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Carbon Capture and Storage Association Response to

Towards Carbon Capture and Storage – A Consultation Document

Introduction

The CCSA is grateful for the opportunity to respond to the Department for Business' consultation 'Towards Carbon Capture and Storage'. The Carbon Capture and Storage Association (CCSA) exists to represent the interests of its members in promoting the Business of Carbon Capture and Storage (CCS).

The Association works to raise awareness, both in the UK and internationally, of the benefits of CCS as a viable climate change mitigation option, and the role of CCS in moving towards a low-carbon global economy. In the view of the CCSA, the application of CCS technology to large combustion plant will be unavoidable in the future if we are to collectively deliver a stable transition to low-carbon energy supply and deliver a fuel-mix diversity which is key for energy security of supply in the UK.

The attached document sets out a detailed response to each of the questions in the consultation, however, to summarise:

SECTION 3:

The CCSA recognises that Government may regard it to be prudent that new plant should be capable of being retro-fitted with CCS. Industry is happy to work with Government to help ensure that future emissions will be minimised whilst maintaining secure energy supplies. However, rather than a Carbon Capture Readiness (CCR) requirement for new power plant, the funding of CCS demonstration projects and long term commitment to market mechanisms for the deployment of low carbon solutions would be more meaningful and of real practical assistance to CCS developments

Developers should be aware of the potential risk of future mandatory CCS and they are best placed to evaluate the risk in the wider project context.

The CCSA is concerned that CCR creates an illusion of progress on CCS, when more urgent issues are the funding of demonstration plant and the establishment of long-term

market mechanisms that enable commercial investment decisions to be made with regard to power plant. Without the other two actions, CCR will do nothing on its own.

The CCSA has the following main points which summarise the detailed responses to Section 3:

- In the long-term the CO_2 price generated within the EU Emissions Trading Scheme (ETS) is intended to be the primary driver for stimulating future investments in low carbon and carbon free technologies, including CCS. In the short to medium term, there is a need for government financial support for the development and demonstration of CCS technology at commercial scale. This support should not favour any one technology.

- Assessing the CCR of new power plant is a prudent step for a developer to take when planning new large combustion plant in order to avoid the risk of a stranded asset in future but that it is not a well-defined concept at present.

- (CCR) is not a well defined concept and there are good reasons why CCR should not be required by regulation. However it is also recognised by the CCSA that Government is seeking advice on Article 32 of the proposed Directive which seeks to signal the direction for the future of carbon reduction initiatives. If regulation were to be introduced then the CCSA believes that a 'light touch' approach to CCR regulation is appropriate.

- Following on, the key principle defining the CCR regulation should be that, at the time of seeking planning consent for a combustion plant, the operator demonstrates there are no known barriers to subsequent CCS installation.

- In addition, the Government should consider how CCR can be safe-guarded to avoid future changes in circumstances creating barriers that impede subsequent CCS development

SECTION 4 & 5:

We would also like to take this opportunity to re-iterate our views on what we see to be the key aspects of a future regime for licensing offshore CO_2 storage in the United Kingdom:

In any first of a kind venture, nothing deters potential developers and investors like regulatory complexity and the risk of unpredictable change. The Association therefore believes that any future regulatory regime governing offshore CO_2 transport, injection and storage needs to be simple, stable and predictable. In this regard we are concerned with three aspects of the arrangements discussed in the Consultation Document:

- Firstly, the potential for un-necessarily complex working arrangements with different regulatory agencies, and the need to manage multiple interfaces with existing licensing regimes. Whilst the Association warmly welcomes the Department's proposal for a bespoke licensing regime for offshore CO_2 storage we are nevertheless concerned that devolution arrangements, the interests of the Crown Estate and the remit of a new Marine Management Organisation, as envisaged under the Marine Bill, raise the prospect of a complex nexus of regimes

for prospective CCS developers to deal with. We understand and respect the need to address the diverse needs of all stakeholders with an interest in the seabed and sub-seabed environment, but we believe that a 'one stop shop' licensing regime with a single, accountable, regulator has much to commend it – not least a champion within Government for this nascent industry, and an opportunity to alleviate the regulatory burden of multiple regimes by leaving it to Government to resolve licensing conflicts rather than divesting this responsibility to the industry.

- Secondly, the need for regulatory competence. This will be key to Government's ability to deliver a stable, even-handed and enabling regulatory framework, and in the case of CCS is vital to ensuring that regulations are developed and applied with the required urgency. Reflecting on the specific identity of the regulatory authority, the CCSA believes that because offshore CO_2 storage operations will share many technical and operational parallels with offshore oil & gas production and natural gas storage (large scale injection, storage and reservoir monitoring operations in the sub-seabed environment) then it will call for much the same skills set. Acknowledging that the licensing of CO_2 storage will probably also have its largest interface with the hydrocarbon licensing regime then the CCSA believes that the current regulator of offshore petroleum operations, the Department for Business, Enterprise & Regulatory Reform (DBERR), would be most appropriate regulator of offshore CCS activities.

- Finally, the risk of delay, complexity and uncertainty introduced by the proposed EU Commission review of storage permits and consents for store closure. The Commission have no competence in this area and therefore we do not believe they will add value to the decisions of national regulators aided by their own technical experts.

It is clear from emerging picture on the likely costs and revenue streams of CCS projects, particularly during early demonstration, that project economics will continue to be challenging. Whilst we look to the carbon price set through the EU Emissions Trading Scheme to provide the primary, long-term financial support for CCS, this will be inadequate over the short to medium term and additional financial support will be necessary. The Association is therefore very concerned that arising from the requirement for a seabed lease, in addition to a storage licence, the Crown Estate Commissioners could see CO_2 storage as an opportunity to extract commercial rents from a fledgling industry that will have little capacity to bear it.

The consultation recognises the very important principle that the rights and assets of existing licensees need to be recognised when considering the permitting of CO_2 storage sites, lest there be detrimental impact to current activities. However, the draft EU CCS Directive unhelpfully proposes a restriction of potentially conflicting activities – with a risk that we sterilise large tracts of the UK Continental Shelf for other activities. The Association's view is that the industry already has a successful track record of managing concurrent activities through legal and commercial agreements, and where possible we should be allowed to continue doing so. We therefore encourage the UK Government to take a light-touch approach to transposing this particular provision of the Directive.

Finally, we urge a measured response to any future need for store Operators to provide financial security to cover potential liabilities associated with storage activities. Any responsible Operator will be willing to cover liabilities for which he is responsible, but the requirement to do so needs to recognise the realities of the risks involved. The requirement to provide financial security can place an onerous obligation on the balance sheet of companies, it can tie up significant capital, and it can limit the capacity for future borrowing, with the risk that this puts the economic viability of such projects beyond the reach of many companies. We therefore argue that any requirement to post financial security should be tailored closely to the risks involved, building for example with the volume of CO_2 stored. The CCSA further submits that CO_2 store Operators should not have financial or other liabilities imposed on them after the following store closure and handover to the State (whether contingent or otherwise and including liabilities for any EU ETS or similar liability). There would be significant practical difficulties with this and we submit that in any case the risk of leakage is diminishingly small in the post closure period as reservoir pressure declines and other subsurface 'fixing' processes take effect.

Responses to Consultation Questions

SECTION 1

Q1 We would welcome views on what more the Government might do to promote the development and deployment of CCS technologies in the UK, EU and Globally.

The vast majority of the scientific community are in agreement that we have less than 10 years to act on climate change, before temperature increases cause irreversible impacts. At the same time, energy security concerns and competition for access to remaining fossil fuels and are climbing the global agenda as many developing nations witness rapid expansion of their economies. The International Energy Agency predicts that at current rates world energy needs will be over 50% higher in 2030 compared with today. And fossil fuels will account for 84% of this growth in demand.

Technology barriers, supply capacity constraints and development costs will continue to limit growth in the share of renewables in the global energy mix, whilst capital intensity, public opinion and long development lead times will similarly constrain the contribution from nuclear. We therefore believe that the necessary cuts in carbon dioxide emissions, whilst energy use continues to grow, cannot be achieved without the widespread deployment of (CCS). In the words of Frederic Hauge, President of the Bellona Foundation, "The immediate and wide implementation of CCS is vital if we are to avoid the devastating – and irreversible – consequences of climate change".

CCS removes approximately 90% of the CO_2 emissions associated with burning fossil fuels and therefore remains the only available option for burning fossil fuels whilst avoiding the related environmental damage, as emphasised by the UK Governments Stern Review; The Economics of Climate Change, published in October 2006.

CCS also presents an opportunity to develop innovative and efficient methods of burning fossil fuels, such as oxyfuel combustion, and the process of pre-combustion carbon capture can produce hydrogen in large quantity, which can be used as a zero-carbon fuel thereby taking the first steps towards a transition to a low-carbon hydrogen economy.

The scale and urgency of the climate change challenge means that all low-carbon options must be progressed. For CCS alone, the IEA estimates that "on average per year 35 coal and 20 gas-fired power plants would have to be fitted with CO_2 capture and storage (CCS) technology, between 2010 and 2050" (IEA Energy Technologies Perspectives 2008). The deployment of CCS projects therefore needs to happen with utmost speed, to avoid a UK and global lock-in of escalating CO_2 emissions from the inevitable continued use of fossil fuels.

For CCS to be widely deployed over a timescale that will materially contribute to CO_2 emissions reductions by 2050 there are six key requirements for Government and industry over the course of the next decade:

- The technology must be mature, and commercially deployable. Achieving this will require a well-structured programme of demonstration projects, and in this regard we welcome initiatives such as the EU Flagship Programme, the CCS demonstration project competitions announced by the UK and Dutch Governments and the support from the Norwegian Government to CCS demonstrations at Karsto and Mongstad.

- An enabling legal framework within which existing barriers, particularly to CO_2 storage, have been removed. In this regard the UK Government are to be congratulated for the lead they took in securing amendments to both OSPAR and the London Convention, removing important legal barriers to the storage of CO_2 in the sub-seabed. However, we are concerned at the ongoing uncertainty created by the failure of the OSPAR contracting parties to ratify this change, without which there is a growing risk of delay to the first tranche of CCS demonstration projects. Further, amendment to the Protocol to the London Convention is also required, to address the cross-border transfer of CO_2. Within the European context the North Sea is likely to be a regionally important repository for CO_2, but without amendment to the Protocol it will remain out of reach for many EU Member States. We therefore urge the British Government to do all it can to secure an appropriate amendment as soon as possible.

