see Section 3.2) to share relevant information on such activities and to ensure that there are no material gaps between safety, environmental protection and planning authorisation considerations, and that all material concerns are addressed.

The HSE initially scrutinises drilling activity and then monitors progress to determine if the operator is conducting operations as planned. During drilling activities, the HSE requires a weekly drilling completion and workover report focusing on well control and well integrity.

During assessment and inspection activities, HSE checks that the operator has independent well examination arrangements in place (HSE, 2008).

The purpose of a well examination scheme is to cover the design, construction and ongoing maintenance of the well, continuously throughout its life from initial design to its final plugging and abandonment (HSE, 2008).

Responsibility for the well examination scheme lies with the well operator. Responsibility covers all aspects of the scheme. The well operator is responsible for ensuring that the scheme is in place, for ensuring that the well examiner is both competent and independent, for ensuring that the scheme is and continues to be effective and that suitable action is taken on any recommendations that the well examiner may make. The
UOG operator must ensure that their entire well inventory is covered by the scheme including any modifications (HSE, 2008).

Interpretative guidance to the regulations, explains the degree of independence that well examiners must have from those responsible for the design construction and operation of the well. The guidance explains that the well examiner must be independent and separate from the immediate line management of the work that he is examining. Although it is permissible for the well examiner to be an employee of the well operator’s organisation, the HSE considers it imperative that there is a high degree of impartiality and independence from pressures from the well operator, especially of a financial nature (HSE, 2008).

The HSE also requires that the well examiner should be someone with sound knowledge and experience of the work to be examined. Competence must cover the full life cycle of the well from design to final abandonments and include any well servicing and change in use that may occur during its lifetime. The HSE recognises that not all the competencies required may reside with one individual and several individuals may be required to cover all of them (HSE, 2008).

The HSE considers it to be essential that operators carry out audits of their schemes to verify the independence and independence of well examiners (HSE, 2008). Oil and Gas UK produce guidance for operators on well examination (OGUK, 2011a) and on the competency of well examiners (OGUK, 2011b).

During the decommissioning phase, there is a requirement to notify the HSE when wells are abandoned and to show that the process complies with Oil and Gas UK guidelines.

The UK’s current system of regulation for assessing well integrity has been assessed as being robust and effective (Insitution of Mechanical Engineers - Institute of Materials, Minerals and Mining, 2016).

HSE also work alongside SEPA in the implementation of the Control of Major Accident Hazards Regulations 1999 (as amended) with the main aim of preventing and mitigating the effects of those major accidents involving dangerous substances. These Regulations mainly apply to the chemical industry, but also some storage activities, explosives and nuclear sites and other industries, where threshold quantities of dangerous substances identified in the Regulations are kept or used. If it is determined that the Regulations apply, a number of steps would have to be taken by the Operator, including for example preparing a major accident prevention policy.

3.4 The Planning System

3.4.1 Planning application

The Planning Authority (i.e. the planning department of the Scottish local authority area in which a UOG development is located) is responsible for granting planning permission for
development related to exploration and production of UOG. Planning permissions are granted under the Town and Country Planning (Scotland) Act 1997, herein referred to as “the 1997 Act“, (as amended by the Planning etc. (Scotland) Act 2006) and associated Regulations.

Any application for planning permission to carry out UOG development involving hydraulic fracturing is likely to be accompanied by an Environmental Impact Assessment (EIA).

Schedule 1 and Schedule 2 of The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 outline the criteria for determining whether an EIA would be required. Guidance published by the Scottish Government states that Developments falling within a description in Schedule 1 to the 2011 EIA Regulations always require EIA. Development of a type listed in Schedule 2 to the 2011 EIA Regulations will require EIA if it is likely to have a significant effect on the environment, by virtue of factors such as its size, nature or location (Scottish Government, 2015a).

UOG operators are likely to seek separate planning consents – potentially necessitating separate EIAs - for initial exploration works and for the subsequent production phase. Each planning consent, if approved, may include conditions specifically controlling decommissioning and aftercare to ensure the site is restored to previous use, or in some cases restored to an enhanced environmental use.

The Planning Authority therefore has a key role to play as the body, which both determines and issues planning consent for landward development works relating to UOG operations. The only exception to this would be if the planning application is appealed or is ‘called in’ by Scottish Ministers for their own determination.

As part of the planning application process, the Planning Authority is required to consult with statutory consultees. This process allows specialist organisations to inform the decision-making process, advice on potential mitigation strategies or conditions and, where possible ensure overlapping requirements for other regulatory regimes can be minimised.

All planning applications in Scotland are required to be determined against the Town and Country Planning (Scotland) Act 1997, which states (at Section 25) that all applications are to be determined in “accordance with the [development] plan unless material considerations indicate otherwise”.

The development plan will vary depending upon which local authority area the application site falls within, and may consist of both Strategic and Local development plans. The various development plans tend not to refer to onshore gas, due to their age, but all have general mineral works and environmental policies that would inform restoration and aftercare requirements and the financial contributions that would be applicable to an UOG planning application. In contrast, emerging development plans, do consider the industry to varying degrees and may offer more specific policy requirements.
Development plans are influenced by, amongst other things, the Scottish Government’s national policy as contained within Scottish Planning Policy (SPP), published in June 2014 (Scottish Government, 2014). Specific policies relating to mineral extraction developments that should be reflected at local policy level are outlined within SPP and should be referred to in relation to the principles underlying potential UOG development.

Planning Advice Note (PAN) 64: Reclamation of Surface Mineral Workings (Scottish Executive, 2000b), provides guidance on the use of planning agreements in minerals applications, alongside aftercare/restoration considerations, and statutory timescales involved. Within the context of the decommissioning phase of UOG development, the Planning Authority is primarily concerned with the effective aftercare management of the site as a land use (for an initial period of 5 years at least, which is determined by Schedule 3, Part 2, Paragraph (7) of the 1997 Act) and ensuring sufficient financial guarantees and reporting procedures are in place to manage that process.

The Planning Authority would control the restoration and aftercare phases through conditions attached to any approved consent (for example requiring a Restoration Plan or Habitat Management Plan) and via Section 75 (s75) Agreements. An agreement under Section 75 of The Planning etc. (Scotland) Act (2006) consists of a contract between Planning Authority and landowner and is often used to secure financial contributions towards infrastructure, in this case restoration (see Chapter 6).

Other means of securing financial agreements can be utilised. For example, the Heads of Planning Scotland (HOPS) ‘Position Statement on the Operation of Financial Mechanisms to Secure Decommissioning, Restoration and Aftercare of Development Sites’ (HOPS, 2015) identifies a number of alternative methods of securing financial obligations such as surety bonds, bank guarantees, parent company guarantees and mutual funds. The Position Statement concludes that “if a financial guarantee is necessary it should be secured and controlled by a legal agreement, most appropriately a Section 75 Agreement” however the Working Group considered that it “could not endorse, at this time, the use of planning conditions as an appropriate or suitable means to fully secure, control and monitor such financial mechanisms”.

3.4.2 Mining Waste Directive - European Community Directive 2006/21/EC1

The European Community Directive 2006/21/EC1 (the Mining Waste Directive) was transposed into Scottish legislation in the form of the Management of Extractive Waste (Scotland) Regulations 2010 (Scottish Government, 2010). These place a duty on Planning Authorities to consent activities relating to extractive waste areas and waste facilities as well as assigning additional requirements for category A (high-risk) waste facilities.

The Scottish Government document ‘Guidance on the Management of Extractive Waste (Scotland) Regulations 2010’ provides an outline of the underpinning principles of the directive and the requirements of these Regulations, although the guidance does not specifically consider UOG. The 2010 Regulations define extractive waste as “waste produced by the extractive industry and resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries” (The Management of Decommissioning, Site Restoration and Aftercare – Obligations and Treatment of Financial Liabilities October 2016)
Extractive Waste (Scotland) Regulations 2010, p.4). This would include wastes arising from decommissioning.

Extractive waste excludes other waste streams arising at minerals development that remains under the control of the Waste Management Licensing (Scotland) Regulations 2011 regime and would be controlled and monitored by SEPA (see Section 3.5).

The main requirements of the Regulations are as follows:

- Waste Management Plans to be prepared by operators for all sites that manage extractive waste (usually considered as part of the planning application process);
- where the material involved is not inert, operators will also need to demonstrate compliance with appropriate environmental and health and safety regulation before commencing extractive waste operations; and,
- financial guarantees, major accident prevention policies, safety management plans and internal emergency plans should be prepared for the most hazardous facilities (Category A waste facilities). It is unlikely that the waste associated with UOG developments would result in any development being considered as a waste facility falling within Category A, therefore additional financial guarantees to those agreed through s75 would be similarly unlikely.

3.4.3 Part IIA of the Environmental Protection Act 1990

Land can become contaminated by a variety of substances associated with industrial operations and the environmental, financial and legal implications of this can be substantial. Ideally, land contamination associated with surface UOG development would be managed under the restoration obligations required by the Planning Authority under the planning permission and associated legal agreements; or as required by SEPA under the Environmental Permitting system in situations where this applies.

If remediation of land contamination by these routes does not occur, then the management and remediation of contaminated land that, in its current state, is causing or has the potential to cause significant harm or significant pollution of the water environment, is regulated by legislation contained within the Environmental Protection Act (1990) known as Part IIA. Part IIA is further established in Scotland by the Contaminated Land (Scotland) Regulations (2000), as amended (2005) and the Scottish Government’s Statutory Guidance: Edition 2 (May 2006) (Scottish Government, 2006) which provides the detailed framework for the definition, identification and remediation of contaminated land.

Part IIA places a duty on local authorities, as the primary regulators, to identify and secure the remediation of contaminated land in their respective areas and to ensure land is suitable for use and does not cause harm to the public or the wider environment.

In fulfilment of Scottish Government objectives, it is each local authority's duty to:

- identify and remove unacceptable risks to human health and the environment;
seek to bring damaged land back into beneficial use; and,

seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

Responsibility for paying for remediation will follow the "Polluter Pays" principle where feasible. Persons who caused or knowingly permitted the substances to be in, on or under the land will be liable, in the first instance. If none can be found, responsibility will pass to the current owners or occupier (Scottish Executive, 2000a). As discussed in PAN 33 'Development of Contaminated Land' (2000) (Scottish Executive, 2000a), where land is statutorily defined as contaminated land and the polluter or landowner is unwilling to pay for remedial works then the provisions of Part IIA allow for the recovery of the enforcing authorities remediation costs from the polluter or, if the polluter is unable to be located, from the owner or occupier of the land. However, remediation notices can only require that land is made suitable for its existing use. Where development is involved, it is expected that the remediation costs would be borne by the developer.

Although the regime is based on the 'polluter pays' principle, local authorities also have powers to carry out remediation work at their own cost where polluters/owners cannot be traced, cannot pay for remediation for reasons of hardship, or where the local authority owns the land.

3.5 Scottish Environment Protection Agency

SEPA is responsible for enforcing environmental legislation in Scotland, as well as being a statutory consultee in relation to the planning application process. SEPA’s ‘Regulatory Guidance: Coalbed methane and Shale’ (Version 121119) suggests the following legislation is applicable to the onshore gas industry:

- The Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended);
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- The Control of Major Accident Hazards Regulations 1999;
- The Environmental Liability (Scotland) Regulations 2009;
- The Management of Extractive Waste (Scotland) Regulations 2010;
- The Waste Management Licensing (Scotland) Regulations 2011; and,
3.5.1 The Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended)

The Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended) arose from the European Community’s Water Framework Directive (WFD) (2000/60/EC) (as amended by Directive 2008/32/EC). The WFD was established to commit member states to the protection and management of the water environment and has been transposed into Scottish law through the CAR Regulations. To allow for proportionate regulation based on the risk an activity poses to the water environment, there are three types of CAR authorisation: General Binding Rules (GBRs), Registrations, and Licences. GBRs represent a set of mandatory rules that cover specific low risk activities, wherein the operator does not need to apply to SEPA. Registrations cover low risk activities that could have a greater risk when considered alongside other small-scale activities. Operators must apply to SEPA to register these activities. CAR licences allow site-specific conditions to be set to protect the water environment from activities that pose a higher risk (SEPA, 2011).

Licences can cover infrastructure projects that may be developed over an extended period of time and geographical area (such as multiple wellsites in a licence block) as well as single or multiple activities on a single site. Application fees apply to all licences, and subsistence (annual) charges may apply. SEPA has simple licences and complex licences for activities, for which different charges apply. For example, boreholes deeper than 200 m will require a complex licence under CAR.

In the context of UOG, the following activities are likely to fall within the CAR regulatory regime:

- drilling;
- injection of fracturing fluid;
- abstraction of water for injection purposes;
- abstraction of produced water and flow-back water; and,
- discharges.

Operators must submit a risk assessment and/or details of the drilling proposed to SEPA with their application for CAR authorisation to show that there would be no adverse effects on the water environment. The submission must also include any mitigation measures that will be used to address adverse effects. Any authorisation granted will specify conditions to limit impacts and may also require a monitoring plan.

During the decommissioning phase, CAR licence(s) are surrendered following SEPA agreement. Paragraph 27 of the CAR Regulations states that before determining whether to grant or refuse an application to surrender a licence, SEPA must:
“(a) assess the risk to the water environment posed by the cessation of the activity...and,

(b) take account of the steps (if any) that have been taken and identify any steps necessary to -

(i) avoid any risk of adverse impact on the water environment resulting from the cessation of the authorised activity; and,

(ii) leave the relevant part of the water environment affected by the authorised activity in a state which will permit compliance with any relevant requirements of the [wider] legislation.”

Prior to accepting the surrender of any licence, SEPA therefore must have sufficient information to demonstrate that there would be no impact on the water environment that exceeds agreed regulatory standards. The duration and level of post-operation monitoring must therefore be sufficient to demonstrate this and as a consequence cannot be explicitly quantified.

3.5.2 The Pollution Prevention and Control (PPC) (Scotland) Regulations 2012

SEPA has regulatory powers under the PPC Regulations (The Pollution Prevention and Control (Scotland) Regulations 2012) for activities such as refining of gas, gasification or other heat treatments, combustion, or disposal of solid and liquid wastes. In the context of UOG proposals, only refining of extracted gas would trigger the requirement for PPC permitting. The exploration, appraisal and decommissioning phases would not therefore require to be permitted under this regime (SEPA, 2016).

As per paragraph 48 of the PPC Regulations, any application to surrender a PPC Permit (Part A) must be accompanied by, amongst other things:

“A report describing the condition of the site affected by the surrender (the “closure report”), identifying in particular any changes from the condition of the site as described in the (i) site report, and (ii) where applicable, the baseline report...a description of the steps that have been taken to avoid pollution risks from the site, including any steps that have been taken to (i) return the site to a satisfactory state, and remove, control, contain or reduce any relevant hazardous substance in soil and groundwater”.

3.5.3 Naturally Occurring Radioactive Material (Radioactive Substances Act (1993))

The accumulation and disposal of naturally occurring radioactive wastes (NORM), present on pipework etc. recovered during decommissioning is regulated under the Radioactive Substances Act (1993) (RSA93). Unless the operator can demonstrate that concentrations of NORM in recovered materials are below the threshold values, all developments will require an authorisation issued under RSA93. While not stated directly in the SEPA’s Regulatory Guidance on unconventional gas guidance (SEPA, 2012), if authorisation is
required under RSA93, monitoring and reporting would likely be required by operators in order to comply with the authorisation.

3.5.4 The Waste Management Licensing (Scotland) Regulations 2011

The management and disposal of any waste streams generated through operation (and not extractive waste) may require to be licensed by SEPA under the above Regulations. Under this regime, identified wastes would need to be stored, treated and disposed of appropriately and in accordance with an approved management plan (SEPA, 2006).

3.5.5 Environmental Liability (Scotland) Regulations 2009

Under the Environmental Liability (Scotland) Regulations, operators who risk or cause sustained and significant damage to land, water or biodiversity will have a duty to avert such damage occurring or, where damage does occur, a duty to reinstate the environment. ‘Significant’ damage would relate to impacts from UOG development on biodiversity of European importance in terms of the Birds Directive (2009/147/EC) and the Habitats Directive (92/43/EEC), to water bodies (e.g. pollution of surface water courses or aquifers) in terms of the Water Framework Directive and to land where public health is at significant risk of being adversely affected.

SEPA’s Regulatory Guidance: Coalbed methane and Shale Gas (SEPA, 2012) Confirms, “activities associated with unconventional gas extraction are likely to come within the scope of ELR”. Operators must notify SEPA if they have caused land or water damage or if there is an imminent threat of such damage. Scottish Natural Heritage (or Marine Scotland for the marine environment) should be notified in cases where the “damage is likely to affect protected species and natural habitats” (para. 46).

In terms of cost recovery, Regulation 17 of the Regulations requires that (subject to paragraphs (2) and (3)), “the competent authority shall recover from the operator who has caused the damage or the imminent threat of damage, the costs it has incurred in relation to preventive or remedial measures taken under these Regulations”.

3.6 The Coal Authority

The Coal Authority manages the effects of past coal mining, including subsidence damage claims that are not the responsibility of licensed coalmine operators (Coal Authority, 2016). It deals with mine water pollution and other mining legacy issues. The Coal Authority is an executive non-departmental public body, sponsored by BEIS.

Any activity that affects (intersects, disturbs or enters) a coal seam requires prior written authorisation from the Coal Authority. They will grant a Coal Methane Access Agreement in appropriate circumstances, but will only do so if the operator already holds the appropriate licence from the OGA.
Figure 6: Regulatory Route Map
4 Regulatory Practice Elsewhere

4.1 Introduction

This chapter examines what lessons can be drawn from the monitoring and regulatory frameworks of other countries and industries and how could these lessons be interpreted and applied in a Scottish context to support robust regulation and monitoring.

This chapter reviews the regulation of UOG development in Denmark, Poland and Spain, which, like Scotland, are all European countries with the potential for emerging UOG industries. This study also considers regulation of the offshore oil and gas industry in Norway, which has a mature regulatory regime for conventional oil and gas development.

Outside Europe, the regulatory regimes for UOG development in the United States, Canada and Australia have been reviewed. As these countries are federations, regulation is also carried out at regional level. As examples, the regulations in Pennsylvania in the US, Alberta in Canada and New South Wales in Australia have also been reviewed.

This chapter looks at how the following are regulated within in each country or jurisdiction:

- licensing and regulation;
- financial guarantees;
- well integrity;
- monitoring; and
- decommissioning restoration and aftercare.

This chapter also looks at the regulation of other industries in Scotland (landfill and open cast coal mining) due to the similarities with UOG development in terms of the financial management of long-term liabilities and restoration requirements.

4.2 Other Countries

4.2.1 Denmark

Introduction

Denmark is one of the leading oil and gas producers in the EU. There are currently 19 producing offshore fields but no producing on-shore fields, either conventional or unconventional (ICLG, 2016). Mean estimated shale gas reserves onshore in Denmark are estimated to be 67 billion cubic metres (GEUS, 2014). However, exploration is at a very
early stage (Milieu Ltd., 2015a) and consequently there are currently no proven reserves in Denmark.

**Licensing and Regulation**

There is no specific legislation applicable to UOG development in Denmark. Instead, petroleum exploration and production (both conventional and unconventional) are governed by the Subsoil Act. Under the Act, the state grants a licence through the Danish Energy Agency (DEA) for surface investigations, exploration and production, each of which require a separate approval from the government. If the conditions on a licence are not met it may be revoked, however, this does not relieve the licensee of any of its obligations under legislation, the licence or any other applicable controls (Milieu Ltd., 2013a).

Areas for on-shore exploration and production are licensed under an open door procedure introduced 1997 under which operators can apply for licences (Danish Energy Agency, 2016a). To date, a single licence for on-shore hydrocarbon exploration has been granted in 2010 in northern Jutland. In 2012, the Danish Minister for Climate Change, Energy and Building introduced a “temporary pause” in the granting of new licenses for shale gas exploration pending an evaluation of the results of exploratory drilling in Jutland. The temporary pause was introduced to allow the Government to assess whether shale gas can be produced in a safe and environmentally sound manner (Danish Energy Agency, 2016a). A single unconventional (shale gas) exploratory borehole (Vendsyssel-1) has been drilled in Jutland in 2014. This confirmed the presence of natural gas, although not in economic quantities in this location, and the well has recently been plugged and abandoned.

In addition to DEA licences, several other permissions are required from Danish municipalities for surface operational activities. For onshore development, it is necessary to obtain construction permissions for processing plants, transportation, pipelines, etc.

**Financial Guarantees**

The Subsoil Act requires that to be granted a licence, an applicant must have the necessary technical expertise and the financial resources. Technical and financial capacity must be assessed and documented at each stage of development and licensees must provide adequate financial security in the form of insurance or financial guarantees (Danish Energy Agency, 2016b).

The licensee must provide either a parent company guarantee or bank guarantee. The guarantor is liable for any obligations or liabilities under the licence to the Danish State and is also liable for damages under the Subsoil Act for making good any pollution or other environmental damage (Milieu Ltd., 2013a).

**Well Integrity**

The DEA has issued guidelines for drilling which set out the requirements for drilling of wells for exploration, development or production (Danish Energy Agency, 2009). Whilst the
guidelines do not provide specific recommendations for well design and well construction, they do require that all wells must be cased and that casing design must ensure control of the well at all times (Milieu Ltd., 2013a). Plans for well drilling, including well design, must be approved by the DEA prior to commencement.

**Monitoring**

The DEA may ask the operator to supply information on baseline water quality prior to approval of drilling operations (Milieu Ltd., 2013a). The decision on the EIA for well Vendsyssel-1 also required that the operator monitor groundwater and methane at the site during operations for submission to the local council (Milieu Ltd., 2015a).

**Decommissioning, Restoration and Aftercare**

The Subsoil Act contains a provision in relation to decommissioning physical structures onshore and offshore. In the event that the state does not wish to take over the facilities, the licensee must remove the facilities in accordance with the details contained in the decision on decommissioning. A closure plan must be provided in due time prior to the anticipated closure of the facility (ICLG, 2016). Prior to the abandonment of a well, the hole must be plugged and abandoned according to procedures approved by the Danish Energy Agency (Danish Energy Agency, 2009). Decommissioned well sites are to be restored to their pre-development state except with the approval of the Danish Energy Agency (and other authorities as necessary).

### 4.2.2 Poland

**Introduction**

In 2011, the US Energy Information Administration estimated Polish shale gas reserves to be the largest in Europe; however, recent Polish estimates have been more conservative. The total number of licences for shale gas exploration has fallen from a peak of over 110 in 2012 to below 60 in early 2015. There has also been slow progress in exploration activities; attributed to high costs associated with legal and regulatory uncertainties and challenging geology. No shale gas production licences have so far been issued (Milieu Ltd., 2013b).

**Licensing and Regulation**

The legal framework of geological and mining works in Poland, including onshore unconventional oil and gas, is regulated by the Polish Geological and Mining Act 2011 (Milieu Ltd., 2015b). The current licensing system is a two-stage process. The Ministry of the Environment publishes the list of areas that will be available for the licences in the next year. During the subsequent tender procedure, applicants are judged on their capacity to carry out the activities of exploration, prospecting or production of hydrocarbons in a way that ensures safety and protects human health and the environment. Applicants are also assessed on their technical capability, financial viability, and programme of works (Milieu...
Rights for exploration, development and production are all held under a single licence valid for between 3 and 50 years.

**Financial Guarantees**

Under to the amended Geological and Mining Act, operators are required to provide a financial guarantee covering the licence provisions and closure obligations prior to the start of operations (Mining Enterprise Liquidation (Decommissioning) Fund) (Cichocki & Młodawski, 2013). The fund may be held in a dedicated bank account or as bonds. In some cases, an additional guarantee may also be required to cover other potential liabilities (Milieu Ltd., 2015b).

**Well Integrity**

Well design in Poland is regulated under the health and safety provisions of the Geological and Mining Act 2011. These set out requirements for casing, cementing and well integrity and require that the well is constructed to withstand the highest possible pressures which may be encountered (Milieu Ltd., 2013b). However, there is no independent review of well integrity by a qualified third party and no monitoring of well integrity has been undertaken for existing developments (Milieu Ltd., 2015b).

**Monitoring**

At existing wellsites monitoring of both the surface and sub-surface potentially affected has been planned or carried out before and where appropriate, after fracturing operations.

**Decommissioning, Restoration and Aftercare**

As mining plant, UOG wellsites are to be decommissioned under the requirements of the Geological and Mining Law Act, which requires operators to secure or dismantle surface installations, devices and objects of the mining plan, to ensure that the hydrocarbon reserve is secured (presumably by plugging and abandoning the wells) and to undertake measures necessary to protect the environment and ensure restoration.

The “measures necessary for the protection of the environment” are not defined or specified by law. However, they must be identified in the “mining plant in liquidation operation plan” and agreed with the local authority. The measures to protect the environment may be specified also in the EIA decision for each development.

### 4.2.3 Spain

**Introduction**

Unconventional gas resources in Spain are found in the Basque Country and Cantabria. Whilst the resource has not yet been fully assessed, estimated shale gas reserves are about 1.4 trillion cubic metres. The development of unconventional gas activities is at a preliminary stage (Milieu Ltd., 2013c) and as of 2015 no wells have been drilled (Milieu Ltd., 2015c).
Licensing and Regulation

Spain does not currently have specific legislation to regulate unconventional gas operations but instead uses existing legislation for conventional hydrocarbons (Milieu Ltd., 2013c).

The framework applicable to upstream activities is contained in the Hydrocarbon Sector Act (Act 34/1998) approved by Royal Decree 2362/1976, which has been amended (most recently in 2015) in order to adapt it to EU directives and to update it to suit the current situation of the oil and natural gas sectors (ICLG, 2016).

Article 9 of Law 34/1998 distinguishes between exploration authorisations, exploration permits and production permits.

Exploration authorisations grant the holder the authority to carry out exploration work in free areas, meaning those geographical areas where neither an exploration permit nor mining concession is currently in force. Exploration Permits entitle the holder to investigate, on an exclusive basis, the existence of hydrocarbons within the granted area for a period of up to 6 years (which can be extended in exceptional circumstances). Once the exploration activity under the permit has concluded, the contracting company can either abandon the exploration programme or apply for a production permit. A production permit is valid for 30 years but can be prolonged twice for periods of 10 years.

Operators requesting a production permit are required to provide technical specifications in support of their application. They also need to provide a general mining development plan and investment programme, estimates of production profile and a plan to decommission and abandon the facilities once the concession has concluded as well as the plan to restore the environment. An environmental impact study is required for hydrocarbon extraction under certain criteria according to EIA legislation. An insurance guarantee covering all requested obligations is also mandatory.

Permits for exploration or production do not exempt the operator from any other authorisations that might be required by the works for example taxation, spatial planning and urban development, environmental protection, industry legislation or the safety of people and property.

Financial Guarantees

Under Article 9(4) of Law 34/98, prior to the start of any work for prospecting, exploration or production activities the operator is required to provide civil liability insurance with respect to damages to people or goods as a consequence of their activities. The amount of insurance required is not defined in law and is established on a case-by-case basis.

Under Article 21 of Law 34/98, operators requesting an exploration permit are required to provide a financial guarantee (in the form of a bank guarantee or in cash). The amount of the guarantee is fixed and should cover all obligations, being updated regularly to cover
new permits or concessions granted. In the case of non-fulfilment of the investment commitment or any other obligation, the guarantee will be executed.

Operators requesting production concessions are required to submit a financial guarantee to secure any obligations deriving from the exploitation concession. Article 27 of the Law 34/98 requires the guarantee to cover dismantling and restoration amongst others. The size of the guarantee is currently determined based on a fixed amount per hectare.

Well Integrity

Before commencement of drilling, operators must submit a request for approval of the well design by the Ministry of Industry, Energy and Trade under Law 34/1998. Article 35 of Royal Decree 2362/1976 on hydrocarbons requires the use international standards for well equipment and installations.

The same provision requires operators to prevent leakage during drilling operations, to protect drinking water by casing and cementing the well and to isolate the rocks containing oil or gas. The operator must monitor downhole pressure annually in order to obtain information on the average pressure of the well and the reservoir. In wells where abnormal pressure levels are recorded, corrective measures must be taken in accordance with the standards of the oil and gas industry.

Monitoring

Recent decisions by the Ministry of Environment that require the environmental impact assessment of exploratory drilling include detailed evaluation of the quality of the surface waters and groundwater prior to extraction project activities in order to evaluate the future impact of the projected activities. However, this information does not address unconventional gas extraction involving hydraulic fracturing and does not impose monitoring obligations on operators (Milieu Ltd., 2015c).

Decommissioning, Restoration and Aftercare

The Hydrocarbon Sector Act provides that the termination of a mining concession will mean production will immediately revert to the State. This may require the operator to dismantle the facilities.

Under Article 15 of Hydrocarbons Law 34/98 the operator requesting an exploration or production permit needs to submit details of both environmental protection measures and a restoration plan. If the restoration plan is not completed then the financial guarantee will be executed.

Under the hydrocarbon legislation, closure of the well, the well site, and the abandonment of the installation must be approved by the competent authorities. Within two months of completion or abandonment of a well or deepening an existing one, the operator shall submit a report of end of production. The financial guarantee is maintained throughout the period of operation. The permanent abandonment of the facility requires the final on-site
inspection by the competent authority, within a year, as well as the assessment of all the reports submitted by the operator.

4.2.4 Norway

Overview of Oil and Gas Activities

Norway has extensive conventional natural gas resources located beneath its continental shelf and is among the world's largest gas exporters and ships most of the produced natural gas through export pipelines to the European market (ICLG, 2016). Norway has no onshore production of hydrocarbons; however, it has a comprehensive and mature regulatory system for offshore exploration and production.

Licensing and Regulation

The main Government authorities responsible for the regulation of development of petroleum reserves are the Ministry of Petroleum and Energy (MPE), the Norwegian Petroleum Directorate (NPD), and the Petroleum Safety Authority (ICLG, 2016).

The main legislation related to oil and gas activities in Norway is the Petroleum Act of 1996 and the associated petroleum and safety regulations (ICLG, 2016).

The rights to the petroleum resources on the Norwegian continental shelf are vested in the Norwegian State. The regulatory regime for Norwegian petroleum activities is based on the licensing system, under which companies are granted rights to explore for and produce petroleum.

Financial Guarantees

Under the Petroleum Act, the MPE can require the provision of financial security from a licensee to cover their obligations towards the state and third parties arising from petroleum exploration and production activities. This is often accomplished using a parent company guarantee. The parent company guarantee is a non-negotiable document that will be a condition for any award or assignment of a Production Licence. Regardless of the state being the main beneficiary under the guarantee, third parties may direct claims for damages caused by pollution or for personal injury directly to the guarantor.

Well Integrity

The NORSOK Standard Well Integrity in Drilling and Well Operations D-010 Rev. 4 (NORSOK, 2013) was developed with broad petroleum industry participation by interested parties in the Norwegian petroleum industry. Sections 4 to 8 of the standard provide detailed information for well design during both exploration and production with the objective of ensuring well integrity.
Decommissioning

The Petroleum Act regulates the shutdown and disposal of facilities on the Norwegian Continental Shelf. Between two and five years prior to an installation ceasing production, operators are required to submit a decommissioning plan, including an Environmental Impact Assessment and plans for public consultation. The MPE makes the final decision on decommissioning in consultation with the NPD (OGUK, 2016).

The decommissioning plan is a comprehensive study that addresses and evaluates different options for decommissioning, including removal, and also includes a comprehensive environmental impact assessment. NORSOK Standard Well Integrity in Drilling and Well Operations D-010 Rev. 4 (NORSOK, 2013) provides a detailed standard for well suspension, plugging and abandonment design.

Specific decommissioning requirements are outlined in Section 5-1 of the Petroleum Act. For abandonment, the licensee or owner is liable for damage or inconvenience caused wilfully or inadvertently in connection with the abandoned facility, unless otherwise decided by the Ministry (Norwegian Petroleum Directorate, 2016).

4.2.5 United States

Introduction

Over the past two decades, domestic UOG development in the US has turned the country into the largest gas producer in the world (ICLG, 2016). The US Energy Information Administration estimates that about 11.34 trillion cubic feet of dry natural gas was produced directly from shale and tight oil resources in the United States in 2013. This was about 47% of total U.S. dry natural gas production in that year (Energy Information Administration, 2015).

Licensing and Regulation

Licensing

The determination of a legal and organisational framework applying to oil and gas activities depends in part on whether the underlying resources are owned by the government or private parties and whether the location is onshore or offshore.

The development of oil and gas reserves on federal lands occurs through leasing programmes managed by the Department of the Interior. Exploration and production activities on federal onshore properties are governed by the Mineral Leasing Acts of 1920 and 1947 and are regulated by the Bureau of Land Management (BLM). The BLM reviews and approves permits and licences for companies to explore and develop oil and natural gas on federal lands, and, once projects are approved, it enforces regulatory compliance.

At the state level, public agencies generally regulate oil and natural gas development and production on state land. For example, in Pennsylvania the Department of Conservation
and Natural Resources can issue leases for shale gas development on state land. There has been a moratorium on new leases on state land in Pennsylvania since June 2015.

The leasing of private land for oil and natural gas development is by individual landowners who negotiate leases directly with operators. In Pennsylvania, this practice has led to widespread, largely uncontrolled, development of both conventional and unconventional development. The subsequent potential for environmental and land-use impacts has been widely reported and has been the subject of detailed review and assessment (for example by Considine, et al., 2012).

Regulation

Regulation of oil and natural gas development and production is carried out by public bodies at the State level (ICLG, 2016). Under the Energy Policy Act of 2005 the use of fluids in hydraulic fracturing used in UOG developments has been exempted from a number of federal statutes including the Clean Air Act, Clean Water Act, Safe Drinking Water Act, and the Comprehensive Environmental Response, Compensation, and Liability Act.

In Pennsylvania, the Department of Environmental Protection’s (DEP) Office of Oil and Gas Management is responsible for facilitating “the safe exploration, development, recovery of Pennsylvania's oil and gas reservoirs in a manner that will protect the state's natural resources and the environment”. The primary regulations are set out in Chapter 78 of the Pennsylvania Code, which covers: issuing of permits; environmental standards; well drilling; operation and plugging together with reporting and financial bonding arrangements amongst others.

These regulations were modified in 2012 to enhance the level of environmental protection by specifically addressing unconventional well development in the state, including measures to prevent the unauthorized releases of regulated substances onto the ground. The modifications also aim to protect public resources and to identify abandoned, orphaned and inactive wells in areas of hydraulic fracturing.

Financial Guarantees

A lessee of federal land must provide the BLM with a bond of at least $10,000 to ensure compliance with all the lease terms, including environmental protection before they begin geophysical exploration on leased or public lands. The BLM may require an increase in the bond amount whenever conditions warrant. For multiple leases, a lessee may provide a $25,000 state-wide bond or a $150,000 nationwide bond.

In Pennsylvania, a lease for oil or gas wells on state land may be bonded using individual bonds for each well or a blanket bond to cover all of the operator's wells. The value of the bonds is dependent on the number and depth of the wells held by the operator so that amounts could range from $4,000 for a shallow well to a maximum of $600,000 for operating 167 wells or more.
Well Integrity

In Pennsylvania, casing and cementing of wells is regulated under Section 78.8 of Chapter 78 of the Pennsylvania Code. The operators must prepare a casing and cementing plan, which is available for inspection by the DEP. Under Section 78.8, operators are required to inspect each operating well quarterly to ensure it complies with the well construction and operating requirements of Chapter 78.

Monitoring

In Pennsylvania, Section 78.5 of Chapter 78 of the Pennsylvania Code requires that operators who wish to preserve their legal defence that the pollution of a water supply existed prior to the drilling or alteration of the well shall conduct a baseline monitoring survey. There are no requirements in the Code for monitoring during operations other than measures set out in under Section 78.89 to be undertaken in response to a natural gas migration incident. There are no requirements in the Code for post abandonment monitoring.

Decommissioning, Restoration and Aftercare

For federal lands, Section 7(b) of the Natural Gas Act requires a natural gas company to obtain approval from the Federal Energy Regulatory Commission (FERC) before abandoning all or any portion of its facilities subject to the jurisdiction of the FERC. The FERC may only permit the abandonment of natural gas facilities upon finding that (1) the available supply of natural gas is depleted to the extent that the continuance of service is unwarranted, or (2) that the present or future public convenience or necessity permits such abandonment. The plugging and abandonment of oil and natural gas wells are also subject to state regulation and, for federal lands to regulation by the Department of the Interior (ICLG, 2016).

Section 78.91 of the Pennsylvania Code sets out the general provisions for plugging wells with detailed requirements set out in Section 78.92. Section 78.65 of the Pennsylvania Code sets out requirements for site restoration following the cessation of operations at a well site. No aftercare requirements are specified in the legislation.