- A mature, enabling regulatory framework providing stable, predictable terms and conditions within which investors can confidently take the required long-term investment decisions. The CCSA therefore broadly welcomes the European Commission's draft CCS Directive, and the primary legislation proposed by the UK Government in the 2008 Energy Bill for licensing offshore CO_2 storage. Whilst we set out detailed comments below in relation to both of these we applaud the Government and the Commission for the global lead they are taking here, and encourage enactment and implementation as soon as practicable.

- Incentives for the early demonstration and deployment of CCS. Whilst we look to the carbon price set through the EU Emissions Trading Scheme (ETS) to provide the primary, long-term financial support for CCS this will be inadequate over the short to medium term to accelerate the demonstration of this immature technology, and a supplementary support mechanism is therefore required. Although the Government has existing instruments to deal with technology Discovery & Development, and the emerging carbon market will have the capacity to drive long-term Deployment, support for the Demonstration phase is still

lacking. This phase is key for 'learning by doing' and for delivering essential cost reductions for deployment. As such, it is in the public interest to foster this stage.

- A supportive fiscal regime. The fiscal and licensing regimes for offshore CO_2 storage need to work harmoniously to ensure an appropriate balance of risk and reward for Government and industry, ideally recognising the challenging economics particularly of early CCS demonstration projects. Since depleted oil and gas fields have the potential to account for a significant proportion of offshore CO_2 storage capacity then the fiscal system needs to facilitate an orderly 'change of use' from hydrocarbon production activities, in particular promoting the re-use of infrastructure and safeguarding the decommissioning tax relief that oil and gas operators have accumulated in these facilities.

- Public acceptance of the benefits and safety of this technology. A significant number of storage sites, and associate transport and injection infrastructure, will be required as take up of this new technology grows. The general public therefore have a legitimate interest in understanding the benefits that this will deliver versus the resources required to achieve it, and in the safety and security of CO_2 transport and storage. An internet survey by the EU Commission last year, to which 80% of respondents were reported to be individuals, revealed that many are ignorant of CCS and that of those feeling able to express a view many voiced concerns about safety, environmental impact (from leakage), and the risk of displacing funding from renewable energy technologies. Therefore there remains much to be done, though increasingly this appears to be recognised, with specific activities now planned by organisations such as the North Sea Basin Taskforce, the Carbon Sequestration Leadership Forum and also by this Association.

SECTION 3

Q2 Do you agree that developers should have suitable space on site or adjacent to it to accommodate future carbon capture and processing plant?

It is a minimum requirement for CCR that sufficient space exists to deploy carbon capture and processing plant. The space required is very dependent on the capture technology envisaged for the site and therefore sufficient flexibility must always be retained to account for unforeseen changes in technology and requirements as the research and development of CCS proceeds. Space requirements should not be mandated for this reason.

The CCSA would stress that rather than prescribe "adjacent land", any future regulation should also refer to "suitable offsite land" – suitable covering space, access, ownership/option/right to use etc. Some items of equipment clearly need to be adjacent, such as post combustion capture equipment, as it most likely impractical to transport flue gases long distance. However instances can be thought of where some equipment may be located at some distance – examples being:

- Capture ready CCGT plants with future conversion to hydrogen firing as the CCR technology choice. Rather than site a gasifier local to the CCGT plant, a remote gasifier connected to the CCGT plant by pipeline would be a viable option.

- Transportation of CO_2 in the vicinity of the power plant may be at lower pressure, to a remote facility where it is boosted to a higher pressure. This was the case for the Peterhead DF1 plant where CO_2 was compressed to a low pressure on the power station site, with compression to a higher pressure at a facility located circa 16km away.

In both instances the offsite facility could be owned and operated by a third party.

Q3 What do you see as the appropriate space requirements to accommodate different types of capture technologies and why? How might these vary in relation to different sizes of plant?

It is noted that 5-6 hectares appears in the Consultation as a guide to required additional space for a 1.6 GW coal station. The figure is in reasonable agreement with studies undertaken by the IEA GHG for post-combustion plant and elsewhere. However the CCSA believes that it would be misleading to suggest in Guidance that there is a particular size of area that would need to be allocated to cater for CCS plant since different CCS technologies will need different space requirements and the suggested figure may be either unnecessarily big or too small depending on the technology. The figure is in reasonable agreement with studies under taken by the IEA GHG for post-combustion plant and elsewhere.

Q4 Should developers be required to assess the feasibility of retrofitting carbon capture technology to their combustion plant?

The CCSA believes that ensuring the CCR of a new power plant and other combustion plants is a prudent step for a developer to avoid the risk of a stranded asset in future. However, the CCSA also believes there are good arguments that suggest regulation of CCR could be unhelpful and these are listed below:-

- Although, CCS technologies can be deployed now in association with power plant, the technologies are evolving rapidly and full-scale implementation experience is very limited. Therefore to mandate a technology whose performance and cost have not been demonstrated at the scale of larger power plant and for which there are no verified CO_2 storage sites, could have unwelcome consequences. It is certainly too early to prescribe, in the detail foreseen by this regulation, the measures that would render a plant CCR.

- There is a wide range of potential CCR measures, with a correspondingly wide range of costs. Developers are best placed to judge the investment risks relating to CCR, balancing the investment cost of CCR measures against the risk of a future stranded asset. The extent of CCR investment is a decision for the developer.

- There are many compelling factors to be taken into account in selecting new power station sites, before any consideration of CCR or CCS. The number of sites that can meet all criteria and proceed to development is relatively small. Given the current lack of knowledge on carbon storage sites, and the uncertainty in location or existence of future CO_2 national pipeline networks, it would be appropriate for developers to assess the risk that their plant may become stranded due to poor location rather than ruling out sites based on simplistic proximity criteria.

- In the long-term, the CO_2 price generated within the ETS is intended to be the primary driver for stimulating future investments in low carbon and carbon free technologies, including CCS. Further Government intervention should be minimised to avoid inefficiencies, in line with the principles of better regulation. In the short to medium term, there will be a need for government support for the development and demonstration of CCS technology. This support should not favour any one technology.

- An extended debate on CCR will simply distract stakeholders from the priority tasks of providing support to enable the demonstration of existing CCS solutions and to the development of more efficient and cost-effective future CCS technology. In addition to supporting development and demonstration, Government can add significant value by communicating the current and developing status of CCS, providing developers with the best possible information to inform their decisions on allowing for CCR.

Regulation must start from current knowledge and capability. If Government is minded, notwithstanding the CCSA advice and opinion, to implement some form of mandatory CCR requirements, then this regulation should be a "light touch", taking account of the principles of "Better Regulation" e.g. as to necessity, minimising administrative burden and being very clear as to the policy outcome. As CCS knowledge and capability evolves, CCR regulation can be refined through Guidance notes. A "route map" for the process would be useful at this stage.

If the initial CCR regulation encouraged highly detailed and prescriptive consent conditions, then an operator could be locked in to an inefficient CCS option, which is then superseded by later developments in technology. This would be a perverse outcome.

In summary, the CCSA believes that there are good reasons why CCR should not be required by regulation. However it is also recognised that there may be additional political reasons determining Government decision on this matter, and if these are considered compelling by Government then the 'light touch' approach suggested by the CCSA is needed.

The CCSA would consider the following to be essential features of such an approach:

- The key principle should be that at the time of seeking consent for a combustion plant the operator can show there are no known barriers to subsequent CCS installation.

- Since appropriate technology at the time of retro-fit is most likely to be significantly different from that assumed at the time of CCR assessment, there would be little benefit in a detailed (and expensive) study. Governments and regulators should not pre-judge the outcome of carbon capture development by specifying mandatory CCR requirements before feasibility and cost-effectiveness have been demonstrated.

- Any mandatory CCR requirements should be kept to a minimum, with operators left to make their own judgement of the investments risks relating to CCR (options of taking early action versus a possible stranded asset at a later stage).

- If CCR regulation is to be applied, the scope of the study for capture plant technology should be only sufficient to indicate that it could be deployed at that site. The expectation would be that a further section 36 application, or equivalent for other combustion plant, with more detailed studies would be made in due course when CCS was to be deployed. Any detailed information provided should never become a binding part of any consent, licence or permission since technology advances may mean that engineering details, or indeed the preferred process, might change significantly by the time CCS is to be fitted to the plant.

- For the same reasons, the Environmental Impact Assessment, EIA, for the power plant could only be expected to contain minimal reference to future CCS deployment on site.

- Decisions on whether to include modifications to the design of a power plant in anticipation of a future capture technology retro-fit should be left to the developer. For instance, it would be the developer who would be in a position to judge the implications of, greater CO_2 emissions throughout the pre-retro-fit period due to, for example, an efficiency penalty resulting from a modified design.

Sections3.14-17 of the Consultation deal with studies of the technological requirements to fit capture plant to an existing power station, however the emphasis appears to be on post-combustion and oxy-fuel as being technologies requiring CCR. It is important that all technologies, including pre-combustion plant proposals, are treated equitably with regard to any CCR assessment, although it is likely that pre-combustion plant will implement CCS from the outset.

The CCR feasibility assessment costs will be very case dependent but currently industry believes that those in the consultation are 5-10 times too low. The level of design detail will probably be dependent on site layout, technology and the area of space available amongst others, and since CCS has not been attempted before in the UK, there are few existing ‘blue print’ designs available to use as starting point - other than those from R&D projects, such as DTI Project 407 which included contributions from a number of power companies and manufacturers.

Q5 Do you know of other evidence that provides a more appropriate benchmark (in respect of post capture amine technology or for oxy-fuel) than the IEA document as to what issues need to be considered for the power station design?

No.

We would regard the IEA document as representing the current best knowledge, rather than a benchmark, and would expect that this, and any other similar document, will be revised from time to time to keep in line with developments.

I t should be noted that the IEA GHG document also looks at pre-combustion capture.

Q6 Do you know of other documents for other capture technologies we should be considering as reference documents?

No.

The IEA report provides an independent view on post-combustion capture, oxy-fuel and pre-combustion technologies, although in some regards it is already outdated e.g. some capture processes which are relatively new are not included e.g. chilled ammonia. There are many published studies on CO_2 capture, but very few which are free of the influence of vested interests. There is a large range of other capture technologies under investigation as research funding builds up world wide. However, none of these are advanced enough for application at even pilot scale and certainly not for demonstration.

Q7 Should a developer have to identify a potential storage area or areas when it develops new combustion plant? If so, do you think that identifying a potential area by reference to the DTI study is appropriate or can you identify other studies on storage sites that might be relevant?

CCSA believe that specifying a single storage site in a study would not be possible for most projects since application would be before the detailed negotiations for a site. The study needs to be at the level of indicating areas where there are a range of potential sites reasonably accessible to the project based on the high level public studies available. Use of the DTI study undertaken by BGS would be appropriate at this stage.

Initially, a generic assessment approach should be taken to the assessment of candidate storage locations for judging CCR status. Operators should not be required to identify specific storage locations in advance of detailed site investigation, demonstration of viability and storage consent applications (potentially by other parties).

Information relating to potential storage areas, and transport routes to them, is likely to be commercially sensitive and this must be recognised if project delays and cost escalations are to be avoided.

Q8 Is a feasibility study for each application the appropriate means of addressing the transport component of CCR?

Yes, if CCR is mandated, a high-level study for each application at least to demonstrate the feasibility of CO_2 transportation from the site, and during the early phase of deployment is appropriate.
When scoping the feasibility of CCR, in some cases it may be appropriate to consider a suite of potential pipeline corridors or other similar broad approaches that involve sharing of infrastructure to demonstrate CCR.

It should be noted that this assessment must be done at a high level and cover broad areas or corridors, otherwise speculative land purchase or obstruction by third parties could prejudice the chance of least cost addition of CCS, and commercial confidentiality could not be maintained. Detailed way-leaving of pipeline routes must not be required at the capture ready stage, and would be inconsistent with a feasibility study.

For inland sites, it can be reasonably assumed that approximately the first 10 kilometres will be the critical part of any CO_2 pipeline development. Generally, if a satisfactory “way out” from the power plant can be established there is a high chance that alternative routes are available thereafter to ensure that a route can be found that satisfies the necessary pipeline legislation for the CO_2 can get to the coast for further sea bed

transportation. **It should therefore be this part of any transport proposal that an assessment concentrates on.**

There are however, a number of advantages to coordinating the development of a transportation infrastructure in the longer term providing this does not slow down or impede first mover projects.. A linked pipeline system for CO_2 transport from a number of capture sites could limit costs and the environmental impact of pipeline construction. This may take place as a result of developer initiatives but early developments could usefully be seen in the context of their potential for extension to provide a wider network enabling disposal from several sites. The necessary oversight can only be provided by Government, in consultation with combustion installation and prospective storage site operators. The CCSA is aware that studies of the possible requirements for CO_2 pipeline routes have been carried out at regional level in the Humber and Mersey/Dee areas and that work has been undertaken the North East and in Scotland.

Some CCSA members see a clear need for a co-ordinated strategic plan for CO_2 transmission infrastructure. This should be developed into a national policy statement (NPS) – under the current Planning Bill proposals, either free-standing or as part of the proposed NPS on fossil fuel fired power generation. The promoters of individual combustion plant projects would then be required only to demonstrate the feasibility of connecting their proposed plant to the proposed national network. This feasibility study would have to be undertaken in sufficient detail to enable a route corridor (not a detailed route) to be identified and safeguarded through the land use planning system until required.

Q9 Should this transport assessment address the three issues set out in paragraph 3.25?

Yes. Conceptual corridors for pipelines routes (of sufficient width to maintain commercial and technical flexibility), listing of barriers and potential mitigation methods should make up part of the overall assessment of CCR for it to be a thorough and therefore credible exercise. If a future strategic CO_2 pipeline network is adopted, and CO_2 transport by pipeline is envisaged, then only in relation to the local connection to the national network.

Q10 Are there any other factor(s) you believe should be included in Article 32? If so, why?

Yes. Article 32 needs to ensure that a level playing field for all technologies is maintained in respect of their overall contribution to the UK stated energy policy goals (maintaining security of supply, ensuring affordability and competitiveness of the economy, as well as radically reducing carbon emissions).

Q11 Should the UK support a 300MWe threshold or should we be arguing for a higher or lower threshold? Why?

The limit should be on thermal input rather than electrical output since CO_2 emissions are determined by the former. It should also apply to all large combustion plant, not only those for electricity production, to avoid the same carbon lock-in problems the directive is trying to ensure does not happen in the electricity sector.

A perverse consequence of the threshold could be that developers build plants just below the threshold, which could be less efficient than the optimum sized plant. This though is unlikely due to the economies of scale associated with larger coal plant, and the module sizes for CCGT plant.

The size of the threshold should not be too low, otherwise the cost of the eventual capture and storage becomes prohibitively expensive.

The suggested threshold re-written as a thermal basis equivalent to 300 MWe (i.e. 600 MWth) is thought to be reasonable.

It is important that the threshold is not defined in terms of mass of CO_2 per energy output (e.g. g/kWh) since this could lead to CCS requirements on plants operating on some fuels whilst enabling others to avoid the requirement entirely.

Q12. Should the coverage of CCR extend to all fossil fuel power plants with a capacity of 300MWe or more?

Yes, unless the plant is a 'peaking plant, see Question 22 and Question 23 responses.

If introduced, CCR should apply to all combustion plant above the determined threshold size on a thermal basis and apply to all fuels, not only coal.

Failure to ensure this would result in a preferred combustion technology, and the inability to reduce CO_2 emissions in the long-term (see Question 11 response).

Further to the response to question 11, CCR should cover not only power plants, but all combustion plants above the adopted threshold equivalent.

Q13 What impact might a CCR requirement have on the likelihood of new build, whether for a 300MWe or more standalone CHP or Good Quality CHP plan attached to coal and gas generating stations?

The imposition of a CCR requirement on "Good Quality" CHP could at the least require CHP schemes to allocate land for future carbon capture equipment. For large scale schemes at industrial sites this may not be too onerous as such sites (and/or the CHP hosts) often have sufficient space. However, for smaller CHP schemes this obligation could present a challenge as such installations are often located in commercial business parks where space is more limited.

Q 14 Should the Government explore with the Commission and other Member States the possible disincentive effect on proposed "Good Quality" CHP plants which might otherwise be caught by a CCR requirement? If not, why not?

In the event that a 'light touch' approach to implementing CCR is adopted by BERR then most CHP will not be impacted. In the event that a more onerous approach is taken that would lead CHP schemes to operate below the threshold of "Good Quality", then Government should work with the Commission and other Member States to avoid any possible disincentives.

Q15 What might be the impact of the potential costs of CCR for 100% biomass power plants and so the implications for their future build? Should the Government explore excluding 100% Biomass schemes from the proposed Article 32?

There is an argument that, since biomass plants are considered to be carbon neutral, then by definition, they do not add to the problem of climate change, they should be exempt from CCR. More importantly emissions from biomass are not covered by the ETS and in the absence of any mechanism to recover CCS costs they cannot be included in any legislation.

Having said this it is recognised that CO_2 is released by biomass combustion and if old biomass is used there is in effect an increase in atmospheric CO_2 levels so provided any CCR requirements are 'light touch' there should be no reason to exclude biomass plants that are larger than the size threshold. As there are few biomass plants in the world that are likely to exceed the proposed CCR threshold the question is probably academic.

Government should also clearly define 100% biomass. During start up, shutdown and also times of load support, fossil fuels are commonly used. This use of fossil fuel should not disqualify a plant from classification as "biomass-fired" and the detailed definition criteria should take account of this.

Q16 In EU negotiations do you agree that the UK Government should support the proposals in Article 32 relating to carbon capture ready?

The CCSA believes that ensuring the CCR of a new power plant and other combustion plant is a prudent step for a developer to avoid the risk of a stranded asset in future. However, the CCSA also believes there are good arguments that suggest regulation of CCR could be unhelpful. These have been set out in response to Question 4. The CCSA therefore believes that Article 32 should not be supported.

In the event that some legislation is considered necessary, then the CCSA believes that a 'light touch ' approach to CCR regulation is appropriate, and Article 32 should reflect this.

The CCSA is also concerned that CCR creates an illusion of progress on CCS, when more urgent issues are the funding of demonstration plant and the establishment of long-term mechanisms that enable commercial investment decisions to be made with regard to power plant.

As discussed in Question 11, the threshold in Article 32 should not be set in terms of MWe, but in terms of thermal input (MWth). Exclusions should apply to 'peaking plant' as discussed in Question 12.

Q17 If, following the negotiations, the adopted EU Directive does not contain Article 32, should UK Government take steps domestically to introduce requirements equivalent to Article 32 in England and Wales? Why do you think this would be justified?

CCSA does not think that the UK would be justified in proceeding with domestic steps for mandatory CCR in the absence of requirements in the EU Directive, for the reasons given in our answer to Question 16.

In addition, imposing mandatory CCR in the UK in the absence of a European-wide initiative could significantly disadvantage UK industry.

In the absence of Article 32, power companies might still wish to build CCR into their designs for the reasons mentioned in this response.

Q18 Do you envisage any difficulties with using the consent regime under section 36 Electricity Act 1989 to implement Article 32?

The CCSA considers the existing section 36 regime could be used to implement Article 32 of the directive for new power plant, but that there will be some difficulties relating to the offsite transportation and storage aspects. The HSE and the Environment Agency (as joint Competent Authority for COMAH) would also need to be involved in defining the safeguards required for the technology proposed by the developer. The consenting body will need to draw upon expertise and consult a wider range of third parties than it currently does.

One specific instance is in relation to local planning authorities. Currently the authority for the area in which the plant is located will be a statutory consultee. In future, a CO_2 pipeline route may pass though many local authority areas and the depth of consultation necessary will have to be decided upon. A balance between a high level consultation consistent with the conceptual nature of the transportation feasibility study, and an in depth consultation when detailed information will not be available, must be struck. The legal status of the CCR consent could also be an issue.

It should be noted that section 36 of the Electricity Act applies to .power plant only. Therefore, if CCR is to be generalised to all combustion plant, other regulations will need to be considered.

Q19 Is the Environment Agency (EA) the appropriate agency to advise the consenting body on whether the proposed plant could be built CCR? If not, who might be better placed to do so?

The Environment Agency would be the best placed body to consent combustion plant as it currently does so, and CCR is just another component of the process. However, it is recognised that the EA may not currently have all the expertise necessary to evaluate CCR proposals and therefore it would need to increase its capacity in this area and bring in support from other Agencies as needed..

Q20. Are there any of the proposed factors another body might be better placed to advise on and why?

The CCSA does not think that any other body would be better placed than the Environment Agency, bearing in mind that only high level assessments would be necessary at this stage.

Q21 Should a plant only be consented if the studies and assessments carried out demonstrate that it could be capable of being built CCR?

No. The CCSA can foresee compelling reasons why a plant is required which override a CCR requirement. These are expanded upon in the response to questions 22 and 23.