4.2.6 Canada

Introduction

Canada is the world’s fifth largest natural gas producer in the world, behind the United States, Russia, Iran and Qatar (ICLG, 2016). Canada’s oil and gas industry is active in 12 of its 13 provinces and territories including Alberta (CAPP, 2016).
Licensing and Regulation

Licensing

Canada’s Federal and provincial governments share jurisdiction over Canadian energy policy, as well as the legal and regulatory framework for the exploration of Canadian oil and natural gas reserves. Accordingly, there is no single energy policy or regulatory body governing the development of oil and natural gas reserves. The Federal and provincial governments are also owners of the majority of Canada’s mineral rights. The majority of the Federal governments’ ownership rights are made up of oil and gas rights in Canada’s national parks and Aboriginal lands.

Although the Federal and provincial governments own the majority of Canada’s oil and gas rights, some oil and gas rights are held by private landowners. For example, approximately 14% of Alberta’s oil and gas rights are privately owned. Companies obtain the right to explore, drill and produce oil and natural gas from private landowners by way of a privately negotiated oil and gas lease (ICLG, 2016).

The oil and natural gas rights owned by Federal and provincial governments and private individuals are transferred to participants through licences and/or leases to explore for, develop and produce oil and natural gas. Once a licence or lease is issued, a participant is entitled to explore for, develop and produce oil and natural gas in accordance with the terms of the licence or lease. At the end of the term, or upon termination of the licence or lease, the rights granted to the participant will revert to the Federal or provincial government that issues the licence or lease (ICLG, 2016).

In Alberta, petroleum and natural gas rights are acquired by operators under regular competitive bid auctions administered by Alberta Energy, a ministry of the Government of Alberta. This body manages the development of the province's non-renewable resources including coal, minerals, natural gas, petrochemicals, conventional oil and oil sands and renewable energy, including granting industry the right to explore for and develop energy and mineral resources.

Regulations

Federally owned oil and gas rights are governed by The Canadian Petroleum Resources Act and The Canada Oil and Gas Operations Act. Provincially owned oil and gas rights are governed by each province’s respective legislation governing the exploration and production of oil and natural gas (ICLG, 2016).

In Alberta, the Alberta Energy Regulator (AER) is an industry funded regulatory body established under the Responsible Energy Development Act of 2013 and associated regulations. AER is responsible for the environmentally responsible development of energy resources in the province including oil, gas, coal and oil sands and associated infrastructure under a number of energy resource enactments.
The Government of Alberta has granted the AER authority to review and make decisions on proposed energy developments, to oversee all aspects of energy resource activities in accordance with government policies, to regularly inspect energy activities to ensure that all applicable requirements are met, to penalize companies that fail to comply with AER requirements, and to hold hearings on proposed energy developments. The AER also allocates and conserves water resources, manages public lands, and protects the environment under a number of separate pieces of legislation.

Financial Guarantees

In Alberta, there is no requirement for up-front financial guarantees as part of the awarding of tenure for oil and gas development and production. Instead, financial guarantees are set under the Licensee Liability Rating (LLR) Program and Licence Transfer Process under AER Directive 006.

The purpose of the LLR program is to:

- prevent the costs to suspend, abandon, remediate, and reclaim a well, facility, or pipeline in the LLR Program from being borne by the public of Alberta should a licensee (i.e. an operator) become defunct; and,

- minimize the risk to the Orphan Fund posed by the unfunded liability of licences in the program (Alberta Energy Regulator, 2016).

The AER's Liability Management rating assessment is designed to assess a licensee's ability to address its suspension, abandonment, remediation, and reclamation liabilities. The assessment is a comparison of a licensee's deemed assets to its deemed liabilities and is conducted monthly and on receipt of a licence transfer application (Alberta Energy Regulator, 2016).

If a licensee's deemed liabilities exceed its deemed assets it is required to provide the AER with a security deposit for the difference. A security deposit is required to minimize the possibility of the licensee's suspension, abandonment, remediation, and reclamation costs being borne by the Alberta Orphan Fund (Alberta Energy Regulator, 2016).

The LLR Program applies to all upstream oil and gas wells, facilities, and pipelines. The Alberta Orphan Fund will pay the costs to suspend, abandon, remediate, and reclaim a well, facility, or pipeline included in the LLR Program if a licensee or working interest participant becomes defunct. The Orphan Fund is entirely funded by licensees in the LLR Program through a levy administered by the AER. In 2014/15 the Orphan Fund spent $16 million on site reclamation, well abandonment, facility decommissioning and pipeline abandonment largely funded by the AER orphan fund levy (Orphan Well Association, 2015).

Well Integrity

In Alberta, detailed requirements for casing and cementing design are set out in AER Directives 008, 009 and 0010. In particular, these require that casing and cementing design should assist with well control and groundwater protection. The well design should
ensure that the materials used are suitable for the life of the well (Alberta Energy Regulator, 2016).

**Monitoring**

In Alberta, AER Directive 035 requires baseline groundwater monitoring for coalbed methane exploration and development for wells above the base of groundwater protection but not for other oil and gas operations. There is no requirement for operational or post-closure monitoring of other UOG developments in Alberta (Alberta Energy Regulator, 2016).

**Decommissioning, Restoration and Aftercare**

The Federal and provincial governments have enacted legislation to govern the abandonment and reclamation of lands subject to oil and natural gas development (ICLG, 2016).

In Alberta, well abandonment is regulated under AER Directive 020. This details the minimum requirements for well abandonments as required under the relevant oil and gas regulations. The stated objective of the well abandonment Directive is to cover all non-saline groundwater and to isolate permeable zones within wells (Alberta Energy Regulator, 2016).

The AER regulates reclamation activities on both private and public land. A company that owns a well or pipeline that is no longer productive is responsible for reclaiming the land, addressing surface reclamation issues and subsurface contamination, and applying to the AER for a reclamation certificate. The standard of all reclamation work must be professionally signed-off and the licensee holds a 25-year liability for surface reclamation issues and a lifetime liability for contamination (Alberta Energy Regulator, 2016).

### 4.2.7 Australia

**Introduction**

UOG activity in Australia comprises both coalbed methane (known in Australia as coal seam gas (CSG)) and shale gas exploration and development. There are substantial reserves of CSG in both New South Wales and Queensland. Exploration for UOG is still in its relative infancy in Australia with an emerging unconventional gas industry in New South Wales and Queensland (Minter Ellison, 2013). This review concentrates on New South Wales where the regulatory system has recently been the subject of extensive scientific review and subsequent improvement (NSW Chief Scientist and Engineer, 2014a; NSW Government, 2015). As such, it represents a good example of a modern regulatory regime that has addressed concerns arising from the development of UOG resources.
Licensing and Regulation

Legislative regime

Australia is a federation of six States and two Territories. Legal and political power is divided between the Federal Government and the State/Territory governments as set out in Australia's Constitution (Minter Ellison, 2013). Each State and Territory government in Australia has jurisdiction over petroleum reserves within their territory. The definition of "petroleum" in each State or Territory jurisdiction generally includes CSG and other UOG resources (ICLG, 2016).

In New South Wales, onshore oil and gas, including UOG development, is regulated by the Division of Resources and Energy within the Department of Industry under the Petroleum (Onshore) Act 1991 (NSW), the Petroleum (Onshore) Regulation 2007 (currently being updated), the Environment Operations Act 1997 and the Environmental Planning and Assessment Act 1979.

Licensing

With some limited exceptions, all on-shore petroleum reserves are owned by the Government of the relevant State or Territory (ICLG, 2016).

In New South Wales, a title (i.e. a licence or lease) must be granted by the Minister for Resources & Energy under the Petroleum (Onshore) Act 1991 before an operator can prospect, explore for or produce petroleum (including coal seam gas), whether on Crown or private land.

As part of the review of oil and gas regulation in NSW the process of awarding of titles is in the process of being changed (NSW Government, 2015). A similar licensing system to that used in Pennsylvania operated in New South Wales until 2011. This led to 65% of the state being licensed for coal seam gas exploration including land in urban areas and within National Parks and other protected areas. Under the 2015, Gas Plan (NSW Government, 2015) a new licensing system has been put in place and unused exploration licences have been recalled and operators compensated. Consequently, only 15% of New South Wales is now licensed and new licences will only be issued under a strategic release programme.

The strategic release programme is similar to the licensing system adopted in the UK and other jurisdictions and fulfils a recommendation of the review of legislation in the New South Wales Chief Scientist and Engineer's review of CSG regulation (NSW Chief Scientist and Engineer, 2014d). The review concluded that the State Government should “use its planning powers and capability to designate those areas of the State in which CSG activity is permitted to occur, drawing on appropriate external expertise as necessary”. The strategic release programme is designed to provide greater clarity and transparency in decision making relating to where exploration activities may take place, and introduces a competitive process for determining who may undertake these activities. (NSW Government, 2015).
Operators successfully applying for a title in NSW must demonstrate how they will reach Minimum Standards required by the Petroleum Onshore Act. This requires operators to supply details of corporate, compliance and environmental performance history including financial standing and technical capabilities (Minter Ellison, 2013). There is on-going assessment of the titleholder’s compliance based on annual activity reports supplemented by information from inspections and audits by the NSW Government. Before a petroleum production lease can be granted, development consent must be obtained under the Environmental Planning and Assessment Act, 1979.

Regulation

On 1 July 2015 the NSW Environment Protection Authority became responsible for compliance and enforcement of all conditions of approvals for gas activities in New South Wales. The Office of Coal Seam Gas or Department of Planning and Environment issue conditions of approval when an application to explore, appraise or produce gas is approved. These conditions include strict controls which industry must comply with, to:

- protect land, water and air
- reduce noise impacts
- control waste management
- manage rehabilitation and biodiversity
- manage the use of chemicals
- require community consultation
- manage infrastructure and requirements for insurance and assurance.

The NSW Environment Protection Authority is responsible for determining compliance with and enforcement of these conditions. The regulator is also responsible for regulating compliance with the codes of practice associated with the gas industry and for compliance with and enforcement of conditions of water access licences issued by the NSW Office of Water (NSW Environment Protection Authority, 2016).

A range of compliance and enforcement mechanisms are available including penalty infringement notices and, if required, prosecution. The State Government’s enforcement approach to non-compliance depends upon the nature or consequences of the non-compliance and the previous performance of the titleholder, including responses to previous notices or sanctions.

Financial Guarantees

It is the responsibility of the New South Wales Government to ensure that land disturbed by petroleum production activities is returned to a sustainable land use.
The operator is required by the Division of Energy and Resources to provide a security deposit that covers the full rehabilitation costs on all titles. This requirement ensures that the State does not incur financial liabilities in the event of a titleholder defaulting on their rehabilitation obligations.

The titleholder is required to provide an estimate of rehabilitation costs for consideration when determining the security deposit amount.

On grant of a title, the security deposit is set at a level that is intended to cover the limited range of activities permitted to be carried out under the title without further approval. On receipt of an application for approval of an activity, the adequacy of the security deposit is reviewed by the Government. If the activity is approved, the security condition is varied to cover the estimated rehabilitation costs for that activity, and any liabilities associated with previous or ongoing activities. Security reviews may also be triggered by title renewals or transfers, regulatory audits, environmental incidents and other changes to rehabilitation liabilities or be requested by the titleholder.

The amount of a security deposit is defined by a Rehabilitation Cost Estimate (RCE) provided by the titleholder. If the RCE is inadequate, it will be rejected and the titleholder will be required to submit a revised RCE (Division of Resources and Energy, 2012). The Division of Resources & Energy will assess and determine when rehabilitation obligations have been met and the security deposit can be released. Partial release of the security deposits may occur when successful rehabilitation has been demonstrated for part of the site. Security deposits are usually required to be submitted either as cash or as a security certificate such as a bank guarantee (NSW Government I&I, 2010).

The security deposit only covers that period of time when the operator holds the title for the petroleum exploration and production activities. As part of the Independent Review into Coal Seam Gas activities in NSW, the Government examined ways in which insurance coverage could be improved along with a range of other measures to deal with environmental risk in the industry (NSW Chief Scientist and Engineer, 2014b).

The review identified that an improved insurance coverage regime would be beneficial to the State and supported the concept of a rehabilitation fund similar to the special purpose fidelity fund set up by the Western Australian Government for mine rehabilitation. Establishment of such a fund would enable an additional layer of coverage and be beneficial to government in the event of long term or unforeseen environmental impacts caused by CSG activities. The fund would represent a third layer of protection in addition to the security deposit process and any new or enhanced insurance arrangements required by Government, with each layer addressing separate risks as outlined in the conclusion of this paper (NSW Chief Scientist and Engineer, 2014b).

Well Integrity

The construction and integrity of Australian coal seam gas wells is managed through a combination of state and territory legislation, industry standards and codes of practice. For example, Australia’s petroleum and gas legislation is based on international standards.
such those produced by the API (API, 2010; API, 2015) and NORSOK (NORSOK, 2013). New South Wales has a Code of Practice for Coal Seam Gas: Well Integrity (Division of Resources and Energy, 2012) which outlines monitoring and reporting requirements to ensure well integrity as specified by the regulator, including standards for well design, casing and cementing (Division of Resources and Energy, 2012).

**Monitoring**

In New South Wales, operators are required to produce a groundwater monitoring and modelling plan (including 2 years baseline monitoring data) as a condition on a Petroleum Exploration Licence. Operational monitoring (water and/or land quality) is required by the NSW Environmental Protection Authority under an Environmental Protection Licence and can also be required by the NSW Department of Planning and the Environment under a site's Development Consent (NSW Chief Scientist and Engineer, 2014c).

**Decommissioning, Restoration and Aftercare**

The New South Wales Code of practice for coal seam gas well integrity (Division of Resources and Energy, 2012) requires that CSG well abandonment must ensure the environmentally sound and safe isolation of the well, protection of groundwater resources, isolation of the productive formations from other formations, and the proper removal of surface equipment. Well abandonment procedures use standard oilfield practice.

Land affected by petroleum production can be rehabilitated to a variety of land uses including agriculture, native ecosystems, forestry and mixed land uses. Under the Petroleum (Onshore) Act 1991, The New South Wales Government has a wide range of powers for regulating rehabilitation including:

- environmental management and rehabilitation conditions on production leases;
- rehabilitation security bonds; and
- clear enforcement powers to ensure titleholders comply with their obligations.

Titleholders must also submit and comply with an approved Petroleum Operations Plan (including a rehabilitation plan), which is used for detailed rehabilitation planning and for monitoring rehabilitation progress and success.

Rehabilitation must be undertaken progressively over the life of the project. The New South Wales Government has responsibility for determining when rehabilitation has met the required standard, taking into account post-production land use, prior to title relinquishment and security deposit release. Partial release of the security deposit may occur when successful rehabilitation has been demonstrated for part of the site.
4.2.9 Lessons for Regulation in Scotland

Introduction

The review of regulatory regimes in a number of countries provides a benchmark against which the current regulatory regime in the UK and Scotland can be assessed. It also provides evidence that the Scottish Government can use when determining whether regulatory powers require modification should UOG development be permitted in Scotland.

A summary of the results of the regulatory review is presented in , which allows a comparison of the Scottish regulatory system against those in the other jurisdictions reviewed on the following basis:

- whether the licensing system is led by the government or by operators;
- whether the regulatory and licensing functions of government are combined or separate;
- how well integrity and well abandonment are regulated;
- to what extent monitoring is required prior to, during or after UOG development;
- whether surface restoration is required; and
- whether funds for decommissioning or repair of orphan wells are available.

Licensing

The UK and Scottish petroleum licensing system as described in Section 3.2 is a two-stage process:

- the identification by the government of which areas are available for licensing; and
- a competitive bidding process for licences with licences awarded to operators who are technically competent and financially viable and have appropriate safety and environmental management systems in place.

The latest (14th) round of licensing in the UK was also the subject of a strategic environmental assessment (DECC, 2013b) and licence applications under the 14th round have, where necessary, been assessed for impacts on European sites.

The majority of the jurisdictions considered operate similar licensing regimes to that in the UK and Scotland. The only notable exception studied is Pennsylvania, where the majority of leases are for privately owned lands and are negotiated directly between the landowner and the operator without state control. This has led to widespread largely uncontrolled development of both conventional and unconventional wells and the potential for environmental and land-use impacts. The Scottish licensing system is comparable with the majority of the jurisdictions studied and can therefore be considered to represent best
practice (as discussed in the review of licensing in New South Wales (NSW Chief Scientist and Engineer, 2014d)).

**Regulation**

A strong regulatory system is necessary to ensure that UOG operations are effectively controlled, so that well integrity during construction and abandonment is to a standard that reduces risk to as low as reasonably practicable (see Section 2.5). Regulators also provide independent assurance that standards are correct and being adhered to especially in areas not the primary concern or interest of those undertaking the activities (DPC, 2009).

As shown in, jurisdictions with strong regulatory control separate regulatory and licensing functions so that the process for allocation of rights to exploit subsurface resources is separated from the regulation of the activities required to give effect to that exploitation (i.e. exploration and production activities) (NSW Chief Scientist and Engineer, 2014d).

Regulation in Scotland, as in England and Wales, is by a number of different bodies, principally SEPA, the HSE and Planning Authorities - albeit with clearly defined roles. A single regulator has been considered to be preferable to multiple regulators (NSW Chief Scientist and Engineer, 2014d; Task Force on Shale Gas, 2015). In England, the Government (BEIS) has responded to such criticism by setting set up a Shale Gas Strategy Group to ensure a ‘proactive and joined-up’ approach to exploration and development of shale gas in England. The purpose of the Shale Gas Strategy Group is to provide co-ordination within and across government (in England). As well as BEIS, the strategy group includes the HSE, UK Treasury, the Environment Agency, Public Health England, the Department of Environment, Food and Rural Affairs (DEFRA) and a number of representatives from mineral planning authorities.

No similar group currently exists in the Scottish Government, however the regulatory system in Scotland is reported to be “generally well-coordinated between the main regulatory bodies” (Independent Scientific Expert Panel, 2014). The Independent Scientific Expert Panel has only identified one regulatory gap relating directly to well integrity, decommissioning or restoration, namely the absence of any mechanism requiring for long-term monitoring and responsibility for wells. However, this report considers that existing post-decommissioning monitoring under the CAR regulations should be sufficient to identify wells at risk of well integrity failure. In relation to long-term responsibility, the Expert Panel recognised that “operators have an open-ended liability to remediate any ineffective abandonment” (Independent Scientific Expert Panel, 2014). Possible methods of managing liabilities associated with orphan wells in situations where operators are no longer in existence is discussed in Chapter 6 of this report.

**Financial Guarantees**

Provision of some type of financial guarantees is associated with the granting of licences or leases in all of the jurisdictions considered. In the majority, including Scotland, financial guarantees are required to be sufficient to cover restoration liabilities (including well
abandonment) for licensed activities. The exceptions are Pennsylvania, where the value of financial guarantees required may not be sufficient to manage all liabilities, and Spain, where financial guarantees may cover surface restoration only. A more detailed review of financial guarantees required for potential UOG development in Scotland forms Chapter 6 of this report.