In any case, the operator should understand the future risks of proceeding with the project and they should carry the risks associated with their project not being CCR.

Q22 Do you agree that the CCR factors might have the consequences described in paragraphs 3.71-2? Would such consequences cause concern and if so why?

Inflexible regulations cause concern to the CCSA. Instances can be foreseen where projects should be consented which cannot demonstrate CCR for the reasons cited in paragraphs 3.71 and 3.72. Specific system security issues are probably the main instances for which CCR might not be appropriate. For instance, rapid start up and shut down capacity aimed at peak lopping, which would only operate on a highly intermittent basis responding to demand surges would be also be potential exception This kind of plant would have a much lower volume of CO_2 emissions over its lifetime than a similar sized base load plant, and so under these circumstances perhaps an annual cap on plant utilisations or CO_2 emissions may be appropriate.

The principle of having an evolutionary approach over a rigid prescriptive set of conditions applies.

Given the immature nature of CCS technology, it is not possible today to formulate an "authoritative list" of all such instances.

Q23 Do you agree that in certain circumstances Government should be permitted to consent to power stations that do not meet all the four factors that underpin the CCR criterion? If yes, what might such circumstances be?

Yes, even if CCR regulation is introduced, the Government should retain the flexibility to consent new power stations that do not meet all the four factors.

It is difficult to be prescriptive today on the circumstances for consenting non CCR plant. The commonly quoted reasons today are

- Peaking plant.
    - o 'Peaking plant' operating for around 500 hours per year require rapid response and rapid load change capability to response to system balancing and frequency control requirements. Capture technology would limit the plants' ability to respond rapidly with load changes.

- Plants in areas where CO_2 cannot be exported, but the grid requires support.
- Plants in areas where the cost of accessing stores is prohibitive.

With time as the market and environmental conditions change, and as the technology matures, the circumstances will change, and the regulations must be capable of changing accordingly.

If the long term emissions reduction method is the ETS and overall emissions caps, then CCR is not required. The market will find the correct balance between peaking plants versus cost of grid reinforcement versus expensive CO_2 transportation versus other yet to be identified requirements. In this case, CCR regulations are not required, just a clear signal that long term carbon pricing and emissions caps are the way forward, along with immediate action on demonstration plants.

If though the Government wishes to proceed with CCR regulations, then it does require flexibility to consent non CCR plants, but the question is, how to decide the criteria to be applied. The CCSA suggests it is not possible to give a prescriptive set of criteria, instead each case should be judged on its merits with the overriding requirement that the carbon emissions will require the purchase of the necessary credits. This permits the Government to retain the flexibility with the commercial "penalty" borne by the developer.

SECTION 4

Question 24: We would welcome views on our proposals for dealing with CO2 storage projects involving EOR.

The CCSA welcomes the proposal in the Consultation Document to extend the option for Operators of enhanced oil recovery (EOR) projects to apply for a CO2 storage permit to cover the CO_2 so stored.

Based on the information provided within the Consultation Document it appears that where EOR/EGR is being carried out also with the intention of permanent storage of the carbon dioxide then the storage arrangements will apply in parallel with those for petroleum licensing i.e. such projects would initially be subject to two concurrent sets of regulatory control. It will therefore be essential to ensure that the provisions of the two regimes mesh harmoniously if Operators are to genuinely be in a position to take advantage of this. Without further details it is not possible to assess how this would work in practice, though we have some concerns about its practicability – in particular with respect to the fiscal treatment of such operations, the differentiation of CO_2 streams for ETS accounting purposes, and the transition to 'pure' storage at the end of EOR operations. It is also not clear from the Consultation Document whether, or at what point, a lease from the Crown Estate might be required. Recognising that any CO_2 storage will likely be incidental to the primary operation of enhanced hydrocarbon recovery we do not see a case for requiring a lease for such projects.

We see several potential dimensions to the differentiation of different CO_2 streams for ETS accounting purposes:

- The first arises in connection with the treatment of any CO_2 that is produced back to surface with the oil or gas. Depending on the project, this may either be exported or re-injected (into the same or a different reservoir).

- The second, and allied to this, it is unclear what would happen in the circumstance that an Operator of an EOR/EGR scheme (originally planned solely for EOR/EGR) decided at a later date to investigate the possibility of using the site for permanent storage of CO_2, but had not secured a storage permit prior to the commencement of EOR/EGR operations. It is unclear if any CO_2 already in the storage site (as a result of EOR/EGR) would be subject to control under the CCS Directive if the

store became licensed. This scenario has implications for any liability issues that may arise throughout the operation of the storage site, as it would be difficult to distinguish any CO_2 'leakage' that was injected as part of EOR/EGR operations from CO_2 that was injected whilst the project was licensed under a storage permit).

- The third and final point is a recognition that an EOR site may comprise several different CO_2 sources, for example emissions from a diesel-drive compressor as well as CO_2 separated from produced hydrocarbons.

All of the above raise the prospect of what amounts to "ETS- CO_2" and "non-ETS- CO_2" on a platform/EOR site. Consequently any legislation needs to provide for a wide variety of potential circumstances, a key factor in which will be accounting appropriately for the volume and location of the CO_2. Any requirement to meter such volumes should balance the needs of accuracy with cost.

Where there is an intent to transition from EOR operations to CO_2 storage only then Operators will need to be assured that they can effect that transition as seamlessly as possible. Here the fiscal rules will again be important, in particular that they provide adequate safeguard of the decommissioning tax relief that oil and gas companies have built up during hydrocarbon extraction operations. In this respect we very much welcome the initiative of the Government – industry 'Change of Use' workgroup, set up by the then Chancellor Gordon Brown in the 2006 Pre-Budget Report to explore potential fiscal barriers to change of use activities.

A key challenge to this otherwise potentially useful option lies in the definition of 'leakage' in the draft CCS Directive. As things currently stand, any CO_2 leaving the boundary of a store would be classified as leakage and would require the Operator to carry out remedial action to prevent it or risk having the storage permit withdrawn – hardly practical where you have the inevitable breakthrough of CO_2 during EOR operations. The recently proposed inclusion of surface facilities in the definition of the storage site may go some way to alleviating this issue, but where (as seems likely) you an Operator needs neighbouring storage to act as a buffer, to modulate the CO_2 flow between source and sink during EOR operations, then this will remain an important hurdle.

Question 25: We would welcome your views on this model licensing and lease structure. Can you see any problems with our conceptual model? If so, how might we address such problems?

[In this answer the term "permit" is used to describe the authorisation for exploration and storage proposed to be granted by BERR or other regulatory authority. The term "property licence" is used to mean a licence in the property sense, an agreement allowing one person to undertake an activity on the property of another, without taking full occupation of that property.]

CCSA supports the proposed licensing model in general, but has reservations about the involvement of the Crown Estate, which differs from the current arrangements for petroleum licensing, with which the CO2 storage licensing regime has to interface and in the case of storage associated with EOR, integrate.

The proposals envisage a dual 'lease' and 'permit' system, with the former issued by the Crown Estate and latter by the 'regulatory authority' (presumed to be BERR except in Scottish territorial waters). The CCSA is uncomfortable with the prospect of responsibility for, and authority over, such an important area being shared between separate organisations with essentially different interests. Splitting responsibilities risks potential confusion and misunderstandings. We would therefore urge careful reconsideration of this proposal. We would particularly favour continuity of the present 'one stop shop' licensing arrangements as they apply to hydrocarbon exploration and production, in which BERR has overall responsibility.

These concerns would be mitigated if the Crown Estate's role were limited to that of "landowner". The Crown Estate should not have any environmental or economic regulatory role; these roles should be the responsibility of BERR exclusively. The seabed lease process should not incorporate the requirements for any consents (development, assignment of interests, third-party commercial arrangements, decommissioning, etc.). Any conditions regulating these should come from BERR via the exploration or storage permit.

It is not clear at what stage a storage lease from the Crown Estate would be required in the case of a project involving CO_2 injection for the purposes of EOR. This ought to be clarified, although in practice EOR Operators are likely to obtain storage permits (and therefore presumably require storage leases) in order to avoid the need for the Operator's CO_2 supplier to surrender allowances in respect of the injected CO_2 under the EU Emissions Trading Scheme.

CCSA questions whether a lease, presumably over a large area, is necessarily the appropriate instrument to use to confer the property rights required by a developer for exploration work. If intrusive subsoil investigations were required on land, one would normally expect to obtain a simple property licence from the landowner to do the investigations, although this of course does not confer exclusivity. If technical and environmental regulation rests with BERR (which in our view it should do), there is no reason why it should be necessary to obtain a full lease from the Crown Estate for exploration work offshore. We would suggest that a property licence from the Crown Estate as "landowner" should be sufficient for most types of exploration work. The terms of such property licences should be highly standardised, with a minimum of negotiation required in each individual case.

CCSA sees no benefit in a consent process for non-intrusive surveys and investigations. It should be sufficient for prospective developers to give notice to the relevant authorities of their intention to undertake such activities in an area defined in the notice.

CCSA is concerned that the Crown Estate Commissioners could see CO_2 storage as another opportunity to extract commercial rents from industry. The costs of offshore CO_2 storage will be very substantial and will ultimately fall on the customers of the industries operating large combustion plant, and electricity consumers in particular. CO_2 storage project economics will be such that there will be little opportunity for extracting rent. It is not in the public interest, especially in the context of continuing upward pressure on energy prices, for the Crown Estate to extract large rents for the use of an asset that has been assigned to the Crown Estate only as a matter of legal theory and administrative convenience.

In any case CCSA would support the development of a standard framework for exploration leases/property licences, and CO_2 storage leases, including the terms on which such leases would be granted and a transparent basis for assessing the associated rents and charges. This is important to facilitate prospective developers' assessment of the commercial feasibility and cost of CO_2 storage projects. The standardisation of lease terms would facilitate the screening of potential CO_2 storage projects for feasibility and simplify the subsequent application for and subsequent negotiation of a lease. Exploration leases/property licences in particular should be capable of being highly standardised. Early clarification on these matters would be particularly welcome for those CCSA members contemplating submissions to the Government's CCS competition.

We are concerned that BERR may be over-rigidly interpreting the terms of the draft Directive with regard to the existence of other extant rights over the seabed and substrata, and the consequent prohibition on the grant of exploration and storage permits for such areas. What the Directive actually would or would not permit, in this regard, needs urgent clarification. What matters is the compatibility of different offshore activities. We would not dispute that the rights of third parties, including those of hydrocarbon, coal and other mineral production licence holders must be protected. The converse must also be true once an exploration and, more particularly, a storage permit is granted and BERR should mange the permitting system to ensure this.

The principle of allocation of permits should follow that for hydrocarbon exploration and production, i.e. there should be competition for exploration permits but subsequent exclusivity (subject to a time limit for implementation, to prevent undue hoarding of proven storage sites) for storage permitting. The absence of a permit requirement during any "dormant" period is logical, but the occurrence of a "dormant" period should not affect the previous exploration permit holder's exclusive rights to a storage permit in the same area (subject again to a reasonable time limit). It should be open to the holder of the exclusive rights to transfer those rights to another prospective storage site Operator.

There may be circumstances other than those outlined in paragraph 4.17, when an exploration permit will not be necessary as a preliminary to a storage permit, if the necessary exploration has already been done and the requisite site data are therefore available. This could arise, for example, in the case of a depleted oil or gas field without EOR. This possibility should be allowed for whether the applicant for the storage permit is the existing petroleum rights holder or a third party transferee.

There needs to be a transparent procedure for allocating exploration permits. An initial process similar to that for oil and gas exploration would appear appropriate, with areas being offered for exploration in response to expressions of interest from industry. Given the need to promote CCS and the lack of a strong economic driver, auctioning is unlikely to be a satisfactory approach if there is competition for an exploration permit over a particular area. Ideally, the applicant most likely to develop a successful project in a reasonable time (and how this is measured would need careful definition) should be the winner of the exploration permit in such cases. Third party rights would guarantee other potential users access in due course to any storage capacity which might result.

CCSA supports the principle of time-limited exploration permits so as to prevent land-banking of potential storage sites by speculators, but the default duration of 2 years within Article 5(3) of the draft Directive is unrealistically short. Clear, transparent criteria

are required as the basis for decision on the extension of exploration permits beyond the time limits originally set. There should be provision to allow exploration permits to be revoked if the permit holder is not actively pursuing exploration of the permit area or decides early in the exploration period not to proceed further.

Storage permits should lapse if the installation of the necessary infrastructure is not proceeded with, within say 5 years from the grant of the permit. We understand that the EU Commission's recently released Explanatory Memorandum mentions this possibility, which would offer a more satisfactory way of reducing permit hoarding or "land banking" than imposing unduly high subsistence charges on permits.

The outcome of exploration of a prospective storage site may affect the area for which a storage permit and lease are required. There should be no requirement for a subsequent storage permit and lease boundary to coincide with that of the exploration permit or property licence/ lease covering the area: the storage permit and lease area may well be less (but not more, unless two or more exploration permit areas are combined) than the area explored.

There may be cases, especially in large geological formations, where there could legitimately be several storage licences active within a single formation and hence a single "storage complex" within the meaning of the Directive. Storage permits should not normally be granted where the permitted activities are likely to adversely affect one another, but if material interactions (such as increases in aquifer pressure) do occur, there are established commercial practices in the oil and gas industry which could be used to address these and any need to apportion liabilities between Operators injecting CO_2 into a common storage complex.

We understand that a fee will be payable by CCS permit applicants and holders, and that the principle of this fee would be (i) to cover the regulatory authority's administrative costs; and (ii) to incentivise licensees not to unduly retain licences without undertaking CCS storage operations (i.e. to avoid the hoarding of acreage licensed for CO_2 storage activities). As noted above, it may be preferable to pursue the latter objective by providing for unimplemented storage permits to lapse after a set period, in preference to charging deterrent subsistence fees. More information is needed on the basis of any fees to be charged for exploration and storage permits, and the proposed balance between initial application, subsistence and surrender fees. The CCSA would particularly encourage Government to publish a transparent mechanism by which potential project developers can establish with a reasonable level of confidence the likely fee that would apply to a permit for their project.

It would be useful to add an additional stage within the "operational period", prior to the injection and post-injection stage, into the permitting model summarised in the table at 4.16. This may be called the "construction" or "pre-injection" stage, when the opportunity to amend the details of the storage operation being permitted will have passed and the storage Operator will be committing substantial capital expenditure, although injection of CO_2 will not have started. The existence of the construction stage should be reflected in the application and subsistence fees payable in respect of storage permits and the rents payable to the Crown Estate for storage leases.

The Consultation Document does not indicate how the proposed exploration and storage permitting arrangements would interface with the marine spatial planning and licensing

provisions of the forthcoming Marine Bill. The Marine Bill should not be allowed to introduce a further regulator or consent requirements into the regulation of CO_2 storage. Some arrangement is required under which CO_2 storage installations (including above-seabed works) do not require a separate consent application to the proposed Marine Management Organisation (MMO) or other authorities in respect of CO_2 storage itself or any of the associated infrastructure. It will however be necessary to take the requirements for CO_2 transport and storage activities into account in the Marine Bill's proposed marine spatial planning process. Both BERR and storage site developers will need to participate actively in this process.

The CCSA also wishes to express its concern at the ongoing uncertainty created by failure of the OSPAR contracting parties to ratify recent amendments intended to enable CCS projects. It is not clear what alternatives exist for the British Government to progress projects in the absence of this ratification, and naturally remain concerned that this could lead to significant delay, especially for any demonstration project. The CCSA members would welcome further briefing from Government on this issue.

Question 26: We would welcome views on how the perimeter of a store should be described in the case of a carbon dioxide store in an unconfined space such as an aquifer.

Subsurface containment of carbon dioxide relies on natural geological trapping, and significant investment will therefore be needed in the characterisation of a potential storage site to ensure that suitable underlying geological conditions/structures are present and to identify potential migration pathways.

In the case of proposed storage in depleted oil or gas reservoirs there will be sufficient reservoir information obtained during hydrocarbon production to enable the structural / stratigraphic trapping mechanism to be fully understood, and therefore the boundaries of the store and any CO_2 contained in it to be mapped to an acceptable degree of accuracy.

In the case of saline aquifers the Consultation Document (para. 4.20) correctly identifies that these "may present little or no physical restriction to the horizontal migration of CO_2 beyond the defined boundaries." However, although CO_2 stored beneath an impervious seal may migrate laterally if it is not completely contained within a structural closure, or trap, the characteristic rate of lateral migration is expected to be slow, because the principal driving force (buoyancy) will be weak in all but the most steeply dipping reservoirs. Near injection wells, buoyancy will be augmented by differential pressure to drive lateral migration of CO_2. Migrating CO_2 must displace native reservoir fluids, which will offer resistance to movement. Over relatively short time scales, CO_2 will dissolve into formation waters. CO_2 -rich waters will be negatively buoyant, halting or reversing lateral migration of the dissolved CO_2. Over longer time scales, dissolved CO_2 may react to form new minerals, permanently immobilising the CO_2. Nevertheless, in such cases it will not be practicable to obtain proof positive that CO_2 has not migrated outside a given volume without disproportionate cost and, possibly, risk. Therefore, the only feasible approach that would yield evidence definitive enough for determining the potential limits of carbon dioxide migration, and thereby the licence boundaries, is numerical modelling studies. These can be designed to resolve the physical and chemical processes for a specific storage site and injection plan, and can be used to predict the ultimate extent of a CO_2 plume. Acknowledging that such models are simplifications of real life systems, incorporating assumptions with respect to boundary conditions, and simplifications with

respect to geological heterogeneity it would be appropriate that the definition of the store boundary / licence area incorporates a margin to account for the modelling uncertainty.

The boundaries of the license area should encompass the whole of the area potentially occupied by the CO_2 phase. Where injected CO_2 is not reasonably expected to be completely contained within a closed geological structure, applications for a storage license and lease should include results of numerical simulations of the ultimate extent of the CO_2 plume. The simulations should account for the range of potential injection plans and uncertainty in the reservoir description so as to identify the maximum likely extent of CO_2 existing as a discrete phase within the storage reservoir. The simulations should account for material changes to the pressure and/or geochemistry of the proposed storage reservoir(s) caused by other operations such as CO_2 injection or injection/production associated with hydrocarbon exploitation.

The prediction of maximum CO_2 plume extent should be re-calibrated from time to time during the injection period with new reservoir observations (e.g. pressure measurements). At the discretion of the competent authorities, the license and lease may be extended into unlicensed areas in order to cover the predicted extent of the CO_2 plume.

The competent authority should consider the implications of a revised prediction indicating that a CO_2 plume may eventually extend into an adjoining storage license/lease. The competent authority should have powers to intervene in cases where evidence demonstrates actual or imminent interaction of the CO_2 plumes that might reasonably be expected to: 1) materially increase the risk of CO_2 leakage into the atmosphere or hydrosphere, or of CO_2 contamination of a valuable subsurface resource; or 2) materially impair the operation of one or the other of the CO_2 injection sites. The purpose of such an intervention should be to minimise potential adverse interaction of the CO_2 plumes by modifying the CO_2 injection operation(s).

Where injected CO_2 migrates outside the boundaries of the license/lease prior to transfer of responsibility to the State, the Operator should retain full responsibility for secure storage of the CO_2 originally injected by the Operator, including liability for material leakage of the CO_2 into the atmosphere or hydrosphere, or material contamination of valuable subsurface resources. At the discretion of the competent authorities, the license and lease should be extended into unlicensed areas in order to cover the observed and predicted ultimate extent of the CO_2 plume.

The CCSA recognises that CO_2 leaking into the atmosphere or hydrosphere or contaminating a subsurface resource may not be unequivocally attributable to a specific injection site where multiple Operators have injected into the same or neighbouring storage reservoirs. Where adverse consequences of CO_2 injection may not be unequivocally attributable, the competent authority should establish a mechanism to spread potential costs among all of the relevant stores, taking account of the extremely low likelihood of leakage or contamination that cannot be attributed to a specific injection site. We believe this approach is preferable to measures intended to identify individual CO_2 sources distant from the point of injection, because the weight of current scientific evidence suggests that: 1) CO_2 sources are unlikely to be identifiable because of the high potential for alteration of chemical and/or isotopic composition during subsurface migration; and 2) tracers added to the CO_2 stream are likely to become extremely

dispersed (and so undetectable) in the course of long-distance migration through very large rock volumes.

The CCSA is uncomfortable with use of the term leakage to describe movement of CO_2 within the subsurface but outside the defined boundaries of the store (cf. Paragraph 4.19 of the Consultation Document). Movements of stored CO_2 within the subsurface should be characterised as migration, with the term leakage reserved for flux of stored CO_2 from the subsurface into the atmosphere or hydrosphere. This usage has been adopted widely in CCS publications. The term leakage might inadvertently imply a need for costly intervention; whereas most instances of migration within the subsurface would not pose an imminent risk of damage to human health and safety or the environment.