Well Integrity and Well Abandonment

In order to ensure well integrity during construction and abandonment work should be to a standard that reduces risk to as low as reasonably practicable. All jurisdictions require well construction and abandonment to be undertaken to guidelines or standards. The most prescriptive of these, including Scotland, are based on industry best practice, including Norwegian (NORSOK, 2013) and US (API, 2010; API, 2015; API, 1993) standards and require well designs and well abandonment plans to be reviewed by the regulatory authorities.

Monitoring

Although baseline monitoring is required in some jurisdictions, in Scotland it is discretionary but is very likely to be required by SEPA as part of the requirements for obtaining a deep borehole licence (SEPA pers. com.). Baseline monitoring is recognised as good practice for operators in the UK by UKOOG.

Operational monitoring is driven by environmental regulation of operational activities in Scotland (under the CAR Regulations) and in Denmark, Poland and New South Wales. In other jurisdictions, operational monitoring appears to be at the discretion of the operator. Scotland is the only jurisdiction of those reviewed where there is a legal requirement for post-closure monitoring – in this case to allow the surrender of CAR licences (SEPA, 2012).

Restoration

Restoration is required by regulation in all jurisdictions, with some requiring restoration to the pre-development or another specified end-use. In Scotland, restoration to a specified end use is achieved through the planning system.

Orphan Well Fund

Funds designed to ensure that residual risks associated with the management of liabilities associated with orphan wells do not fall the on public purse are currently in place in Canada (e.g. Alberta) and a similar system has recently been proposed for use in New South Wales (NSW Chief Scientist and Engineer, 2014d). Currently there no such scheme in Scotland or the UK more generally. The possible role of such funds for potential UOG development in Scotland is discussed in more detail in Chapter 6.
### Table 3: Summary of Regulatory Assessment

<table>
<thead>
<tr>
<th>Country</th>
<th>Licensing</th>
<th>Regulation</th>
<th>Financial Guarantee</th>
<th>Well Integrity</th>
<th>Baseline Monitoring</th>
<th>Operational Monitoring</th>
<th>Post-closure Monitoring</th>
<th>Well Abandonment</th>
<th>Restoration</th>
<th>Orphan Well Fund</th>
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<td>Denmark</td>
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<td>Spain</td>
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<td>Scotland</td>
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</tbody>
</table>
### Key

<table>
<thead>
<tr>
<th>Licence</th>
<th>● Competitive bids for designated areas</th>
<th>○ Bids initiated by operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation</td>
<td>● Independent regulator</td>
<td>○ Combined regulation/licensing authority</td>
</tr>
<tr>
<td>Financial Guarantee</td>
<td>● Covers all liabilities</td>
<td>○ Partially covers liabilities</td>
</tr>
<tr>
<td>Well Integrity</td>
<td>● Well design approved by regulator</td>
<td>○ Well design guidelines only</td>
</tr>
<tr>
<td>Baseline Monitoring</td>
<td>● Required for all UOG developments</td>
<td>○ Required for some UOG developments</td>
</tr>
<tr>
<td>Operational Monitoring</td>
<td>● Required for all UOG developments</td>
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<tr>
<td>Post-Closure Monitoring</td>
<td>● Required for all UOG developments</td>
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<tr>
<td>Well Abandonment</td>
<td>● Well design abandonment approved by regulator</td>
<td>○ Well abandonment guidelines only</td>
</tr>
<tr>
<td>Restoration</td>
<td>● Site restoration required</td>
<td></td>
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<tr>
<td>Orphan Well Fund</td>
<td>● Orphan well fund in place</td>
<td>○ Orphan well fund proposed</td>
</tr>
</tbody>
</table>
4.3 Other Industries

4.3.1 Introduction

In addition to the regulation of UOG in other countries, lessons for Scotland can be taken from the regulation of two other industries; namely the landfill and opencast coal mining industries. Both require the successful regulation and management of restoration liabilities and, in the case of the landfill industry, the regulation and management of long-term environmental impacts also.

4.3.2 Landfill Industry

The Planning Authority

The Scottish Government's national planning policy as contained within Scottish Planning Policy published in June 2014 (Scottish Government, 2014), states in paragraph 192 that Planning Authorities should:

“secure decommissioning or restoration (including landfill) to agreed standards as a condition of planning permission for waste management facilities; and ensure that landfill consents are subject to an appropriate financial bond unless the operator can demonstrate that their programme of restoration, including the necessary financing, phasing and aftercare of sites, is sufficient”.

Furthermore, The Scottish Government’s Planning and Waste Management Advice (Scottish Government, 2015b) states that:

“The design of the final landform of landfill sites, the mitigation of adverse impacts during the operational period, and the long-term control of landfill gas and leachate are important matters. Proposals for site restoration and aftercare should be fully set out in applications and appropriately conditioned, though regulatory interventions diverting waste from landfill may extend the life of consented sites, affecting restoration targets, final landform profiles and after-use”.

Planning authorities generally control the performance, restoration and aftercare of a landfill site through planning conditions and a financial bond attached to any approved consent via a Section 75 (s75) Agreement. This is an agreement under Section 75 of The Planning etc. (Scotland) Act (2006) and consists of a contract between Planning Authority and landowner and may be used (amongst other things) to finance the appointment by the council of a compliance officer to monitor the site during the term of the planning permission.

This position is reinforced by paragraph 248 of the Scottish Planning Policy (SPP), which states, in respect of mineral permissions that “Planning authorities should ensure that rigorous procedures are in place to monitor consents, including restoration arrangements, at appropriate intervals, and ensure that appropriate action is taken when necessary”. It
should be recognised however that there is no legal provision for planning authorities to use Section 75 agreements to fund local council operations. The installation of a compliance officer through this means would therefore have to be justified in terms of demonstrating that the monitoring is a highly specialist function which goes beyond the statutory functions of the authority.

As discussed in Chapter 3 above, other means of securing financial agreements can be utilised. For example, the Heads of Planning Scotland (HOPS) ‘Position Statement on the Operation of Financial Mechanisms to Secure Decommissioning, Restoration and Aftercare of Development Sites’ (June 2015) identifies a number of alternative methods of securing financial obligations such as surety bonds, bank guarantees, parent company guarantees and mutual funds (see Chapter 6 for more detail).

Scottish Environment Protection Agency

The Landfill (Scotland) Regulations 2003, as amended, implements the EU Landfill Directive in Scotland and set standards for the design and operation of landfills. SEPA regulate landfill sites directly through the Pollution Prevention Control (Scotland) Regulations 2012. Once a Pollution Prevention and Control permit is issued, the regulator ensures that its conditions are met until such times as the regulator accepts its surrender.

A Plan for Closure and Aftercare Procedures must be submitted as part of any permit application, outlining the methods and measures, proposals and procedures which the applicant/operator intends to implement at the installation to ensure that the permitted activities define the means of ensuring definite closure of the permitted installation and demonstrate the maintenance of all necessary infrastructure until such time as the installation can be deemed to no longer pose any hazard to the environment.

Regulation 18 of the Pollution Prevention and Control (Scotland) Regulations requires that SEPA may grant a permit in respect of a specific waste management activity only if it is satisfied that the applicant is “a fit and proper person to carry out that activity”, including ensuring that the applicant has made adequate financial provisions (by way of a security or an equivalent arrangement to ensure that “obligations (including after-care provisions) arising from the permit in relation to the activity are met”.

Paragraph 13 of the Landfill (Scotland) Regulations relate specifically to the costs associated with the disposal of waste in landfill and require that the operator should ensure “that the charges the operator makes for the disposal of waste in its landfill covers [...] the costs of setting up and operating the landfill; [...] the costs of the financial provision required [...] and, [...] the estimated costs for the closure and after-care of the landfill site for a period of at least 30 years from its closure”.

Following definite closure of a landfill, Regulation 17 of the PPC Regulations requires that:

“the operator remains responsible for the maintenance, monitoring and control for such period as SEPA determines is reasonable, taking into account the time during which the landfill could present hazards.”
Revenue Scotland

Revenue Scotland is the tax authority responsible for the administration of Scotland’s devolved taxes. The Scottish Landfill Tax (SLfT) is a tax on the disposal of waste to landfill and is charged by weight based on two rates: a standard rate for active materials and a lower rate for less polluting (referred to as ‘inert’) materials. As is currently the case with (UK) landfill tax, operators of landfill sites in Scotland will be liable for SLfT, and this cost is expected to be passed on to the local authorities and businesses who dispose of waste at the landfill sites.

4.3.3 Opencast Coal Mining Industry

The Planning Authority

Opencast coal has been produced for many years in Central Scotland. When the opencast coal industry was hit by falling coal prices in 2013 a number of site operators went into liquidation (Scottish Government, 2015c; Mackinnon, et al., 2014). Due to inadequate monitoring of progress in restoration and insufficient financial instruments being in place to fund restoration of opencast coal sites, there is a legacy of unrestored sites requiring remediation.

For example in East Ayrshire, restoration liabilities for unrestored opencast coal sites are estimated at £161 million as against a total restoration and aftercare bond coverage of £28.6 million (Mackinnon, et al., 2014) with the balance falling on the public purse. There are public concerns that the development of a UOG industry in Scotland could potentially lead to similar problems in future. According to the McKinnon Report, the primary causes in East Ayrshire were inadequacy in both operational procedures and regulatory oversight by the planning authority (Mackinnon, et al., 2014).

These issues have also been examined by the Scottish Government’s Opencast Coal Task Force for Scotland as a whole (Scottish Government, 2015c). The Task Force concluded, “There is in place a [planning] regime that if followed correctly would ensure competent monitoring and effective compliance”, i.e. the problems were associated with the implementation of the control and implementation of financial management of liabilities for opencast coal restoration and not the regime itself.

Measures are currently being put in place in Scotland to ensure that such a problem does not occur in future in the opencast coal industry. These measures include improving the ability of local authorities to monitor operator’s compliance with restoration obligations and to ensure that an appropriate level of financial cover for these obligations is in place (Scottish Government, 2015c). These measures would be anticipated to benefit other similar industries such as UOG development that may require the use of financial guarantees to manage restoration liabilities.

The Scottish Government’s national planning policy direction as contained within the SPP, states in paragraphs 247 and 248 that Planning Authorities should:
(247.) “...through planning conditions and legal agreements, continue to ensure that a high standard of restoration and aftercare is managed effectively and that such work is undertaken at the earliest opportunity. A range of financial guarantee options is currently available and planning authorities should consider the most effective solution on a site-by-site basis. All solutions should provide assurance and clarity over the amount and period of the guarantee and in particular, where it is a bond, the risks covered (including operator failure) and the triggers for calling in a bond, including payment terms.”

and;

(248.) “...ensure that rigorous procedures are in place to monitor consents, including restoration arrangements, at appropriate intervals, and ensure that appropriate action is taken when necessary. The review of mineral permissions every 15 years should be used to apply up-to-date operating and environmental standards although requests from operators to postpone reviews should be considered favourably if existing conditions are already achieving acceptable standards.”

The HOPS ‘Position Statement on the Operation of Financial Mechanisms to Secure Decommissioning, Restoration and Aftercare of Development Sites’ (HOPS, 2015), draws together work undertaken by the Opencast Coal Task Force examining financial guarantees along with insight based upon best practice being carried out by various planning authorities:

“It is critical that the quantum of a performance guarantee is sufficient throughout the lifespan of the development to restore and provide aftercare at the site to its intended final use. If the method of calculating the guarantee quantum is flawed then no matter how efficient monitoring and review mechanisms are, the funds available will be insufficient to restore the site. This is a significant risk to compliance with the planning permission.” (p. 4).

Further, “The Opencast Coal Task Force is advising of the need for a ‘progress plan’ that can be regularly submitted setting out the extent of development carried out over a given period of time; this allows a check to be made against the compliance with the terms of the planning permission. The Group acknowledges that in the course of working a site, the development may require an amendment dependent upon, for example, geology, market demands and mineral quality. Hence the concurrent submission of a ‘programme plan’ would set out details of the work to be undertaken over the ensuing period, and allow a view to be taken about any material variation to the development, in turn necessitating a variation to the planning permission and potentially the financial guarantee. Additionally each opencast coal site will require to have a compliance assessor, paid for by the developer but responsible to the planning authority. Regular reports would be prepared and a checklist of compliance with approved plans and conditions set out. Monthly returns would be publicly available and sent to Scottish Government, providing a regular statement on the compliance with the planning permission.” (p. 7)

The planning authority would generally control the performance, restoration and aftercare of an opencast coal site through one of the various financial guarantee options discussed
above, which would be attached to any approved consent via Section 75 (s75) Agreements. An agreement under Section 75 of The Planning etc. (Scotland) Act (2006), consists of a contract between Planning Authority and landowner and may be used (amongst other things) to finance the appointment, by the council, of a compliance officer to monitor the site during the term of the planning permission.

**Scottish Environment Protection Agency**

Licences and permits for access to the nation's coal primarily fall under the remit of the Coal Authority, as do legacy issues such as subsidence of abandoned mines and mine water pollution. However, SEPA regulate the environmental impacts of coal related activities through the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended), the Waste Management Licensing (Scotland) Regulations 2011, and the Radioactive Substances Act 1993 (RSA93). These activities include both coal mining and coalbed methane extraction.

**CAR Licence** – For any single development, multiple CAR licences may be required to fully cover the range of activities undertaken. The submission must also include any mitigation measures that will be used to reduce adverse effects. Any authorisation granted will specify conditions to limit impacts and may also require a monitoring plan. During the decommissioning phase, CAR licence(s) are surrendered following SEPA agreement. Prior to surrendering any licence, SEPA therefore must have sufficient information to demonstrate that there would be impact on the water environment that exceeds agreed standards. The duration and level of post-operation monitoring must therefore be sufficient to demonstrate this and as a consequence cannot be explicitly quantified.

**Waste Management Licence** – The management and disposal of any waste streams generated through operation (and not considered as extractive waste) may require to be licenced by SEPA under the above Regulations. Under this regime, identified wastes would need to be stored, treated and disposed of appropriately and in accordance with an approved management plan.

**Radioactive Substances Permit** – If NORM is produced through activities such as coal mining dewatering, then a permit under RSA93 may be required. If authorisation is needed, monitoring and reporting would likely be required by operators in order to comply with the authorisation.

**The Coal Authority**

Under the Coal Industry Act 1994, certain specified coal mining operations require a statutory licence from the Coal Authority, including surface mining activity. The Coal Authority will determine applications for licences and associated leases in accordance with its statutory duties which include: ensuring that those authorised to undertake coal mining operations are able to finance both the proper carrying on of those operations and the discharge of liabilities arising from those operations, and to operate cooperatively with the Health and Safety Executive relating to (for example) the exchange of information. The
Coal Authority may also take account of the extent to which the Applicant has obtained the other necessary surface access rights, permissions and consents.

The Coal Authority may grant a “conditional licence” which defers the coming into effect of the authorisation to mine until specified requirements have been satisfied, for example, that planning consent has been obtained. In this example, appropriate financial guarantees for restoration and aftercare should be in place prior to achieving planning consent, and therefore authorisation from the Coal Authority will be similarly dependent on these being arranged. The conditional licence will lapse if these requirements are not fulfilled within a specified period.

The Coal Authority ‘Guidance Notes For Applicants For Surface And Underground Coal Mining Licences’ (2013) outlines the requirements that must be met in order to be granted a licence to mine, this includes Applicants entering into an “Interaction Agreement”: “The term “interaction” is used to describe the physical effects which activities connected with any coal or coal mine may have on other such activities (including their subsidence effects), or on other interests in coal. Those effects include water or gas migration and the results of a withdrawal of lateral or vertical support. Interaction can occur in situations where the activities are separated by considerable distances. In order to deal with this, a framework has been created which will bind signatories to an agreement (the “Interaction Agreement”) to a process of notification, discussion and giving and obtaining consent and an obligation to act reasonably.” (p. 4).

4.3.4 Lessons from Other Industries for Scotland

The study has also reviewed the regulatory systems relating to landfill sites and opencast coal mining in Scotland to see if there are lessons to be learned and applied to the betterment of UOG regulation. For both industries, restoration responsibilities are regulated by planning authorities whilst environmental compliance is regulated by SEPA. Where the two industries differ is in the treatment of financial guarantees. In the case of landfill development, SEPA requires that the operator must have made adequate financial provisions to meet its obligations (including aftercare). In the case of opencast coal mining, planning authorities can control the performance, restoration and aftercare of opencast coal sites through financial guarantees attached to legal agreements between the planning authority and the operator.

The restoration of opencast coal developments provides one model for the means by which Planning Authorities may control surface restoration of UOG developments and manage liabilities. When making comparisons between the two industries, however, the size of the surface restoration liabilities associated with UOG development is likely to be considerably smaller than that associated with opencast coal extraction.

The wider applicability of the approaches to managing financial risk for landfill sites and opencast coal extraction to UOG development – including licensing - is discussed in more detail in Chapter 6.
5 Community Benefits

5.1 Introduction

Decommissioning and restoration can deliver positive benefits for both former UOG sites or to the wider community. Planning permissions for UOG development normally set out restoration requirements for sites, typically requiring restoration to a site’s original land use or to other beneficial use. The proposed community benefits package put forward by UOG operators (see below) could also be used to provide wider community benefits. Using the landfill tax credit regime as an example, this could be through land reclamation and restoration, funding of community based projects or groups, maintenance of public parks or other amenity, nature conservation, and the preservation of buildings or archaeological sites.

5.2 UKOOG Community Engagement Charter

UKOOG’s “Community Engagement Charter” includes a commitment on behalf of its membership to pay:

- £100,000 per site to the local community situated near to each exploratory (hydraulically fractured) well site. This will be paid by the operator, regardless of whether or not recoverable deposits are found; and
- 1% of production revenues to communities during the production stage, before the operator has accounted for their costs;

Each year, operators will publish evidence detailing how the commitments within the community benefits package are being met.

UKOOG has committed to reviewing the community benefits agreement as the industry develops in the coming years and has pledged to consult further with local communities on an ongoing basis.

Based on production and gas in place scenarios produced by the Institute of Directors (IoD) in its May 2013 Shale Gas report (IoD, 2013), UKOOG has estimated that community benefits at the production stage under its scheme could be worth in excess of £1.1 billion across the UK over a 25 year production timescale, with much of this benefit coming in the first 10 years. UKOOG did however acknowledge that exact numbers will depend on local geology and flow rates. The IoD report in its mid-case scenario estimated 100 production sites, equating to a potential community benefit per site in the region of £5m-£10m.
One licence holder in Scotland (INEOS) has made public its intention to provide community benefits at a higher level (6%) than those specified by the rest of the industry in both England and Scotland.

5.2.1 Pilot Scheme - Exploration

In 2014 UKOOG announced the launch of a pilot scheme for community benefit packages at selected shale gas exploration sites in the UK, which involve exploratory drilling, hydraulic fracturing and flow testing of the exploration wells.

The principles that UKOOG has established for the pilot phase are that:

- the scheme should be independent from the industry, operators or political organisations;
- the funds to be managed and distributed by an organisation with experience and integrity;
- the communities should have the lead role in identifying local priorities for the funds; and
- the funds to be used for the overall benefit of local communities rather than individuals.

To ensure community benefit funds are managed and distributed appropriately, UKOOG has collaborated with UK Community Foundations (UKCF) – to provide the ability to develop an independent national framework that establishes an industry standard with guaranteed quality and consistency.

Once a qualifying planning consent has been granted, the intention is for UKCF and the appropriate local community foundation to manage a consultation process aimed at defining local priorities and guiding the appointment of a community panel that would be responsible for deciding how the money will be spent.

The pilot scheme will be overseen by a joint steering group made up of UKOOG, UKCF and independent observers who will ensure local communities are informed about how the pilot schemes will work with respect to community benefits and how members of the community can be involved in the consultation phase.

5.2.2 Production Stage

Since announcing its Community Engagement Charter in June 2013, UKOOG has reported that it has received a significant amount of feedback with respect to how benefits during a production phase might be distributed including proposals with respect to direct payments to individuals affected. As a result of this feedback, UKOOG has confirmed its intention to launch a consultation programme across a range of stakeholders to gauge community opinion on a number of different potential schemes, including direct payments to individuals and broader based community funds.
5.3 Conclusions

Restoration can deliver positive benefits for both former UOG sites or to the wider community. Planning permissions for UOG development normally set out restoration requirements for sites, typically requiring restoration to a site’s original land use or to other beneficial use. The proposed community benefits package put forward by UOG operators could also be used to provide wider community benefits. Using the landfill tax credit regime as an example, this could be through land reclamation and restoration, funding of community based projects or groups, maintenance of public parks or other amenity, nature conservation, and the preservation of buildings or archaeological sites.

The main points that emerge from the discussion of the community benefits that could be funded by UOG development are that:

- the amount of funding for community projects which is potentially available is very considerable – particularly at a time of public spending restraint; and
- the industry is open to views about how the spending should be prioritised, managed and targeted.
6  Financial Instruments

6.1  Introduction

This chapter examines the management of the different financial liabilities associated with:

- the surface restoration of UOG sites ("restoration liabilities");
- the decommissioning of UOG wells ("decommissioning liabilities");
- monitoring of UOG wells after decommissioning but prior to surrender of the PEDL, and any requirement for repair of wells due to failure that occur during this period ("aftercare liabilities"); and
- repair of any well failures in the future after licence surrender ("long-term repair liabilities"),

by means of use of appropriate financial instruments.

Financial instruments are required to ensure that restoration, decommissioning, aftercare and long-term liabilities are adequately funded to ensure that the environment is protected whilst minimising risk to the public purse. The financial instruments required under the present licensing and planning regimes (as set out in Chapter 3) are assessed and any gaps in financial coverage identified and considered together with potential improvements to the regulatory regime that may be considered by the Scottish Government.

Management of financial liabilities for surface restoration is the responsibility of the local authority under the legal agreements attached to planning permissions for UOG development (see Section 3.4) and will be on a wellsite by wellsite basis.

Management of financial liabilities associated with failure of wells after decommissioning, but while a wellsite is licensed, is the responsibility of the licensing authority (currently the OGA but in future under a Scottish licensing authority) under the petroleum licensing system and will be on a licence by licence basis.

6.2  Key Issues

6.2.1  Overview

The following issues influence the size and timing of financial liabilities and how they are managed:

- the unique nature of wells;
• post-decommissioning well failure; and
• financial strength of licence holders.

6.2.2 Unique Nature of Wells

Unless drilled in close proximity to another well, it is likely that the rocks through which a well passes will be site specific. This means that construction and abandonment plans will need to be specifically tailored to the geological situation of each well.

In addition, as described in Chapter 2, some UOG wells may penetrate rocks above the target shales or coal that contain gas/oil or fluids under pressure. Because of this, these wells present a greater potential risk of well leakage if no allowance for the presence of hydrocarbons or fluids under pressure is made during well construction and abandonment. These wells may therefore have additional engineering requirements (and therefore additional funding requirements) during abandonment and decommissioning, to prevent the well providing a pathway for leakage.

Wells which prove to be dry or otherwise non-viable at the initial testing stage will also require decommissioning at the end of testing and may require more conservative well abandonment designs than production wells for the reasons set out in Section 2.5.

6.2.3 Well failure Post-Decommissioning

As discussed in Chapter 2, there is a small probability that a well that has been decommissioned according to best practice will fail. Should a failure occur, it is most likely to happen in the period after decommissioning, when monitoring and aftercare are ongoing.

However, there is also a low possibility that a well that has been properly decommissioned and which has shown no indications of failure during the post-decommissioning monitoring period could fail in the longer term i.e. over a period of several decades.

6.2.4 Relative financial strength of Licence Holders

It is clear that not all licence holders will have the same degree of financial strength and represent different levels of risk in relation to the certainty that future restoration, decommissioning and aftercare costs will be covered.

6.3 Uncertainty around Size of Liabilities

6.3.1 Introduction

Despite the similarities to conventional oil and gas, the UOG industry is a new industry within Scotland and the rest of the UK. The lack of a significant number of completed UOG wells in Scotland means that there is uncertainty around the costs of decommissioning and this is exacerbated by the fact that the decommissioning plan for each well will be specific to that well. The variation in the uncertainty associated with decommissioning and
aftercare financial liabilities through the lifecycle of a well is illustrated in Figure 7 and explained below.

Liabilities will be held by the holder of the licence, which may be a single operator, or a consortium of operators, each of which shares joint and several liability. Licence holders can prepare cost estimates for well abandonment using oil and gas industry guidance (OGUK, 2015c). These guidelines are applicable throughout the whole development lifecycle of wells: including at the field design stage, for annual financial reporting and for planning of decommissioning. Licence holders can also prepare cost estimates for surface restoration using standard estimating methods.

With time, industry data on the actual costs of decommissioning will also become available which will enable estimates of individual well decommissioning costs to be improved reviewed, updated and refined on a periodic basis that will reduce the level of uncertainty in decommissioning costs.

6.3.2 Prior to Drilling

Until well consent is given by licensing authority and drilling begins, decommissioning liabilities are minimal. At this stage, the design for decommissioning of any well will be preliminary. The estimates of decommissioning, aftercare and long-term repair liabilities will have relatively large ranges and therefore any provision for liabilities at this stage should include significant contingency sums.

6.3.3 At Completion of Drilling

As drilling commences and progresses, sub-surface decommissioning liabilities will increase both with depth and as the well passes through particular rocks (e.g. pressurised formations). However, the real information obtained in drilling enables the engineering design for decommissioning to be refined and more accurately costed. This in turn enables the decommissioning liability to be estimated with a higher degree of certainty and a lower range. Similarly, restoration, aftercare and long-term repair liabilities can also be better estimated.

6.3.4 At Completion of Drilling and Testing – Dry Wells

In the case of wells that are dry, or otherwise non-viable, decommissioning will occur once the well is completed and tested. The size of the decommissioning liability will be the cost of the approved the well abandonment plan for decommissioning. The estimates of aftercare and repair liabilities will remain the same as at the completion of drilling, as no additional information will have been obtained from the operation of the well during production.
### Figure 7: Variation in Decommissioning Liabilities with Time

<table>
<thead>
<tr>
<th>Time frame (years)</th>
<th>Project conceptions: well design and preliminary decommissioning design</th>
<th>Drilling and testing</th>
<th>Production</th>
<th>Aftercare (during licensing)</th>
<th>Aftercare (post-licensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Estimates of decommissioning costs have low confidence levels</td>
<td>Information from drilling allows decommissioning costs to be more accurately assessed</td>
<td>Production and industry data and QES work enable costs to be accurately assessed</td>
<td>Any repair costs based on monitoring data</td>
<td>Long-term failure - low risk of occurrence</td>
</tr>
</tbody>
</table>
6.3.5 During Production

For wells put into production, information on the integrity of the well will be gathered during production, including monitoring for signs of leakage by detection of SCP and monitoring of groundwater quality. As the industry expands, information from other wells will also become available. This will allow more refined estimates of decommissioning costs to be calculated, as well as after-care and long-term repair liabilities. However, estimates will only be refined if they are updated when new information is received, therefore it would seem prudent to create a regulatory requirement to carry out a periodic review of liability estimates.

6.3.6 End of life wells

Once production ceases at a well, the well abandonment plan for decommissioning will be finalised subject to approval by the licensing authority and the HSE, and to contractual agreement with any service companies employed to carry out the works. At this point, the cost of decommissioning and therefore the associated liability will be crystallised at the contracted amount, plus the cost of any variations and/or delays. At the same time the cost of surface restoration will also be finalised.

Once a well is decommissioned, it will enter a period of monitoring and aftercare prior to surrender of environmental authorisations. The purpose of the monitoring is to ensure that emissions from the well are do not exceed agreed standards.

If a well leaks and emissions to air and/or groundwater are above agreed standards and repair of the well may be required (dependant on the proximity of and risk to sensitive receptors, such as local residents and watercourses). The cost of any such repair will be dependent on the nature of the well failure.

Licence holders for UOG developments have a responsibility to repair leaking decommissioned wells and therefore they have a responsibility to make a financial provision for such repair costs. As with decommissioning costs, the maximum cost of repair will be dependent on the depth of the well, the hydrocarbon bearing potential of the strata through which the well passes and the local geology. However, this information will be known at the time of decommissioning and it is therefore possible for licence holders to estimate the of costs repair conservatively at the time of decommissioning.

As with decommissioning liabilities, the after-care and long-term repair liabilities need to be reviewed periodically and be subject to approval. However, once a well is decommissioned, the maximum liabilities for after-care and long-term repair are unlikely to vary significantly with time (except to allow for inflation and for reduction in future monitoring costs as each year passes) before the environmental authorisation can be surrendered.
6.4 Financial Instruments Available

6.4.1 Overview

The financial instruments which could be used to ensure that adequate funds are available to cover both decommissioning and restoration liabilities for UOG developments are:

- shareholder funds;
- parent company guarantees;
- letters of credit/secured debt;
- bonds;
- payments into escrow; and
- mutual funds.

All these instruments are available to the licensing authority for financial provision for the management of sub-surface liabilities associated with well leakage on a licence-by licence basis. Parent company guarantees, bonds and payments into escrow have also been used by local authorities for financial provision for the management of surface restoration liabilities in other industries and can be similarly used for UOG development on a wellsite by wellsite basis. These financial instruments and their applicability are summarised in Table 4.

Table 4: Summary of Financial Instruments

<table>
<thead>
<tr>
<th>Financial Instrument</th>
<th>Local Authority (Restoration)</th>
<th>Licensing Authority (Decommissioning)</th>
<th>Licensing Authority (Orphaned Wells)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shareholder Funds</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Company Guarantees</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Letters of Credit</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Bonds</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Escrow Accounts</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Mutual Fund</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
The financial instruments also to cover the following liabilities:

- anticipated decommissioning liabilities (foreseen liabilities); and
- costs of accidents/failures (unforeseen liabilities).

These are generally covered by different types of financial instrument.

In addition to the above, licence holders have access to environmental liability insurance which includes cover for pollution arising from plugged and abandoned wells (UKOOG, pers.com.).

6.4.2 Shareholder Funds

At their simplest, shareholder funds can be described as the net assets of the company. However, this definition includes things such as money owed but not received (and which ultimately may not be received), or the right to earn money in the future from Public Private Partnership contracts. For the purposes of demonstrating that a company has sufficient shareholder funds to cover decommissioning and repair liabilities, the assets under consideration should be restricted to realisable assets (including cash, fixed property (although some caution is required because property is not always realisable into cash), retained earnings, bonds, shares in other companies etc.).

The net assets (and therefore the realisable assets) of a company change year on year. Where an licence holder is allowed to rely on shareholder funds to cover its decommissioning and repair liabilities, there will always be a level of uncertainty that sufficient funds will be available at the point that they are needed in the future. Consequently, shareholder funds should be re-validated at least annually (see Section 6.5).

6.4.3 Parent Company Guarantees

Parent company guarantees are guarantees issued on behalf of a subsidiary company by the company considered to be its parent. The effect of the guarantee is to make the parent company liable for particular obligations of the subsidiary company if the subsidiary fails to carry out those obligations.

In usual practice, the parent company is considered to be the company that owns or has a controlling interest in the subsidiary. However, this enables the immediate parent company to be a holding company. If the holding company has no assets other than the subsidiary, parent company guarantees issued by it would be worthless. Consequently, if the subsidiary is part of a group structure with multiple layers, parent company guarantees will only be acceptable if they are issued by a company higher in the group that has substantial assets, i.e. one which is not simply a holding company and where the parent company's core business is independent of the subsidiary. In some cases, guarantees will only be acceptable if they are issued by the ultimate parent company i.e. the company that controls the group.

Where parent company guarantees are used, the company issuing the guarantee is required to show it as a contingent liability on its balance sheet. This can reduce the ability
of that company to borrow money in the future. Where a parent company has entered into
debt arrangements that contain “negative pledges”, it may be prevented (by the terms of
those arrangements) from issuing parent company guarantees. Consequently, entities
seeking to use parent company guarantees to cover their future liabilities will generally
seek to provide them at the lowest level possible, particularly if issuing them at the
ultimate parent company level complicates the ability of the group to finance itself.

Where a company is not a true subsidiary, i.e. it is not in the control of one parent (for
example the company is a joint venture company owned by two or more other companies),
it is still possible to provide parent company guarantees from each of the companies that
own it. In such cases it is common for the party being guaranteed (who would be the
licensing authority in the case of UOG development) to ask each of the owners to provide
a joint and several guarantee. This makes each of the owners responsible for all the
liabilities of the subsidiary, rather than just the proportion of the shareholding in the
subsidiary that they own. In many cases, the owners will be reluctant to agree to joint and
several liability and this could effectively prevent a licence holder with more than one
parent from offering parent company guarantees.

Parent company guarantees are only good as long as the guarantor itself remains in
robust financial health. For example, in the past, high profile failures of energy companies
such as Enron and TXU Europe, and more recently Scottish Coal, have shown how rapidly
financial health can deteriorate.

In the case of Enron, fraud and illegal use of off-balance sheet vehicles had disguised the
extent of liabilities. In the case of TXU Europe, falling wholesale electricity prices and
wholesale coal prices undercut the trading operations of the group, which had entered
into long-term purchase contracts with power stations and coal producers at higher
prices. In the case of Scottish Coal, falling coal prices, caused by a fall in demand for coal
from British power station corresponding with a surge in US coal exports, meant that its
revenues were no longer sufficient to meet all of its liabilities.

In all three cases, parent companies guarantees became worthless and triggered further
insolvencies in companies that were reliant on those guarantees. In the case of Scottish
Coal, the administrator was not able to find buyers for seven of Scottish Coal’s opencast
coalmines, resulting in the liability for restoration being orphaned.

If parent company guarantees are used to cover UOG well decommissioning liabilities,
they would have to be match the maximum duration of the liability; that is until the licence
is surrendered. In addition, they should explicitly state that they are governed by the law of
Scotland and can be validly executed under the laws Scotland.

From an industry point of view, parent company guarantees would be a low cost way for
UOG operators to show that their decommissioning and repair liabilities are covered.
6.4.4 Letters of Credit/Secured debt

A letter of credit is usually a letter issued by a bank to a recipient guaranteeing that the recipient will be paid a sum of cash provided certain conditions are met. Letters of credit are typically used in:

- the construction industry, to guarantee that construction firms and equipment suppliers will be paid provided that they have met the terms of a construction contract; and

- international trade, to guarantee that a manufacturer of goods in one country is paid by a purchaser in another.

Using the example of international trade, the purchaser of goods makes an arrangement with a bank for the bank to pay the manufacturer. The bank will only issue a letter of credit where it is certain that the purchaser will re-pay it (the bank). The level of security that the purchaser is required to give to the bank will depend on the relationship between them, but could range from the purchaser paying the bank up-front, to the bank and the purchaser agreeing a term loan (which allows the purchaser to repay the bank over a number of years) backed by assets pledged as collateral. The bank will charge the purchaser and/or the manufacturer a fee for issuing the letter of credit. Whatever the repayment arrangement between the bank and the purchaser, this will not normally be visible to the manufacturer. From the manufacturer’s point of view, the credit-worthiness of the bank becomes the key issue, rather than the credit-worthiness of the purchaser.

Letters of credit could be used to cover decommissioning and repair liabilities in the UOG industry. In this case, they would be more complicated than the international trade example as a licensee would not be paying for goods but using the letter of credit to guarantee that the decommissioning work would be carried out. There would have to be clear definition of the purpose of the letter of credit (to provide funds to the licensee to carry out the work or to provide funds to the licensing authority to procure decommissioning works in the event of a licensee default, or both) and the circumstances in which it could be used.

Secured debt is similar to a letter of credit, in that a bank will provide a line of credit to fund a particular purpose. Using the international trade example again, the bank does not have any dealings with the manufacturer; it simply agrees to provide funds to the purchaser to buy the goods from the manufacturer. This debt is secured by assets put up by the purchaser as collateral. The bank can seize the assets if the line of credit is used and the resultant debt is not repaid. The bank will charge the purchaser arrangement fees, interest on debt drawn down, and commitment fees on any undrawn debt.

In theory, secured debt could be used in the unconventional oil and gas industry where a licensee has a) assets other than the well itself and b) cash flow from other activities that will be used to repay the debt (if the debt is actually drawn down) after the well is decommissioned. There are a number of possible variations to this, from scheduled term
loans to lines of credit that will only be drawn upon if the licensee has insufficient liquid funds to pay for decommission when the well ceases to be viable.

In practice, for both letters of credit and secured debt, the licensing authority would have to examine the terms of the instrument carefully to ascertain:

- whether or not assets used by the licensee as collateral have also been used to pass financial strength tests (which would be double counting);
- the extent to which pledged assets are ring-fenced;
- the circumstances under which funds will be made available;
- whether or not the funds will be available to the licensing authority if the licensee fails to decommission the well;
- the transparency (to the licensing authority) of the arrangements between the institution and the licensee (for example, the licensing authority having the right to be informed if the licensee defaults on the terms of the instrument); and
- the creditworthiness of the institution issuing the instrument.

From the licensing authority’s point of view and provided that the instrument is correctly and transparently structured, and the licensing authority has the right to draw down funds (if the UOG operator fails to decommission the well), it would reduce the risk that an UOG operator (or its parent company) does not have sufficient funds available to pay for decommissioning. However, it does not remove all risk; if the institution issuing the instrument becomes impaired or insolvent in the future, there would a risk that the instrument will not be honoured in its entirety.