Question 27: Is it important to retain the possibility of using the sub-surface space for multiple purposes so long as these do not conflict?

There are many competing commercial and other interests requiring access to both the seabed and sub-seabed of the North Sea. These are an important national resource that need to be managed responsibly and efficiently, with due regard to safety and to the environmental impact of the activities that seek to exploit them. Therefore, whilst we agree that that the future licensing of carbon dioxide stores should not compromise existing rights and assets, we also believe that any licensing regime should not seek to un-necessarily prohibit concurrent activities in the same geographical space unless absolutely necessary. As noted, this could otherwise have the effect of sterilising large parts of the North Sea, including locations likely to be suitable for CO_2 storage sites. Therefore the Association supports the approach proposed in the Consultation Document, to press for changes to the draft CCS Directive in favour of permitting multiple development of the same area, so long as such uses do not conflict with each other.

We agree that the drafting of Article 5(4) of the draft CCS Directive is potentially unhelpful here, as it would appear to limit the location of CO_2 storage sites to places where there are no extant rights. The practical effect of this will depend upon both the final accepted definition of ‘storage complex’, in particular the size of the rock volume surrounding the geological formation in which the CO_2 is stored and intended to provide secondary containment, and on the definition of ‘conflicting use’.

Regarding the storage complex, if the volume of the complex is not unduly large in either lateral or, particularly, vertical extent, then the practical effect of any exclusion may be limited. In other words, it may still be possible to exploit accessible geological formations that over- or underlie the storage complex provided that the defined boundaries of the storage complex are not so large as to prohibit this.

Regarding the definition of ‘conflicting use’, we believe that national regulatory authorities should be granted discretion in the interpretation and application of this very important limitation. For example, there is, apriori, no obvious conflict from the concurrent exploitation of a hydrocarbon reservoir underlying a formation being used for CO_2 storage. Neither is there from adjacent activities exploiting the same geological formation. Therefore, whilst we agree that the regulatory authority should be under a duty not to issue a storage licence where doing so would have a significant detrimental impact on the holders of existing rights without first consulting the owner of those rights (para. 4.27), experience in the hydrocarbon extraction industry clearly demonstrates that where apparent conflict may, or does, arise then the existing legal framework provides a

sufficiently robust basis on which to manage any liabilities that arise. Commercial agreements between the developers of adjacent storage sites can also provide another route to managing potential conflict – borrowing again from the hydrocarbon industry, the concept of 'unitisation' of reservoirs could enable responsibilities to be shared in cases where interaction can be proven.

Question 28: Are the suggested arrangements for dealing with potential interference between carbon dioxide storage and petroleum production adequate? If not, what would you suggest?

The Association agrees that there needs to be clear policies setting out rights and obligations in the event of multiple developments over the same acreage. And whilst we are broadly aligned with the principles set out in this section of the Consultation Document, a number of questions remain to be addressed:

1. Whilst we agree with the principle set out in para 4.26, that the rights to exploit any hydrocarbons discovered during exploration for a storage site should revert to the holder of the petroleum licence, it is not clear how long the holder of the petroleum licence would have to evaluate if the hydrocarbon reserve is economic and/or can technically be developed. The outcome will be important to prospective CO_2 storage site developers, and we think that the existing Fallow process operated by the oil & gas licensing unit in BERR may provide a basis for managing this.

2. With reference to para. 4.28, the Association understands the need for the regulatory authority to apply a public interest test in deciding whether a particular geological formation in unlicensed acreage should be developed as a CO_2 storage site, as a hydrocarbon reservoir, as a natural gas storage site, or for another purpose. However, it would be beneficial to all potential users of the subsurface if further details could be provided of the criteria by which this test will be applied.

Recognising that the UK's continental shelf is a mature hydrocarbon province we suggest that the potential availability of CO_2 storage space (in particular in saline formations) far outweighs any remaining pockets of economically recoverable oil and gas reserves or of suitable offshore natural gas storage sites and that, accordingly, priority should be given in these cases to safeguarding security of energy supply interests.

3. We understand that in instances like this it may be necessary for the regulator to engage other agencies and Government Departments in reaching a decision, but recognising that prospective developers may have to suspend exploration operations or postpone development investment decisions then it would be helpful if this process could be time-limited.

Question 29: If the Directive remains focussed on environmental protection, should the UK implementation arrangements be wide enough also to control economic considerations?

It is important that any future CCS legislation, and the associated regulations and permitting regimes based on it, fully encompass all aspects necessary to promote the development of CO_2 storage sites whilst safeguarding the environment and protecting the rights and assets of existing licensees. Therefore, in keeping with our answers above, to Q27 and Q28, we believe that UK implementation arrangements for the draft

CCS Directive should be comprehensive enough to take economic considerations into account.

As noted in our response to Q27, we would prefer to see arrangements here that rather than automatically ruling out all possible 'conflicting use' instead provide for more effective co-existence of multiple activities. We note potential learnings from the hydrocarbon industry; in particular that the existing legal framework probably provides a sufficient basis for managing many of the liability issues that may arise from concurrent operations.

Question 30: We would welcome your views on the criteria that should apply to the termination of a licence and our preferred approach, also set out in Article 18(1) of the proposed Directive.

It is important to the viability and long-term uptake of CCS technology that an appropriate framework is defined within which long-term stewardship and associated obligations pass from the site Operator to the State at a defined point following the cessation of injection operations. The CCSA therefore welcomes the proposal in this consultation that responsibility for a store should be transferred at the termination of the CO_2 storage licence, and the Association fully endorses the concept that there should be no further obligations on an Operator after this transfer.

The CCSA understands the Government's need for conditions governing CCS operations, and specifically the handover criteria, to be based on the 'polluter pays' principle. However, we also believe that the framework for site handover must balance this important principle against the legitimate need for regulatory certainty if capture and storage projects are to be brought forward with the required urgency. In particular (i) the transfer obligations on both the storage site Operator and the regulatory authority should be clear and unambiguous. We would prefer that these be pre-agreed between the regulator and Operator and explicitly defined in the storage permit; and (ii) The period between the end of injection operations and handover to the State should be as short as possible, as this likely represents a period of time during which a store Operator will be receiving no revenue stream but will have to bear the full operating costs of maintaining the store and associated facilities and intervention capability.

Fundamental to defining workable criteria for the transfer of responsibility is recognition that the risk of surface leakage in the post-operational period is exceedingly low. Further, with the dissipation of pressure and action of other processes in the subsurface, this risk declines still further with the passage of time during the post-handover period.

Storage sites will be licensed on the basis of rigorous site characterisation and risk assessment procedures. Over a lengthy period (typically 20 years or more) of injection operations and monitoring, initial uncertainties in rock and fluid characterisations will be reduced significantly. Lesser uncertainty translates into greater confidence in future storage performance. Leakage, if any, is most likely to occur prior to transfer of responsibility, by which time forces acting on the CO_2 (buoyancy and pressure differentials) will have begun to dissipate at or before cessation of injection, with the result that (i) At the time of transfer, potential problems are most likely to have been identified and resolved, either by physical remediation or arrangements to account for emissions; and (ii) Leakage risk should decline with the passage of time during the post-

handover period. The CCSA is concerned that misunderstanding here and subsequent over-emphasis of the hazard and risk may lead to threshold criteria for handover that are simply unworkable, with the effect that potential developers are deterred from ever undertaking CCS projects. We note, for example, in para. 4.57 of the Consultation Document comparisons are made to nuclear decommissioning. We believe these inappropriately conjure an image of grave danger and great environmental risk. Unlike nuclear fuels and waste, CO_2 is abundant and widely dispersed in the natural environment. It is used extensively in industrial applications, including very large quantities injected daily for Enhanced Oil Recovery (EOR). The primary justification for extensive new handover regulation is to support emissions control systems, rather than to manage a high-risk threat to health and safety.

Time Based versus Criteria Based Handover

CCSA endorses the proposal that transfer of responsibility should depend on satisfaction of specific technical criteria, rather than expiry of a pre-determined time interval. This approach maximises assurance of long-term storage performance while minimising the time elapsed from cessation of injection to termination of the license. The principal argument for transfer after a fixed period is to avoid open-ended obligations for Operators in the period after storage revenue has ceased (and the attendant costs of providing financial security during this period). However, we believe that the certainty about license termination desired by Operators can better be provided by clear, unambiguous criteria and tolerance limits agreed in the original storage licence.

Transfer Criteria

CCSA supports the notion that criteria should provide evidence of acceptable future storage performance or “long term security of storage” as a pre-requisite for transfer of responsibility. However, we are uncomfortable with the proposed definition of “long term security of storage” to mean that CO_2 is “permanently contained within the storage complex for the indefinite future”. There can be no proof that such containment is “permanent” in the sense that the word is normally understood.

Transfer criteria should directly address the potential adverse consequences of CO_2 migration: surface leakage and/or contamination of subsurface resources. Stored CO_2 should be assumed to lie entirely within the limits of the licensed storage complex, unless there is convincing evidence to the contrary. Proof-positive of containment within the storage complex could not be meaningfully demonstrated and would potentially involve substantial cost. (It may well be more technically feasible to demonstrate absence of CO_2 outside the storage complex than to reliably locate all of the CO_2 within it.)

Site-specific transfer criteria should be incorporated in the terms of each storage license, taking account of the characteristics and storage risks peculiar to the store as well as the best appropriate technologies to determine the risks of surface leakage and subsurface contamination. Transfer criteria tailored to each site should broadly require demonstration that, within agreed tolerance limits:

- After cessation of injection, there is no significant leakage from the store, where significant leakage means any unwanted release of stored CO_2 to the atmosphere or to the hydrosphere that exceeds a level pre-defined in the site Environmental Impact Assessment as having the potential to cause measurable, significant harm to human health or to the environment.

- There is no obvious contamination of other identified resources (potable water, hydrocarbons, coal, etc) from the stored CO_2, where this has not already been agreed with the regulatory authorities and the resource owners, where obvious contamination means that measured levels of CO_2 in the resource concerned are unequivocally above background levels, and the elevated levels of CO_2 are attributable to the CO_2 store.

- Available evidence indicates that the stored CO_2 will remain within the licensed boundaries of the storage complex.

- As far as can be reasonably anticipated, the condition of the storage site and associated facilities, and the anticipated future behaviour of the stored CO_2, poses no risk of measurable, significant harm to human health/safety or to the environment.

- An approved plan for decommissioning the facilities intended for CO_2 storage has been carried out and certified as complete by the competent authority.

- Where necessary, the licensee(s) have provided adequate provision for future liabilities incidental to the CO_2 storage operation, such as those associated with decommissioning of facilities.

Leakage Remediation

In the case of a leakage event (however improbable) during the operational or post-closure period the appropriate course of action for addressing this should be informed by a dialogue between the Operator and the regulator. Certain options may not be feasible, whilst others may give rise to greater impact than the consequences of the leaking CO_2. We therefore believe that regulatory requirements for leakage remediation should provide for consideration of a wide range of arrangements to account for emissions, and specifically including the possibility of surrendering emissions allowances, on the basis of a cost-benefit analysis.

Post Transfer Monitoring (para 4.39)

The Association believes that obligations to continue monitoring after decommissioning and license termination are impractical and inconsistent with the principle of transfer of responsibility. After licence termination, the store will have been subject to rigorous risk assessments and to the monitoring and modelling of the dynamic behaviour of the stored CO_2 for a lengthy period (typically more than 20 years). While it cannot, in principle, be proven that there is no probability of leakage, there will be abundant evidence, rigorously assessed by the regulator, to that effect. In our view, to contemplate further monitoring would be a waste of valuable resources that would be better devoted to active abatement of atmospheric CO_2.

Question 31: We would welcome views on the proposed financial security arrangements we should introduce. For example:

(a) Should we require independent financial security in all circumstances? If not, when should we do so?

(b) Should we specify the type of financial guarantee arrangements, or should we provide for flexibility to suit the circumstances, possibly only specifying those guarantees that would not be acceptable?

Overview
It is important to clearly distinguish between (a) the actual obligation to decommission the infrastructure used to transport CO_2 and inject CO_2 into storage sites, (b) the contingent liabilities that arise from leakage of stored CO_2 during the period of revenue generation; and (c) the contingent liabilities that arise from leakage of stored CO_2 after the period of revenue generation.

The CCSA submits that this is an important distinction from the point of view of putting forward financial security to cover the costs and risks associated with CO_2 storage.

The provision of financial security (in the form of financial guarantees or other credit support) for actual liabilities is something that the CCSA accepts as being necessary for the efficient operation of an industry as it involves the passing of credit risk. However, the provision of financial security to cover contingent liabilities is not an appropriate use of resources. For contingent liabilities occurring during the period of revenue generation, other methods of covering the potential exposure, such as insurance policies, should be considered. The contingent liabilities in respect of leakage of stored CO_2 after the period of revenue generation may arise at a point in time long after the storage site is closed. Neither financial guarantees nor insurance would be appropriate in respect of contingent liabilities arising after the period of revenue generation. During this period, the diminishingly small liability for leakage ought to fall to Government, offset if necessary by a risk-based charge levied on individual CO_2 storage facility Operators during the relevant revenue generation period based on the quantity of CO_2 injected.

Decommissioning of infrastructure
The CCSA would support a decommissioning regime for CO_2 storage that is based on the existing regime employed in relation to offshore petroleum operations in the North Sea. This regime involves similar (and in some cases the same) transport and storage infrastructure as that required fro CO_2 storage and only imposes a requirement for security to be posted where the circumstances require it. Fundamentally, the North Sea decommissioning regime places the costs and risks of infrastructure decommissioning with the owners and Operators of that infrastructure. In other words, risk and responsibility for decommissioning sits with those best able to control the costs and risks involved.

As is noted at paragraph 4.56 of the Consultation, the requirement to provide financial security can impose a significant cost on Operators of projects and can have a significant impact on the ability to fund projects. The CCSA agrees with this statement. A requirement to provide financial security can place an onerous obligation on the balance sheet of companies, and can tie up significant capital. This carries the risk that the economic viability of CCS projects is put beyond the reach of many medium and smaller market players.

A requirement to provide financial security should not be compulsory in all circumstances and the requirement should not arise before the issue of the permit (or, arguably, before construction of the relevant infrastructure has commenced). Such a requirement should

be imposed at the discretion of a regulator where it is necessary in all the circumstances, taking into account the credit strength of the relevant company. The CCSA submits that the only circumstances justifying the provision of security would be where the regulator has legitimate concerns about the financial strength of the Operator (i.e., where the credit rating of the Operator or its guarantor are below a certain level) in the context of the projected costs of decommissioning. The current test used in the Petroleum Act 1998 may be a useful guide in this regard, that is, only "if the Secretary of State is not satisfied that a person will be capable of discharging its duty to carry out the decommissioning programme".

A key benefit of the existing petroleum regime is the significant amount of discretion on the part of the regulator to impose requirements for abandonment plans and financial security in support of these abandonment plans. This discretion allows the regulator to seek financial security from Operators where it is necessary to do so, but does not impose a responsibility on all Operators to post expensive letters of credit or other credit support in all circumstances. The CCSA submits that a similar level of discretion should apply to regulation of the decommissioning of CO_2 storage facilities.

As with the North Sea oil and gas regime, the level of any financial security to be provided in relation to a particular CO_2 storage facility could be reviewed on an annual basis, reflecting the best estimate of the Operator's share of the costs of decommissioning the relevant CO_2 storage facility.

As is pointed out in paragraph 4.54 of the Consultation, the Directive indicates that Member States should ensure that adequate provision is made for financial security "prior to the submission of the application for a storage permit". In the case of decommissioning obligations, this should require an applicant to submit details of the financial wherewithal of the Operator to fund the anticipated decommissioning obligations that may arise. An assessment can them be made as to whether decommissioning security will be required. However, this security should not need to be posted until such time as the permit is actually granted or the credit position of the Operator requires it. In other words, the timing of any obligation to post financial security for decommissioning obligations should reflect the time at which the need for the financial security arises. This need arises no earlier than the time when facilities are constructed or, for initially financially sound Operators, the time when the credit position of such Operator deteriorates to a level where credit support is required. If the financial security were to be provided earlier, this would 'tie-up' significant capital at a time when expenditure will be required to obtain a lease, storage permit and undertake the necessary investigations and assessments to support the licence application.

Where security is to be posted, the type of security is important. Letters of Credit or on-demand performance bonds typically impose significant additional project costs. Given the marginal nature of CCS investments, the CCSA strongly encourages the acceptance of parent company guarantees (subject to the parent company being of an acceptable financial standing) to cover decommissioning obligations. The marginal nature of CCS investments also means that security (in any form) should not be required unless absolutely necessary.

As a final point, the CCSA would also point out that if a decommissioning regime that is different to the current North Sea regime was to be employed, there may be unnecessary complication in trying to reconcile different decommissioning regimes applying to

infrastructure which, in some cases, will be common to the oil and gas industry and the CO_2 storage industry.

Liability for contingent liabilities associated with leakage into the atmosphere and marine environment during the period of revenue generation

As pointed out at paragraphs 4.44 and 4.51 of the Consultation, current estimates suggest that the probability of CO_2 leakage occurring from a CO_2 storage site is very low. In addition, as noted at paragraphs 4.49 and 4.52 of the Consultation, the potential liabilities associated with any given leakage are very difficult to estimate in advance. The liabilities that arise from leakage of stored CO_2 include damage to the environment, risks to human health, damage to underground natural resources (e.g. reserves of hydrocarbons or aquifers) or disruption to their exploitation, and financial liabilities arising from requirements to purchase EU ETS allowances (or their equivalent under future emissions trading regimes).

Given the contingent nature of liabilities for leakage, and their low risk of occurring at any given storage site, the CCSA believes that industry will be willing to bear the risk of leakage occurring during the period of revenue generation. The CCSA also submits that the method by which this risk is shared amongst industry participants should be determined by the industry. Where a company is willing to take this risk of contingent liabilities itself, and has the financial capacity to do so, "self-insurance" could be considered. Alternatively, insurance may be taken out on an individual basis, with each Operator being responsible for putting in place adequate cover, or even on a wider, industry wide "pooled" basis. The CCSA considers that it is likely that insurance products may come on the market to provide cover for the risks associated with contingent liabilities. The price of any such insurance would be set by the insurance market and would naturally rise or fall as the understanding of the perceived risk profile develops over time. The costs of insurance are likely to be significant (especially for the first CCS projects) until the insurance industry gains experience.

If an insurance market for CO_2 storage does not develop (or until such market develops), another possible approach would be for industry to develop a common industry fund. Operators would be asked to submit money to the fund based on the results of a limited number of pre-determined risk scenarios associated with their storage complex and volume of CO_2 injected.

An advantage of a "pooled" approach (in whatever form it takes) is that each participant in the CO_2 storage industry would be covering a portion of the risk associated with CO_2 leakage across the industry as a whole, rather than all companies being required to cover the full quantum of potential costs associated with a specific leak from their own facility. This approach should ensure that Operators of CO_2 facilities are not burdened with unnecessary, inefficient and onerous financial obligations in respect of providing credit support to contingent liabilities which have a very low-probability of occurring.

The Operator's obligation to pay an insurance premium each year should cease upon the Operator ceasing to generate revenue for its engagement in CO_2 storage.

Liability for leakage into the atmosphere and marine environment after the period of revenue generation

The CCSA agrees with the position adopted by the European Commission in its draft directive that risks associated with CO_2 storage should pass to Member States upon certain criteria being met at the end of the revenue generation period of a storage site. The CCSA further submits that CCS Operators should not have financial or other liabilities imposed on them after the period of revenue generation (whether contingent or otherwise and including liabilities for any EU ETS or similar liability). There would be significant practical difficulties in requiring a company to be liable for any costs associated with CO_2 leakage whenever it may occur in the future. In addition, the very long-term deposit of financial security that would be required would involve prohibitive costs.

Given these difficulties, a possible solution would be for the Government to assess the potential liabilities associated with leakage occurring after the revenue generation period and imposing a levy on CCS Operators (to be charged during the revenue generation period) based on the quantity of CO_2 injected. Such an approach would be analogous to the regime contemplated in respect of nuclear waste, where the Government takes responsibility for the disposal of nuclear waste and assumes all contingent liabilities associated with this. In return, and to cover the actual and potential liabilities which the Government may incur, the Government imposes a risk-based premium which it charges to the nuclear plant Operator on each unit of nuclear waste produced. The levy is imposed during the period of revenue generation for the nuclear plant Operator and there is no recourse to such Operator after that period.

An industry board could be convened to advise Government on the appropriate level of financial provisioning for these post-handover contingent liabilities.

The CCSA submits that there should be two criteria for the amount of this price per unit of CO_2 injected. The first is certainty – Operators only have a fixed period of revenue generation and they need to be able to model their costs and revenues in order to be able to price the service of CO_2 storage. Secondly, should reflect the perceived risk of leakage (and the associated liabilities and costs attached to such leakage) on an object basis following handover.