From an industry point of view, letters of credit and secured debt would be more costly than relying on shareholder’s loans and parent company guarantees, but will avoid the opportunity cost of making a direct up-front provision (such as holding cash on account) to cover decommissioning liabilities. If UOG development is permitted in Scotland, in the early years of the industry the fees/interest charged for such instruments are likely to be higher than those charged to other industries, but will likely fall, as the first wells are successfully decommissioned.

6.4.5 Bonds

Bonds come in many different forms. Most commonly known as performance bonds and surety bonds, they are usually provided by banks or insurance companies to cover liabilities. Bonds issued by banks are often called “bank guarantees”.

Bonds all have the same form in that they do not guarantee that the work covered by the bond will be completed. Instead, they guarantee that the party insured by the bond (“the client”) will receive funds (up to the value of the bond) in the event that the party being guaranteed (the “contractor”) fails to honour its contractual obligations.
The contractor is required to pay premiums to the bond issuer for the bond. The size of the premium is dependent on the amount of the bond, the type of bond required and the perceived risk (that the contractor may not complete its obligations). In the event that the bond is called upon, the bond issuer generally has subrogation rights that permit it to recover damages from the contractor.

Bonds typically (but not exclusively) operate for just the period in which the provider has contractual obligations and expire at either the practical completion of the work or at the end of the rectification period specified in the contract. It is common for bond issuers to require that a breach of contract is first upheld by a court or an adjudicator before the bond is honoured. This in turn requires the client to prove that it has suffered a loss as a result of the contractor’s breach of contract. Thus, if bonds are being used, it is better that they are "on-demand" bonds, which require the party granting the bond to pay out on a claim without looking into the circumstances of the claim. If a claim is made when it should not be, the bondsman will still pay out and then the operator would have to try to recover the sum from the licensing authority.

Bonds are used to guarantee that mining, oil and gas, and landfill companies, for example, will restore sites to an agreed state once extraction has ceased. These are also called restoration bonds, reclamation bonds and reinstatement guarantees. Within the UK, bonds have been successfully used by both SEPA and the Environment Agency to manage financial liabilities.

The party being insured under these bonds is usually a government agency or the relevant regulator and the party being guaranteed (contractor) is the extraction or landfill company. Exact requirements for the bonds vary from country to country, but generally the bond issuer will require a legally approved restoration plan, which includes a detailed cost estimate and timetable for the work to be carried out. The bond amount required by the government agency or regulator is usually equal to the detailed cost estimate plus a contingency sum. Typically, the bond is not released back to the bond issuer until the government agency or regulator is satisfied that the restoration has been successful, which is usually at the end of the after-care period.

Some hybrid bonds are structured in an 'endowment' format so that funds are built up over the productive life of the mine, well site or landfill site, which the operator (contractor) then draws down to restore it. The government/regulator can only call upon the bond if the licensee cannot carry out its obligations.

The bond amount can either be ‘fixed’ or ‘rolling’. The former relies on a sum estimated at a particular point in time, the latter allows for the amount to be varied at prescribed intervals depending on what has actually occurred (and is occurring) on the site.

Within Scotland, restoration bonds were used by the opencast coal mining industry (as well as parent company guarantees). When operators of certain sites became insolvent in 2013, the restoration bond provision was found to be inadequate and that the approach to framing and structuring bonding requirements had varied among planning authorities. The
Scottish Government’s Opencast Coal Task Force has recommended actions to ensure that this situation does not occur in future (Scottish Government, 2015c).

Bonds could be used to warrant UOG well decommissioning and after-care liabilities. As yet, there is no liquid market for UOG decommissioning bonds, but given the size of the overall bond market in the EU, it would seem reasonable that a liquid market would appear if UOG development were permitted in Scotland. In such a case, the premiums would most likely be high to start with, up to perhaps 25% of the bond value.

As with opencast coal, the effectiveness of bonds will depend on the accuracy of the assessment of the decommissioning liability and the suitability of the bond for its purpose. Learning from the experience of the opencast coal industry, this indicates that in order to use restoration bonds for UOG wells:

- decommissioning and repair liabilities must be accurately estimated, regularly updated, be verified by an independent well engineer and correspond to the decommissioning design approved by the HSE;
- the bonds must be rolling bonds where the bond value can be periodically adjusted (i.e. the amount used at well consent is not a fixed amount);
- the bonds must survive insolvency of the licensee (or its parent);
- the licensing authority must be adequately staffed by persons in possession of the necessary knowledge and skills to ensure that bonds are of an appropriate type and quantum; and
- the licensing authority must ensure licence conditions are adhered to and that licensees cooperate with and give full disclose to the independent well engineer.

Providing the foregoing are achieved, from the licensing authority’s (and local authority’s) point of view bonds would increase the certainty that funds will be available for decommissioning and repair, subject to the bond issuer remaining solvent. The licensing authority/local authority will therefore need to monitor the financial strength of the bond issuer as well as the licensee. From an industry point of view, bonds will be more expensive than use of shareholders’ funds or parent company guarantees (and probably more expensive than letters of credit/secured debt in the early years).

6.4.6 Payments into Escrow

An escrow account is an account held in trust by a third party or “trustee” (usually a bank) on behalf of the parties to a transaction or contract. Funds in the account remain the property of the depositor, but may only be drawn down with the agreement of the trustee and for the specific purposes of fulfilling the depositor’s contract obligations (in this case to cover decommissioning). Once the depositor has carried out all contract obligations, any remaining funds are released back to the depositor.
Payments into escrow give absolute certainty that funds will be available to meet future liabilities provided that the bank holding the funds remains solvent. However, as the money in the account is held on deposit, it will only attract interest. With interest rates below the rate of inflation, with time the money held in escrow may turn out to be insufficient to meet all liabilities. As with mutual funds, the sufficiency of the amount placed into escrow will be dependent on accurate estimation of the size of each liability. Use of escrow accounts is expensive, as the payments into them have to be made up front.

In Scotland, escrow accounts have been used for a variety of environmental purposes. This includes their use at the Polkemmet opencast mine, where tonnage related payments were made into an escrow account controlled by the council to part cover its restoration liabilities. Escrow accounts have also been used for the restoration of wind farms and hydroelectric power stations.

In the case of UOG wells, from the licensing authority’s point of view escrow accounts would give certainty that funds will be available, although there will be doubt that the total liability will be covered when it is realised, unless there are regular reviews of the sums held with appropriate adjustments to cover any gaps in likely restoration costs. From an industry point of view, escrow accounts will probably be the highest cost way of covering liabilities.

Escrow accounts may be useful in some circumstances in ensuring that decommissioning liabilities are met. For example, in the case where the licensee of an operating well (or a parent company providing a guarantee) experiences a material negative change in its financial strength, there could be doubts that it will be able to fund the decommissioning of the well once production has ceased. In such a circumstance, it would be useful for the licensing authority to have the power to compel the licensee to place a sum into escrow to cover the estimated decommissioning liability. The licensing authority would hold the money in escrow until such time as it was required to pay for decommissioning, or until such time as the licensee could demonstrate that it (or its parent) had returned to an acceptable level of financial strength.

Escrow accounts are generally unsuitable for covering long-term (post-licence surrender) repair liabilities for two reasons:

- only a small number of wells will realise their repair liabilities and if every well had to make a provision in escrow, the amount of money tied up would in all likelihood damage the viability of the industry; and
- the long-term nature of the repair liability would mean the real value of funds held in escrow would be substantially diminished by the time the liability was realised, unless the escrow sum is regularly reviewed and increased to meet any gaps in likely repair liabilities.

6.4.7 Mutual Funds

Mutual funds (also known as pooled funds) operate on the basis that the individual liabilities are pooled together and the cost of these liabilities (if they are realised) are
covered by a single fund. In the case of UOG development, mutual funds are applicable to management of:

- liabilities arising following surrender of the licence; or
- liabilities arising from the decommissioning of orphan wells (i.e. where the licence holder has gone into liquidation and ceased to exist).

Mutual funds are capitalised by contributions in advance from the parties who have pooled their liabilities. For a mutual fund to work, the contribution from each member has to be proportional to the real liability that it is pooling, and the fund would have to be managed by professionals (authorised by the financial regulator) who would invest it so that its value keeps pace with inflation.

The key advantages of pooled funds are:

- a capitalised fund is provided in advance to meet liabilities; and
- where the liabilities of each member are being accurately calculated on the same basis, it is possible to reduce the amount of contingency included in individual liability estimates. The rationale for this is that if the pool is large enough, the sum of individual cost over-runs and under-spends will tend to cancel each other out.

The key disadvantages of pooled funds are:

- as well as accurate calculation of the size of liabilities, they require an accurate calculation of the probability of the liability occurring. If the probability or the size of liabilities is under-estimated, the fund will be underfunded and some of the liabilities will be orphaned;
- if the fund manager cannot grow the fund at or above the rate of inflation, the fund will ultimately become underfunded and some of the liabilities will be orphaned; and
- they do not guarantee that the work required to discharge the liability will be carried out by the party liable for it, merely that funds will be available to pay for the work.

In the case of unconventional oil and gas well decommissioning, there is a 100% probability that the decommissioning liability will be realised, therefore the key issue is accurate estimation of the size of each decommissioning liability.

From the licensing authority's point of view, mutual funds would provide a high degree of certainty that industry-wide decommissioning liabilities will be covered (subject to the caveats that the regulator has ensured that individual liabilities have been accurately estimated and the fund keeps pace with inflation). However, if the licensee cannot complete decommissioning (for example if the licensee has become insolvent), the regulator will have to procure a contractor to carry out the work. From an industry point of view, mutual funds are unlikely to be attractive: Notwithstanding the possible reduction in the contingency included in the liability estimate, the contributions in advance (and the
fund management fee) will make this a relatively high cost way of ensuring that decommissioning liabilities are covered.

In the case of repair liabilities after decommissioning (both during the after-care period and in the long-term after licence surrender), mutual funds could have valuable role to play: it is projected that only a small percentage of wells will fail after decommissioning and realise the repair liability. From a regulatory point of view, the oversight of a single mutual fund will be considerably easier than ensuring that wells continue to have viable cover for their repair liabilities on an individual basis. However, in the case of repairs being needed after licence surrender, it is most likely that the regulator will have to procure a contractor to carry out the repairs. From an industry point of view, pooling liability will probably be cheaper than each licensee making a separate provision to cover its full liability over a period of time measured in decades.

### 6.5 Financial Instruments in Other Comparable Industries

#### 6.5.1 Landfill

Landfills continue to produce both leachate and landfill gas for many years after the landfill has closed, ceased taking waste and all the cells within it have been capped. Consequently, landfill environmental authorisations require a long-term after-care period, during which the integrity of the cap (which prevents ingress of air and rain and uncontrolled egress of gas), gas levels, leachate levels, condition of the waste and cap stability are monitored.

Surrender of environmental authorisations for landfills is only possible once completion criteria have been met. These vary according to the type and nature of each landfill, but generally the landfill operator is required to demonstrate that the waste in the landfill is unlikely to present a hazard to the environment and that gas production, leachate production and emissions have stabilised.

Clearly, the circumstances around the decommissioning of landfill sites are different to those of UOG wells; the latter will be decommissioned as soon as practicable and in such a manner that further emission of gas is prevented. In contrast, where electricity is generated by combustion of landfill gas, electricity sales revenue provide an economic incentive to landfill operators to effectively cap (the main cost of decommissioning) and maintain the site.

In order to guarantee long-term after-care liabilities, bonds are the primary financial instruments which landfill operators are required to provide by SEPA as the environmental regulator. The waste management industry is mature and dominated by large companies. As would be expected when dealing with a mature industry where the risks are well understood, there is a liquid market for the supply of such bonds.
6.5.2 Opencast coal mines

Opencast coal mining is a sequential process where the coal deposits are mined in a series of cuts. In each cut the topsoil and sub-soil are removed first (and conserved away from the operational area), then the overburden and then the coal. In the first cut, the overburden is removed and placed in a stockpile outside the excavation area. For all cuts except the final one, once the coal has been extracted the cut is filled by casting the overburden from the next cut into it. The final cut is filled by transporting the material in the stockpile and depositing it in the final cut.

The best practice for open cast coalmines is to restore the site progressively as the excavation front moves away from the first cut. Progressive restoration ensures that the bulk of the cost of restoration is met from the revenues from coal sales. However, even if final restoration is restricted to re-filling the final cut and replacing the soils, this still represents a large financial liability for which a provision must be made in advance.

From the point of view of restoration, the key differences between UOG wells and opencast coal sites are:

- the size of sites to be restored, with wellsites being considerably smaller and less onerous to restore than opencast coal sites; and
- that the decommissioning of a UOG well can only commence once production has ceased, therefore progressive decommissioning funded by production revenues is impossible. Instead, provision has to be made for the full decommissioning cost before production has ceased.

Opencast coal mine operators have used parent company guarantees, restoration bonds and payments into escrow in the past to guarantee that sites will be restored (in accordance with the terms of planning conditions and Section 75 agreements). As discussed in Section 4.2.8, in a large number of cases, the provisions proved to be inadequate when the open-cast coal industry was hit by falling coal prices in 2013 and a number of site operators went into liquidation (Scottish Government, 2015c; Mackinnon, et al., 2014).

Measures are currently being put in place to ensure that such a problem does not occur in future in the opencast coal industry. These measures would be anticipated to benefit other similar industries such as UOG development. These measures include improving the ability of local authorities to monitor operator’s compliance with restoration obligations and to ensure that an appropriate level of financial cover for these obligations is in place (Scottish Government, 2015c).
6.6 Current Financial Regime

6.6.1 Introduction

In common with other regulatory regimes around the world (see Chapter 4), the current licensing system in the UK (including Scotland) has been developed primarily for conventional oil and gas (particularly offshore oil and gas) and UOG development was not a consideration when it was developed.

At present, oil and gas production and decommissioning is primarily regulated by the Petroleum Act 1998 as applied by the Oil and Gas Authority through guidance. Onshore oil and gas is also covered by the Petroleum Licensing (Exploration and Production) (Landward Areas) Regulations 2014.

Under this legislation, licence holders are required *inter alia* to:

- supply the Minister every 6 month with an abstract of the accounts;
- not abandon any well without the Minister’s consent; and
- abandon wells in accordance with a specification approved by the Minister.

The legislation does not require UOG operators to make a specific financial provision for the costs of decommissioning, after-care or repair of well failures after decommissioning.

The existing regime for covering decommissioning costs is included in guidance issued by the OGA for PEDL applicants. A key part of the regime is that PEDLs are issued as Deeds, which binds the licensee to obey the licence conditions regardless of whether or not they are using the licence at any given moment. Where more than one company is named on a licence, each company has joint and several liability for operations conducted under it.

6.6.2 Financial Tests

Each licence holder is required by the OGA currently (and the Scottish licensing authority in future) to pass financial strength tests that are applied at the time that the operator(s) makes a licence application. The tests are re-applied more stringently at the point that a Well Consent application is made. They are also applied to:

- new companies when a licence is assigned; and
- parent companies where the parent is supplying the funding or where a parent company guarantee is relied upon to pass the tests.

In the context of ensuring that surface restoration obligations are fully guaranteed, the local authority will be reliant on the ability of the licensing authority to ensure that the operator satisfies the financial strength tests required by the petroleum licensing system.
It is clear that not all UOG operators have the same financial strength or quality. At the two extremes, there could be companies that:

- have low gearing and appear well capitalised, but which are relatively small and therefore do not have sizeable net cash flows; or
- have high gearing and appear thinly capitalised, but due to their size have large net cash flows.

Each presents a different risk that future decommissions and aftercare costs may not be covered. In the case of the former, future cash flow may be insufficient to fund decommissioning (if the actual cost of decommissioning is significantly greater than estimated at the time well consent is given). In the case of the latter, high gearing could tip the company into receivership in the future, either because of future increases in interest rates, or because of relatively minor (in percentage terms) changes in costs and/or revenues.

The OGA currently has two distinct types of financial criteria that it uses to assess financial strength:

- Financial Viability, which refers to a company’s ability to remain solvent; and
- Financial Capacity, which refers to the company’s ability to meet specific costs.

Financial Viability

Before any company receives a licence, it must have:

(i) positive total net assets (shareholders’ funds);
(ii) a current ratio (current assets divided by liabilities falling due in less than 12 months) of at least one;
(iii) gross gearing (total debt divided by shareholders funds) of no more than 75%; and
(iv) interest cover (operating profit divided by net interest payable) of at least two.

The term “liabilities” as used here does not include decommissioning costs if decommissioning is not scheduled to occur within the next 12 months.

The licensing authority may still consider a PEDL applicant to be financially viable if:

- it fails the total net assets test but can demonstrate that the deficit is fully funded (e.g. by a corporate parent, directors’ or shareholders’ loans, commercial debt or other lines of credit);
- it fails the current ratio test but can demonstrate (with evidence) that its working capital requirements are financed by adequate short term funding arrangements (e.g. by a corporate parent, bank overdrafts, directors loans etc.); or
• it fails the gross gearing test but can demonstrate that it will be able to service the debt (both interest and principal repayments).

(OGA, 2015b)

As part of the tests, each company must provide:

• a copy of its most recent published accounts or a pro-forma balance sheet which has been certified by a director and is sufficiently detailed to enable the Financial Viability Assessment to be undertaken;

• cash flow projections, incorporating a debt repayment schedule as appropriate. For onshore applications the projections should cover a period of five years; and

• evidence of any third party funding arrangements (OGA, 2015b).

An important point to note is that “Well Costs” have to be included in the cash flow projections, but the regulations do not currently specifically require decommissioning costs to be included within the “Well Costs”. This appears to be a major omission, as failure to include decommissioning costs could give an entirely false picture of the required of the financial viability of a well.

From the licensing authority’s point of view, regular re-testing of shareholders’ funds will create additional work (depending on the interval between re-tests). However, if the financial tests are passed, the regulator should have a high degree of certainty that the full decommission costs will be funded for situations where the licence holder is not insolvent. From an industry point of view, being able to rely on shareholder funds to cover decommissioning and repair liabilities is likely to be a low-cost option for doing so.

From the licensing authority’s point of view, parent company guarantees will have a similar level of uncertainty to shareholders funds: the net assets of the parent company used to underwrite the guarantee can also change year on year. As a result, the licensing authority’s workload would be increased, as it would have to re-test the financial strength of the parent company (or companies) regularly as well as that of the licensee. However, if the parent company continues to pass the tests and the guarantee is absolute, there will be a high degree of certainty the total decommissioning and repair liability will be met. One point to be considered, however, is that if the parent company guarantee is not worth enough towards the end of the period of operation (just before decommissioning starts) then the licensing authority will be vulnerable if the parent company refuses to increase the guarantee or provide a substitute guarantee and just walks away from the site and the liability i.e. the assets from the site have been taken and distributed and there is no money left to deal with restoration. Both independent bonds and independent escrow accounts avoid this potential problem.
Financial Capacity

The financial capacity test was primarily conceived for offshore oil and gas. The provisions also apply for onshore wells but need to be interpreted for onshore circumstances. Each company must demonstrate adequate Financial Capacity to cover its share of the proposed Work Programme as well as all of its existing commitments (including overseas commitments). The Work Programme includes projected costs of decommissioning (OGA, 2015b).

As the OGA decommissioning unit currently only considers offshore decommissioning costs, a separate requirement appears to be needed for onshore decommissioning costs. The projected costs of decommissioning used in this test are those projected by the licensee prior to drilling. There does not appear to be an explicit obligation for licensees to independently validate, update and refine costs if the tests are re-run after a well has been drilled.

OGA “requires evidence of 100% funding cover for all [Field Development Plan], Firm and Contingent Commitments. In the case of Drill or Drop wells in a portfolio, a company must demonstrate 100% funding capacity for the single most expensive net well cost exposure, plus 50% of the cost of the others.” (OGA, 2015b)

The OGA considers that “where a company has a net worth that is so much greater than the cost of a Work Programme, this alone may be enough to assure the OGA that they will be able to raise funding where necessary, or will be able to fund the work from their own internal resources.” (OGA, 2015b)

These two provisions in the regulations clearly envisage that some companies will be passed on the strength of their balance sheets alone. This would appear to have been because of the offshore oil and gas industry, where the market capitalisations of major companies are billions of pounds. This is unlikely to be the case in the UOG industry. It therefore reinforces the need for decommissioning costs to be specifically included in the “well costs/works programme” when the tests are carried out, and that the costs have been validated.

The OGA’s current primary financial capacity measure is that a Company has Commitment Cover of 2.00 or better where:

- Commitment Cover = Net Worth divided by the sum of existing and proposed licence commitments;

and

- Net Worth = Shareholders’ Funds less Intangible Fixed Asset.

Logically “licence commitments” should be defined in legislation/regulation to specifically include future liabilities for decommissioning, aftercare and repair of post-decommissioning well failures. It is important to note that currently this is not the case.
There is a general need for flexibility, in order for licensees to be able to put in place funding arrangements that suit them. However, there may be circumstances where the licensing authority should have the power to specify a particular arrangement (such as escrow accounts). This would be to ensure that adequate funds are available to cover decommissioning, aftercare and repair liabilities once production and revenue generation at a well have ceased.

The OGA currently considers that funding arrangements to meet deficits in Commitment Cover can include:

a) Issue of additional share capital, where evidence can be given that the funds are available and have been irrevocably committed to the share issue by the investor(s), or the share issue has been guaranteed/underwritten by a recognised financial institution or stock brokerage (future share issues will not be acceptable without such evidence).

b) Parent company loan supported by a copy of the executed loan agreement.

c) A parent company guarantee using one of two (OGA) prescribed forms of words. Where an applicant seeks to satisfy the OGA of its Financial Capacity in this way, besides requiring an parent company guarantee, the OGA will apply its financial criteria and documentation/evidence requirements to the parent instead.

d) Directors’ loans, which must be confirmed in writing and the Company must also satisfy the OGA about the directors’ ability to make such loans from their private resources.

e) Loans from banks or other financial institutions that are evidenced by the provision of a copy of the executed loan agreement. Loan agreements that have been made conditional upon the award of licence are acceptable but letters of intent from a bank or other financial institution are not. If a company will be relying on commercial debt to meet its existing and/or proposed licence commitments, or is a subsidiary of a corporate group which is reliant on commercial debt, the OGA will need assurances that the funding arrangements will remain in place long enough to fund the Work Programme and that the company and, if applicable, the corporate group to which it belongs can meet the interest payments and agreed capital repayment obligations. A debt repayment schedule for the applicant company and, if applicable, for the corporate group should therefore be provided along with summary cash flow projections clearly showing interest charges and capital repayments. If the debt repayment schedule shows any significant redemption of debt within the next 12 months which cannot be met from operational cash flow, details of how the redemption will be funded should also be provided.

f) Future cash flows from existing assets where those assets have proven reserves and are in production, or where production is imminent. The OGA will require detailed financial projections for a period of not less than 5 years. As a minimum, these projections should comprise cash flow forecasts for both the Applicant Company and
consolidated cash flow forecasts for any corporate group to which the Applicant Company may belong. Any assumptions made in the compilation of these forecasts should also be provided. Speculative cash flows, for example where assets are not in production and where production is not considered imminent, are not acceptable (OGA, 2015b).

6.7 Gaps in the Financial Regime

6.7.1 Restoration

Provided the recommendations of the Opencast Coal Taskforce are implemented across those local authority areas in which UOG development may be undertaken (Scottish Government, 2015c), no specific gaps have been identified in the planning regime where this is used to control surface restoration liabilities under Section 75 planning agreements.

6.7.2 Decommissioning

There appears to be a gap in the regulations relating to decommissioning, aftercare and long-term well failure liabilities of onshore wells. This is because currently the OGA decommissioning unit only deals with offshore wells: there is no existing unit to deal with on-shore decommissioning costs.

The definitions of “Well Costs” and “Works Programme” used in the regulations and guidance could be interpreted to only cover the projected decommissioning costs at the time that well consent is applied for (i.e. before the well has been drilled). They do not make reference to the costs of after-care or long-term well repair liabilities. As demonstrated above, there is a measure of uncertainty regarding the estimates of decommissioning costs prior to drilling.

The legislation and regulations do not include a specific requirement to include decommissioning costs (or aftercare or long-term well repair) in “Well Costs” or “Works Programme” once a well has been completed. Logically the term “licence commitments” used in the regulations and guidance should be defined to explicitly include decommissioning, aftercare and repair liabilities, but as currently worded this appears to be open to interpretation.

Once the a well is completed, the licensing authority has power to require the tests to be re-run if it deems this necessary, but there is no specific requirement to do this at regular intervals. However, if the tests are re-run, there is no specific requirement to refine decommissioning and other liabilities once a well has been completed. Together, these create the possibility that some portion of post-production liabilities could be unfunded.

The current regulations are geared towards companies with the large balance sheets required to operate offshore. If unconventional onshore oil and gas exploration and production is permitted, it will take place on a smaller scale, and most likely, on shorter time scales (from exploration to decommissioning) than offshore conventional oil and gas.
It will therefore be accessible to companies with smaller balance sheets, whose financial strength could change more rapidly than the financial strengths of the offshore companies.

6.7.3 Liabilities after Licence Surrender.

The current regulations do not legislate for the cost of repairing leaking wells once the licence has been surrendered. As described in Chapter 2, there is a low likelihood of long-term failure of wells that have successfully surrendered their environmental authorisations. Should any problems occur in a decommissioned well, they would most likely occur during the aftercare and monitoring period (in which case, the costs of repair will be covered by the financial arrangements put in place to cover Repair Liabilities during the aftercare period). Failure of a well after the environmental authorisation has been surrendered, if it occurs, is more likely to occur decades into the future than in the years immediately after surrender.

6.8 Possible Remedies - During Licensing

6.8.1 Guiding Principles

When considering potential remedies the following factors have been taken as guiding principles:

• adequate funding should be available to ensure that wells are timely and securely decommissioned and that any long-term, post-decommissioning well failures are repaired where necessary to protect public health and the environment; and

• the funding of such decommissioning and repairs should fall to UOG operators and not to the public purse.

These two objectives should be met in a proportionate way that results in the least adverse impact on the economic viability of the UOG industry.

6.8.2 Possible Changes to the Existing Regulatory Regime

With the devolution of the OGA’s powers to a future Scottish licensing authority, there is an opportunity to adapt the existing licensing regime to the Scottish situation to ensure that the liabilities for decommissioning, aftercare and repair of failed wells (prior to licence surrender) are adequately provided for by licence holders and that they do not fall on the public purse. Recognising that the shorter project lives and smaller scale of unconventional oil and gas compared with conventional oil and gas, and the experience of the Scottish opencast coal industry, the following remedies could be considered:

• define “decommissioning liabilities” to include the cost of decommissioning and aftercare up until licence surrender;
• define “repair liabilities” as the cost to repair a well should emissions post-decommissioning exceed agreed environmental standards;

• require the future Scottish licensing authority to ignore unrealisable assets such as goodwill when considering a company’s assets or net worth;

• require licensees to supply evidence and a technical opinion (by the independent well examiner) to support their estimates of decommissioning liabilities and repair liabilities;

• require decommissioning liabilities to be specifically included in “well costs” and “works programme” and shown as a separate line in the cash flow projections supplied by licensees to the licensing authority for the purpose of applying the financial strength tests;

• require UOG operators to provide a commentary to the Scottish licensing authority (in statutory drilling returns) of any material changes in the estimate of Decommissioning Liabilities as a consequence of geological conditions encountered during drilling;

• require the Scottish licensing authority to monitor UOG operators actively, including site inspections at regular intervals.

• give the Scottish licensing authority powers to compel licensees to provide additional financial arrangements prior to well testing, if information gathered during drilling indicates that there could be a material increase in the estimate of decommissioning liabilities;

• require UOG operators to re-submit, with evidence and technical opinion, their estimates of Decommissioning Liabilities and Repair Liabilities once drilling and well testing are complete;

• require the Scottish licensing authority to re-run the financial strength tests on completion of well testing;

• require licensees to update and independently re-validate their estimates of decommissioning liabilities and repair liabilities at least annually, taking into account operating data, evolving best practice and inflation;

• require the Scottish licensing authority to periodically re-run the financial strength tests during gas and oil production (noting that the licensees are already required by existing regulations to resubmit accounts and other financial information on an annual basis) and during the aftercare period; and

• where a UOG operator fails the tests, the Scottish licensing authority could be given powers to compel the licensee to provide specific additional or alternative financial arrangements where, in the opinion of the licensing authority:
  - these are necessary to respond to changes in oil, gas, banking, bond or insurance markets; or
the financial circumstances of a UOG operator or any other entity which the operator depends on to meet its Licence Obligations including Decommissioning Liabilities and Repair Liabilities have materially and negatively changed or are likely to materially and negatively change as a result of those market changes.

Ideally the specific arrangements compelled by the Scottish licensing authority should be at least sufficient to cover the decommissioning liability and the provision of insurance or payments into a mutual fund to cover the after-care and long-term repair liabilities.

In addition, whenever production has ceased, either temporarily or permanently, until the environmental authorisation has been surrendered the UOG operator could be required to demonstrate (through the financial strength tests) that sufficient funds will continue to be available and "ring-fenced" to cover the latest estimate of Decommissioning Liabilities. Where this cannot be demonstrated to the satisfaction of the licensing authority, the licensing authority could be given the power to call upon funds, guarantees, bonds and insurance policies provided by the licensee and/or its parent company to cover its Decommissioning Liabilities and place their proceeds into escrow.

Whenever production at a well is ceased, either temporarily or permanently, UOG operators could be required to provide insurance policies or other instruments acceptable to the licensing authority to cover the Repair Liabilities of that well.

The UOG operator could also be required to demonstrate to the satisfaction of the licensing authority that the provider of the instrument used to cover the Decommissioning and/or Repair Liability has approved the operator’s decommissioning design. In the event that regulatory approval of the decommissioning design occurs after the date on which the instrument is required, the operator could be required to either:

- demonstrate to the licensing authority that the instrument provider has noted and accepted any changes to the decommissioning design (since the instrument was issued) required to gain regulatory approval; or

- provide a new financial instrument compatible with the design that has received regulatory approval.

Where a well fails during the aftercare period, the design of the repair should be subject to regulatory approval.

6.9 Possible Remedies – After Licence Surrender

6.9.1 Introduction

The current regulations do not legislate for the cost of repairing wells once the licence has been surrendered. As set out in Chapter 2, wells, which are designed, constructed and abandoned to a high standard in a strong regulatory environment, are considered to be at low risk of leakage. Should any problems occur in a decommissioned well, they will most
likely during the aftercare and monitoring period. In this case, the costs of repair will be covered by the financial arrangements put in place to cover repairs during the aftercare period. Long-term failure of a well after the PEDL has been surrendered will occur decades into the future (if at all) rather than in the years immediately after licence surrender.

Under the “polluter pays” principle, the licensees at the time of decommissioning should still be liable for the future costs of repair of the well if such a failure occurs. However, there will be a real possibility that at the time of failure, those licensees will have either ceased to exist or will no longer have the financial strength to pay for the repairs. In such a case the repair liability will be orphaned. Such an eventuality could be avoided by simply never permitting licensees to surrender their licences and requiring them to continue to pass the financial strength tests indefinitely. However, such an option would appear unrealistic: it would impose an ever larger administrative burden on the licensing authority as decommissioned wells proliferate (substantially increasing the total cost of regulation); and it would impose indefinite costs on industry, which are unlikely to be proportionate to the risk and which would in all likelihood damage the economic viability of the industry.

In an ideal world, licensees would deal with the long-term liability by buying an insurance product in the market, with the licensing authority as the insured party (to ensure the licensing authority has funds to procure repairs to the well in the event of a failure in the period after licence surrender). In reality, such products do not yet exist. Even if they did, the long-term nature of the liability means that there would be a risk that the insurance provider could withdraw from the market at some point in the future, thereby negating the cover and leaving the repair liability orphaned.

Given the above and the current immaturity of the unconventional oil and gas industry in Scotland, the simplest and most secure way of ensuring that long-term failure liabilities are covered would be an industry-wide mutual fund (see Section 6.4). The fund would be capitalised over time by collecting “premiums” from all licensees. Then, should any well fail after licence surrender, the costs of repair of that well could be borne by the mutual fund under the direction of the licensing authority.

To examine the feasibility of a mutual fund, a number of issues need to be considered:

- the size of the mutual fund;
- premiums
- failure occurring before the fund is fully capitalised; and
- fund management.

6.9.2 Size of the Mutual Fund.

As there is a low probability of any well failing, a mutual fund would not have to be so large that it could cover the cost of all decommissioned wells failing. Rationally, it should be sufficiently large to cover the costs of repairing a percentage of all wells drilled (“the failure
percentage”). As all wells require licensing authority approval of the decommissioning design under an industry wide licensing authority regime, it would seem appropriate to calculate the failure percentage on an industry-wide basis. In the early stages of the industry, the failure percentage should be determined by reference to the long-term failure rate in conventional oil and gas wells, but with an additional margin that reflects differences between conventional and unconventional well drilling and operating practices (and therefore the stresses placed on the well annulus). As the industry matures and experience is gained, the licensing authority would be able to adjust the failure percentage in the light of experience.

For the extreme case of a total well decommissioning failure (where hydrocarbons or well fluids are freely migrating between different geological horizons and/or to the surface), the maximum cost of repair of each well will have been estimated in advance. If regulation requires the repair liability to be estimated, the repair liability will be estimated once well testing is complete (and refined and adjusted in each year thereafter). It should therefore be possible for the licensing authority to produce an estimate of the industry-wide maximum repair liability (for all wells that have been completed to date). Again, as the industry matures, better information is made available and more wells are drilled, the licensing authority will be able to adjust the industry-wide repair liability.

Once the failure percentage has been estimated, the licensing authority would be in a position to estimate the size of the mutual fund required. At its most simplistic, this could be achieved by multiplying the industry-wide maximum repair liability by the estimated failure percentage plus a sum to cover the cost of administering the fund.

In reality, should failures occur, they could range from minor failure (emissions marginally raised above agreed limits) to total failure. A failure may therefore not require the full repair liability to be spent in order to repair the well, but this will depend on the nature of the failure and where in the well column the emissions are originating. As the industry matures and better information becomes available, it may be possible to ascribe different failure percentages for different types of failure. If deemed appropriate, this could enable the size of the mutual fund to be adjusted to account for the different failure percentages and the repair costs of different types of failure.

### 6.9.3 Premiums

If a mutual fund were established on this basis, UOG operators would be required to populate it with premium payments. The premium for a well should be proportional to the estimated repair liability for that well. At its most basic, the premium should be equal to the repair liability for that well multiplied by the (industry-wide) failure percentage, plus an amount to cover the cost of administration of the mutual fund. If the failure percentage is adjusted in the future, the size of the of the premium will change.

Premium payments could either be lump sums or payments spread over time, but as a minimum the premium should be paid in full before the licence is surrendered:
• Should UOG operators be required to continue to pass the financial strength tests during aftercare and monitoring, they would have to continue to demonstrate sufficient assets to cover the Repair Liability during the aftercare period.
  
  - Where the Repair Liability has been covered by shareholders funds, parent company guarantees or letters of credit, the value of the assets would be greater than the premium. In such cases, the premium could be paid as a lump sum when the assets are “released” at the time of licence surrender.
  
  - Where the Repair Liability has been covered by insurance, the licensing authority could require the licensees to provide additional assets to cover the premium, if the UOG operator wishes it to remain payable at PEDL surrender.
  
  - If a well fails during the aftercare period, the possibility that the cost of repair could equal or exceed the Repair Liability will need to be considered by the licensing authority. Taking into account the margin by which the Licensee passed the most recent financial strength tests, at the time that failure is declared the licensing authority will need to consider whether or not to compel the Licensee to provide additional assets or to pay the premium immediately.

• If licensees are not required to continue to pass the financial tests during the aftercare period, the licensing authority could be given the power to compel payment of the premium at the start of decommissioning.

• UOG operators could be given the option of paying the premium in advance should they choose to do so; if the premiums are deemed to be tax deductible, licensees could be incentivised to pay the premium whilst the well is in production (to offset tax liabilities).

• Where payments are made in advance, UOG operators could remain liable for additional charges (or refunds) in the future, should the licensing authority adjust the industry-wide failure percentage before the PEDL is surrendered.

• Where a licensee elects to pay in advance, it should be given the option to pay the premium in instalments.

6.9.4 Failure Occurring before Mutual Fund is Fully Capitalised.

The principle of a mutual fund is to share the costs of repairing long-term well failures amongst the industry. However, if only a limited number of wells are drilled, it is possible that the fund will not be large enough to pay the repair costs if one or more of those wells fails after licence surrender (i.e. the failure rate is greater than the failure percentage used to calculate premiums). This liability could be balanced by consideration of:

a) the minimisation of the probability of failure occurring through the robust system of regulation and licensing authority approval of well and decommissioning design; and
b) the size of the liability, which will be relatively small given that only a small number of wells are drilled.

The monetary options for minimising the liability of excesses falling to the public purse are limited. The most realistic one would be to increase the failure percentage (and thus the size of premiums) in the early years of the industry’s development. This would however increase industry costs, which may in turn reduce the number of viable wells and therefore be potentially self-defeating.

6.9.5 Fund Management

Any mutual fund would need to be managed over a long period of time. It would need to be invested in such a manner that it grows at a rate that keeps pace with both inflation and the increase in the nominal cost of future well repairs.

6.10 Conclusions

6.10.1 Whilst Operators are Licensed

It is essential that UOG operators have sufficient funds available to cover liabilities associated with the abandonment and decommissioning of wells. The licensing authority can test the financial robustness of operators during licence applications, if a licence changes hands or before a well consent is issued. The licensing authority also has powers to compel the supply of further financial information once operations commence, and to require a company to “take action” if the licensing authority is not confident that there are sufficient funds to cover its liabilities.

We have identified this as a weakness in the existing provisions in that there appears to be no power to require specific arrangements for onshore well decommissioning and aftercare if a company proves to be failing the financial tests after a well consent is awarded. A relatively simple solution could be to re-apply the financial strength tests regularly for operators and to ensure that the well costs used in the tests include sufficient allowance for the operator’s decommissioning and restoration liabilities.

If a company fails the financial strength tests, under the existing regulations the OGA does not have the power to compel operators to make specific further financial provisions. It is clear that both the liabilities for individual wells and the robustness of individual operators will vary. The Scottish Government should consider therefore whether the future Scottish licensing authority needs to be able to compel specific financial provisions to match the individual circumstances. These could include provision of Parent Company Guarantees, insurance, bonds or letters of credit or payment into escrow accounts - depending on the reasons for failing the tests.

Post-decommissioning well failure is unlikely, but should it occur it is most likely to happen within a few years after well abandonment and decommissioning. It could therefore be expected that the licensing authority will not accept surrender until all environmental...
authorisations and restoration obligations have been complied with. During this period, the licensing authority could continue to apply the financial tests and require specific financial action should significant liabilities be identified by the regulators.

6.10.2 After Licence Surrender

The likelihood of long-term failure of decommissioned UOG wells that were well constructed and abandoned is considered to be low.

In the event that a failure does occur after licence surrender, long-term insurance products could cover such risks. Alternatively, a mutual fund could be established to cover the costs of repairing leaking orphaned wells in the future. As an example, an annual levy on consented wells raised through the licence fee could be used for this purpose.

6.10.3 Impact on the Cost of Regulation in Scotland

Should UOG development be permitted in Scotland, there will be increased regulatory costs associated with:

- increased regulatory oversight by the future Scottish licensing authority;
- ensuring that local authorities in which UOG development may occur are resourced to implement the recommendations of the Opencast Coal Taskforce.

There will also be increased regulatory requirements for SEPA should the industry grow and develop.
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Milieu Ltd., 2013b. *Regulatory provisions governing key aspects of unconventional gas extraction in Poland*, Brussels: Mileu Ltd..

Milieu Ltd., 2013c. *Regulatory provisions governing key aspects of unconventional gas extraction in Spain*, Brussels: Mileu Ltd..


OGUK, 2011a. *Guidelines for well-operators on well examination Issue 1*, London: Oil and Gas UK.

OGUK, 2011b. *Guidance for well-operators on competency of well-examiners Issue 1*, London: Oil and Gas UK.


OGUK, 2016. *Norwegian Continental Shelf Decommissioning Insight*, London: Oil and Gas UK.


Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Coalbed Methane</td>
<td>Gas extracted from coal seams</td>
</tr>
<tr>
<td>Coal Seam Gas</td>
<td>Australian term for coalbed methane</td>
</tr>
<tr>
<td>Hydraulic fracturing</td>
<td>A process used to increase the permeability of a rock through the creation of networks of interconnected fractures by the injection of pressurised fluids</td>
</tr>
<tr>
<td>Licensing Authority</td>
<td>Currently the Oil and Gas Authority, however, licensing powers for onshore oil and gas in Scotland will be devolved to the Scottish Government under the Scotland Act 2016.</td>
</tr>
<tr>
<td>Local Authority</td>
<td>The Scottish council area in which a UOG development is located</td>
</tr>
<tr>
<td>Oil and Gas UK</td>
<td>The representative body for the UK offshore oil and gas industry</td>
</tr>
<tr>
<td>Permeability</td>
<td>A measure of the ability of a rock to allow fluids to pass through it</td>
</tr>
<tr>
<td>Sedimentary Rock</td>
<td>A rock generally formed by the deposition of the weathered remains of other rocks or by the deposition of the results of biogenic activity</td>
</tr>
<tr>
<td>Shale</td>
<td>A fine grained sedimentary rock</td>
</tr>
<tr>
<td>Shale Gas</td>
<td>A natural gas found in shale. Can also be referred to as unconventional gas</td>
</tr>
<tr>
<td>United Kingdom Onshore Oil and Gas</td>
<td>The representative body for the UK onshore oil and gas industry</td>
</tr>
<tr>
<td>Well Integrity</td>
<td>The ability of the well to prevent hydrocarbons or operational fluids leaking into the surrounding environment</td>
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## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>AER</td>
<td>Alberta Energy Regulator, Alberta, Canada</td>
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<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>BEIS</td>
<td>Department of Business, Energy and Industrial Strategy (formerly DECC)</td>
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<tr>
<td>BGS</td>
<td>British Geological Survey</td>
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<tr>
<td>BLM</td>
<td>US Bureau of Mines</td>
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<tr>
<td>CAPP</td>
<td>Canadian Association of Petroleum Producers</td>
</tr>
<tr>
<td>CAR</td>
<td>Water Environment (Controlled Activities) (Scotland) Regulations 2011</td>
</tr>
<tr>
<td>CBM</td>
<td>Coalbed methane</td>
</tr>
<tr>
<td>CSG</td>
<td>Coal-Seam Gas</td>
</tr>
<tr>
<td>COSLA</td>
<td>Convention of Scottish Local Authorities</td>
</tr>
<tr>
<td>DEA</td>
<td>Danish Energy Agency</td>
</tr>
<tr>
<td>DECC</td>
<td>UK Government Department of Energy and Climate Change (to mid-July 2016). Now the Department of Business, Energy and Industrial Strategy (BEIS)</td>
</tr>
<tr>
<td>DEP</td>
<td>Department of Environmental Protection, Pennsylvania, US</td>
</tr>
<tr>
<td>DPC</td>
<td>New South Wales Department of Premier and Cabinet</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>FERC</td>
<td>US Federal Energy Regulatory Commission</td>
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<tr>
<td>HOPS</td>
<td>Heads of Planning Scotland</td>
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<tr>
<td>HSE</td>
<td>Health and Safety Executive</td>
</tr>
<tr>
<td>ICLG</td>
<td>International Comparative Legal Guides</td>
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<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>IoD</td>
<td>Institute of Directors</td>
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<tr>
<td>LLR</td>
<td>Alberta Licensee Liability Rating</td>
</tr>
<tr>
<td>MPE</td>
<td>Norwegian Ministry of Petroleum and Energy</td>
</tr>
<tr>
<td>NORM</td>
<td>Naturally Occurring Radioactive Materials</td>
</tr>
<tr>
<td>NORSOK</td>
<td>Standards developed by the Norwegian petroleum industry</td>
</tr>
<tr>
<td>NPD</td>
<td>Norwegian Petroleum Directorate</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales, Australia</td>
</tr>
<tr>
<td>OGA</td>
<td>Oil and Gas Authority</td>
</tr>
<tr>
<td>OGUK</td>
<td>Oil and Gas UK - UK offshore oil and gas industry association</td>
</tr>
<tr>
<td>PAN</td>
<td>Planning Advisory Note</td>
</tr>
<tr>
<td>PEDL</td>
<td>Petroleum Exploration and Development Licence</td>
</tr>
<tr>
<td>PPC</td>
<td>Pollution Prevention and Control (Scotland) Regulations 2012</td>
</tr>
<tr>
<td>RCE</td>
<td>Rehabilitation Cost Estimate in Alberta</td>
</tr>
<tr>
<td>RSA93</td>
<td>Radioactive Substances Act 1993</td>
</tr>
<tr>
<td>SEPA</td>
<td>Scottish Environment Protection Agency</td>
</tr>
<tr>
<td>SLfT</td>
<td>Scottish Landfill Tax</td>
</tr>
<tr>
<td>SCER</td>
<td>Council of Australian Governments Standing Council on Energy and Resources</td>
</tr>
<tr>
<td>SCP</td>
<td>Sustained Casing Pressure</td>
</tr>
<tr>
<td>SPE</td>
<td>Society of Petroleum Engineers</td>
</tr>
<tr>
<td>SPP</td>
<td>Scottish Planning Policy</td>
</tr>
<tr>
<td>UOG</td>
<td>Unconventional Oil and Gas</td>
</tr>
<tr>
<td>UKCF</td>
<td>UK Community Foundations</td>
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<tr>
<td>UKOOG</td>
<td>UK Onshore Oil and Gas - representative body for the UK onshore oil &amp; gas industry</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>WFD</td>
<td>Water Framework Directive</td>
</tr>
</tbody>
</table>
Appendix A. Consultation
Appendix A. Consultation

A.1 Scottish Environment Link

A.1.1 Introduction

A workshop with Scottish Environment LINK, AECOM, KPMG and British Geological Survey was held on 21st March 2016 at KPMG’s offices in Edinburgh.

Team introductions and brief description by KPMG of the objectives of the meeting and the work being conducted.

Scottish Environment LINK provided a brief overview of their functions. LINK informed KPMG, AECOM and BGS that there are numerous subgroups within Scottish Environment LINK. Some of these subgroups may want to input into this process. A summary of the stakeholder session will be fed back to these groups and responses will be collated and returned.

A.1.2 Objectives of the Research Projects

An overview of the scope of the research project was provided. KPMG, AECOM and BGS highlighted that the purpose of the study is to increase the evidence-base for the Scottish Government on unconventional oil and gas and no formal recommendations will be provided to the Government.

KPMG, BGS and AECOM provided an overview of the five work streams. One key point LINK highlighted was the lack of overall environmental study, which would combine all five work streams. LINK also stated that the five work streams should highlight any gaps in evidence or data.

A.1.3 Decommissioning Overview

AECOM gave an overview of the scope of the three phases of their work including the sources and case studies they would be drawing from. Two key reports they are looking at are the Scottish Task Force report on shale gas and the Independent Expert Report. LINK highlighted the concern that these were written by engineers, not environmental experts, and so do not consider the full externalities and costs.

AECOM/KPMG discussed the interactions between their two respective studies.

There was a discussion about recent consultations on mine monitoring fees and opencast. LINK informed the group that there has been recent resource directed to this industry. LINK suggested AECOM should consult with the Scottish Government to identify whether it would be possible to engage with these parties as part of this project.

There was a detailed discussion between LINK and AECOM around the Scottish regulatory framework.
The need for a well-articulated broader regulatory picture was highlighted if it were to be included in any model. It was agreed that the current structure is not detailed enough to be included.

LINK also highlighted the issue of orphan wells (those that have been left by foreign developers and there is no way to get financial compensation from them) and the need to prevent them.

The permitting and regulation in Scotland is different to that in England. LINK particularly noted that this was true for the waste management industry. LINK highlighted the concern that the Scottish regulatory framework could allow much shorter sightedness than England.

The final topic discussed was that the implementation of certain guarantees that could affect the governing body responsible. Do these local authorities have the expertise and capacity to do this? One option discussed by AECOM/LINK was a centralised planning unit e.g. an advisory group.

### A.1.4 Consultation Response

Following the consultation meeting a written consultation response was provided by LINK. The main points are summarised in the table below, together with cross-references to where these issues are discussed in this document.

<table>
<thead>
<tr>
<th>Summary of Issues Raised</th>
<th>Location in Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>- LINK consider key issue is long-term methane emissions</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>- Written decommissioning plan approved by planning authority, SEPA, well examiner and secured by legal agreement</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>- Clarity on how landownership is relinquished by operator.</td>
<td></td>
</tr>
<tr>
<td>- Robust measures to ensure decommissioning does not fall on public purse.</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>- Restoration should be to a minimum standard, which should enhance the local environment.</td>
<td>Chapters 3 and 5</td>
</tr>
<tr>
<td>- Further research into interactions between fracking fluid and formation water required.</td>
<td>Not in scope</td>
</tr>
<tr>
<td>- Appropriate post-decommissioning monitoring period should be agreed with the regulators and based on evidence.</td>
<td>Chapters 2 and 3</td>
</tr>
<tr>
<td>- Cessation of monitoring should be contingent on no evidence of leakage or associated pollution</td>
<td>Chapters 2 and 3</td>
</tr>
<tr>
<td>- Appropriate financial guarantees must be secured by planning authority covering whole cost of decommissioning in case of insolvency or non-compliance using funds in escrow</td>
<td>Chapter 6</td>
</tr>
</tbody>
</table>
A.2 Convention of Scottish Local Authorities

A.2.1 Welcome and introductions

A workshop with COSLA, AECOM, KPMG and British Geological Survey was held on 22nd March 2016 at a hotel in Edinburgh.

Team introductions and brief description by KPMG of objectives of the meeting, including data requests and purdah limitations.

COSLA provided a brief overview of their functions. COSLA informed the group that a summary of the stakeholder session will be fed back to the local authorities and responses will be collated and returned to us.

COSLA clarified that they do not take a particular political view regarding the potential development of unconventional oil and gas – currently they have a neutral opinion towards hydraulic fracturing.

A.2.2 Objectives of the research projects

An overview of the scope of the research project was provided. KPMG, AECOM and BGS highlighted that the studies will not make any formal recommendations. The group informed COSLA that there might be a formal consultation process by the Scottish Government after the completion of the five research studies and interested stakeholders might wish to engage with more formally.

COSLA were keen to understand who else had contributed at this stage. The group provided a description of the stakeholders that had been engaged at the request of the Scottish Government.

A.2.3 Decommissioning

AECOM gave an overview of the scope of the three phases of their work including some of the sources they would be drawing from and the case studies they will use. Two key reports they are looking at are the Scottish Task Force report on shale gas and the
Independent Expert Report. AECOM/KPMG discussed the interactions between their two respective studies.

There was a discussion on whether AECOM will consider creating a new funding mechanism or streamline existing mechanisms. The latter seemed to be the preferred choice. The heads of planning (HOPs) will have a concern about the resources that will be required due to tight budgets and the need for this to fall on properly resourced authorities. It was suggested in England it may have to rest at a government level.

A.2.4 Consultation Response – Decommissioning

Following the consultation meeting a written consultation response was provided by COSLA. The main points are summarised in the table below together with cross-references to where these issues are discussed in this document.

<table>
<thead>
<tr>
<th>Summary of Issues Raised</th>
<th>Location in Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>There must be agreement form local community representatives and elected members prior to UOG exploration or activity.</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>The principle of the “polluter pays” must be upheld in relation to UOG activity.</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>The regulatory framework for UOG development should be agreed in advance between the local government, Scottish Government and industry advisers</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>Highlighted concerns about water contamination and water use and disposal.</td>
<td>Not in scope</td>
</tr>
<tr>
<td>The decommissioning report should focus on work undertaken by the Coal Task Force around bank guarantees and other funding mechanisms.</td>
<td>Chapters 4 and 6</td>
</tr>
</tbody>
</table>

A.3 UK Onshore Oil and Gas

A.3.1 Welcome and introductions

A workshop with UKOOG, AECOM, KPMG and British Geological Survey was held on 22nd March 2016 at a hotel Edinburgh.

Team introductions and brief description by KPMG of objectives of the meeting, including data requests and purdah limitations.

A.3.2 Objectives of the research projects

An overview of the scope of the research project was provided. KPMG, AECOM and BGS highlighted that the purpose of the study is to increase the evidence base for the Scottish government on unconventional oil and gas. This is not a project to make any formal recommendations. KPMG, BGS and AECOM provided an overview of the five work streams and the further public health study that is being produced.
UKOOG stated they would like the opportunity to discuss options and mitigations before they are included in the final report, however it was noted that stakeholder time has to remain equal among the different stakeholder groups. The regulatory structure for decommissioning is shared amongst the UK and UKOOG represents the whole of the UK, hence they would like to know any further developments in options and mitigation that could have a direct impact on England and Wales.

A.3.3 AECOM: Decommissioning

AECOM gave an overview of the scope of the three phases of their work including some of the sources they would be drawing from and the case studies they will use. Two key reports they are looking at are the Scottish Task Force report on shale gas and the Independent Expert Report. LINK highlighted the concern that these are written by engineer’s not environmental experts and so do not consider the full externalities and costs.

AECOM/KPMG discussed the interactions between their two respective studies.

AECOM informed the group that the Scottish government have not yet given any indication of what they will do about regulation or decommission but suspect this research will form a part of decision.

A.3.4 Consultation Response - Decommissioning

Following the consultation meeting a written consultation response was provided by UKOOG. The main points are summarised in the table below together with cross-references to where these issues are discussed in this document.

<table>
<thead>
<tr>
<th>Summary of Issues Raised</th>
<th>Location in Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>• UKOOG’s understanding of decommissioning of UOG development</td>
<td>Chapters 2 and 3</td>
</tr>
<tr>
<td>• UKOOG’s understanding of the risks associated with UOG development</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>• UKOOG’s understanding of regulation of UOG development by HSE, SEPA and the planning authority</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>• UKOOG’s commitment to post-decommissioning environmental monitoring</td>
<td>Chapters 2 and 3</td>
</tr>
<tr>
<td>• UKOOG’s view that financial liabilities are best met by a combination of the guarantees within the licensing system accompanied by insurance.</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>• UKOOG are investigating whether mutual funds may take the place of some insurance products.</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>• The Scottish Government should ensure that its powers are devolved to cover the responsibilities of BEIS and the OGA</td>
<td>Chapter 3</td>
</tr>
</tbody>
</table>
A.4 The Broad Alliance

A.4.1 Objectives of the research projects

Representatives of the Broad Alliance were not available for the consultation events in March 2016.

An overview of the scope of the research projects was submitted by email to the Broad Alliance by KPMG, AECOM and BGS.

A.4.2 Consultation Response - Decommissioning

<table>
<thead>
<tr>
<th>Summary of Issues Raised</th>
<th>Location in Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The Broad Alliance does not consider UOG development has a place in Scotland and had no views on decommissioning of UOG developments.</td>
<td>Not in Scope</td>
</tr>
<tr>
<td>• The Broad Alliance raised concerns about the historical failure to decommission extractive industries in Scotland – including coal, lead and shale oil as well as North Sea oil, steel and others.</td>
<td>Chapters 2, 3, 4, 5 and 6</td>
</tr>
</tbody>
</table>
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