The CCSA submits that the imposition of a levy on Operators of CO_2 storage infrastructure during the revenue generation period would be the only liability the Operator would need to bear in respect of any contingent liabilities arising after the revenue generation period. In effect, the payment of this levy would mean that the CO_2 storage Operator would have paid up-front for all future liabilities and would therefore be taking financial responsibility for these post-handover contingent liabilities. For this method of risk-sharing to work effectively, the Government would need to indemnify CO_2 Operators for all leakage liabilities arising post-handover. It is important to remember that the Government will have been paid to take these risks at a price based on the estimated cost of these risks.

Recognising that the risks of leakage during the post-handover period are likely to be very small, so any fund required to cover any attendant liabilities would also be very small. We believe that the administrative costs of such a mechanism may be greater than the risk coverage; therefore, we would advocate that the government cover this risk, and fund any expenses from general revenue or lease & licence fees.

Question 32: Of the two types of arrangements we have identified, what do you see as the advantages and disadvantages of each approach for carbon dioxide storage? Are there other arrangements you believe may be more effective?

As set out in response to Q31 above, the CCSA would support a decommissioning regime for CO_2 storage which is based on the existing regime employed in relation to offshore petroleum operations in the North Sea. This regime involves similar (and in some cases the same) transport and storage infrastructure as that required from CO_2 storage and only imposes a requirement for security to be posted where the circumstances require it. Fundamentally, the North Sea decommissioning regime places the costs and risks of infrastructure decommissioning with the owners and Operators of that infrastructure. In other words, risk and responsibility for decommissioning sits with those best able to control the costs and risks involved.

The Consultation, at paragraph 4.57, suggests that the approach to decommissioning nuclear facilities may be worth considering in the context of CCS.

The CCSA submits that the decommissioning regime in place for oil and gas is much more appropriate as an analogy to CCS than that in place for the decommissioning of nuclear facilities. This is because the nature of the facilities involved in a nuclear power station are vastly different to those involved in respect of CCS storage infrastructure and decommissioning nuclear facilities requires dealing with the issue of radioactivity. Accordingly, the costs of decommissioning CCS infrastructure are much lower than the costs of decommissioning nuclear facilities and the complexity and risk to human life and the environment are incomparable. Put simply, the decommissioning of CCS infrastructure does not warrant a complex, funded regime.

The North Sea has a well understood and successful decommissioning regime for infrastructure which is identical to CCS infrastructure and has successfully dealt with decommissioning issues arising in an industry with many participants from all over the world. There is likely to be commonality between the owners and Operators of upstream oil and gas infrastructure in the North Sea and the owners and Operators of CO_2 storage infrastructure. Given that these participants are already familiar with and comfortable with this regime, proposing a fundamentally different regime seems unnecessary and may result in delays in the implementation of CCS projects in the UK.

Question 33: To what extent should the financial guarantee arrangements include a provision for contingent liabilities? How should we estimate an appropriate level of financial provisioning for these liabilities?

As set out in relation to our response to Q31 above, the CCSA submits that financial guarantee arrangements should be put in place only in respect of the liability for decommissioning of infrastructure and only where the creditworthiness of the Operator is low enough to require it. Liabilities for decommissioning can be readily estimated. The CCSA submits that financial guarantee arrangements should not be used to provide for contingent liabilities. Instead, insurance (or a similar product) can be used to cover contingent liabilities during the period of revenue generation and a Government levy can be used to off-set the Government's potential liability in assuming responsibility for the period arising afterwards.

Question 34: Should any provisions for contingent liabilities pass to government on termination of a licence to compensate for the residual risk that will transfer?

The CCSA submits that the financial security arrangements outlined above should not require the passing of provisions to the Government in respect of decommissioning. The insurance policies put in place by the CCS Operators will address the contingent liabilities for CO_2 release occurring during the revenue generation period. After the revenue generation period, where the primary liability rest with the Government, provision will already have been made in the form of levy payments made by the CCS Operators during the revenue generation period. The level of these levy payments should be determined by Government based on its assessment of the contingent liability of CO_2 leakage after the revenue generation period of a CO_2 facility.

In other words, the Operators of CO_2 storage facilities should bear the responsibility for all risks associated with CO_2 storage facilities across the life of such facility, but this responsibility would be fully discharged at the end of the revenue period of a CO_2 storage facility. From this point, it is up to Government to deal with any liabilities that may arise as a result of leakage but the Government will have received provision from the CCS industry to deal with such liabilities.

Question 35: We would welcome your views on the measures covered by Annex 2, particularly if you think that anything is missing or unnecessary.

<u>General comment:</u>
This question relates only to the "CO_2 Storage License" (CSL) and does not mention the (necessarily precursory) "CO_2 Exploration License" (CEL). BERR should define terms for a CEL. We recommend that CEL terms be based on petroleum licensing, last for 5 years and confer exclusive development rights (subject to the fulfilment of the CEL conditions) on the holder.

From Annex 2: A licence will place an obligation to retain carbon dioxide within defined geological boundaries.

1. This is a sensible requirement and the definitions of the geological boundaries of the store and the storage complex (as discussed in our response to question 26) are important. Geological models can provide an appropriate methodology for estimating the spatial dispersion of the injected CO_2 over time.

2. The licensed volume should include the maximum expected extent of the CO_2 plume (taking due account of technical uncertainty), but a developer should also have to evaluate the area of impact (which could include elevated fluid pressure). Such a concept is used by the US EPA – a potential developer is required to evaluate an "Area of Review".

3. Identifying the precise spatial location of 100% of the CO_2 is less important than ensuring that the CO_2 remains securely stored.

From Annex 2: A licence will place the Operator under a general obligation to protect the marine environment from pollution.

We agree that this is a sensible requirement.

From Annex 2: A licence will be subject to obtaining a lease from The Crown Estate.

In keeping with our answer to Q25, the Association is concerned that the requirement to obtain a lease from the Crown Estate could introduce unnecessary cost and delay. Instead, a 'one stop shop' for license and lease would be preferred, whereby developers interact with only one government agency (which would act on behalf of the licensing and leasing authority).
Should the Crown Estate be involved then the Association would prefer that:

1. The role of The Crown Estate should be limited to that of landlord; it should not be involved in risk assessment or risk management.

2. To reduce the regulatory burden of needing to satisfy two consenting authorities the Crown Estate should be obliged to issue a lease if a license is awarded;

3. To enable prospective developers to assess early project feasibility, the Crown Estate should publish a pricing formula whereby the costs of a CO_2 storage lease can be determined in advance.

From Annex 2: A licence will apply during both the injection and post-injection period, although some of its conditions may vary in those periods.

The CO_2 Storage License should apply during the Operation and Closure periods. The developer's activities during these periods will be quite different. During the Operation period, the risk of leakage will be highest, but the developer will (presumably) have a source of revenue. During the Closure period, the risk of leakage will reduce, but the developer will (presumably) have no source of revenue and the opportunities for monitoring and intervention will diminish.

The permit should include clear, concise, relevant, enforceable conditions. The permit should be laid out so that it clearly states what conditions the applicant has to satisfy during CO_2 injection and post injection. The licence should also detail the requirements for transfer of the storage site to the State. Provision should be included within any licensing system which permits the licence holder to apply to the competent authority to vary the permit.

From Annex 2: A licence will place an obligation on the licensee to undertake the licensed activities in a way that does not interfere with other uses of the sea or seabed. Such obligations are commonly found in other offshore licensing arrangements. They might include for example, a duty to consult and maintain effective communication with fishing interests, to refrain from activities that unjustifiably interfere with navigation or fishing interests, to deal promptly with compensation claims, to give MoD 6 months' notice of installation movements and 6 weeks' notice of a seismic survey, to maintain and install underwater beacons to MoD specifications

1. We agree that the concept is sensible.

2. In addition to not interfering with existing uses of the surface and sea-bed, a CGS license-holder should also not interfere with existing uses of the deep sub-surface (such as the operations of petroleum licensees).

3. We would welcome clarification on whether there are any issues regarding restricted access to Marine Conservation Areas under the Marine Bill that may influence the planning process for a CGS project.

From Annex 2: A licence will provide for the regulatory authority to withdraw, suspend or vary a licence (for example if actual performance of the store differs significantly from modelling predictions).

This is sensible provided that the licence stipulates in detail the circumstances under which this might occur, in order to give regulatory certainty to prospective store Operators. Of particular importance here will be regulators competence (especially in subsurface matters e.g. geology, reservoir engineering, etc) and the requirement to establish tolerance limits around modelling predictions that can never be precise.

The regulatory authority should only consider withdrawing, or suspending, the licence if operation of the store is likely to result in significant environmental damage, unacceptable risks to human health, or impact the recovery of licensed hydrocarbon reserves/mineral reserves, etc. The Operator should have a right of appeal against any variation to the permit. It should be noted that the suspension of a storage permit would have knock on impacts on the upstream power plant.

From Annex 2: A licence will provide the regulatory authority with 'step in' rights. These will enable the regulator to undertake duties under the licence or remediate environmental pollution, where the licensee fails to do so and recover the cost from the licensee.

This is sensible. We would welcome clarity on the circumstances under which step-in rights might be exercised. The licensee should be provided with a reasonable opportunity to remedy a situation prior to the exercise of step-in rights. It is assumed that Guidance Notes or Model Clauses accompanying the legislation will specify in greater detail the circumstances under which licence withdrawal / suspension could occur.

From Annex 2: A licence will specify certain key operating parameters of the store. For example the maximum permitted carbon dioxide injection rates and pressures and the maximum permitted storage capacity.

We agree that this is a sensible requirement. Ideally, the consent should not be too prescriptive and allow operational flexibility. It would be helpful if the competent authority could provide a list of key operating limits it proposes to include within a storage permit for comment. Ideally any operating limits defined within the storage permit should be presented as a maximum rate not to be exceeded.

From Annex 2: A licence will specify the characteristics of the carbon dioxide stream. This will include for example the maximum permitted concentrations of incidental associated substances. Records regarding the carbon dioxide stream will also have to be kept.

We agree that this is a sensible requirement. The licence should avoid requiring an arbitrary and overly prescriptive definition of the CO_2 stream. For example, there is little point in specifying the proportion of the CO_2 stream that can be CO_2, if there is no specification of the impurities (the effect of 1% nitrogen on a storage site is quite different from the effect of 1% H2S). An overly-prescriptive approach would risk arbitrary discrimination against some capture technologies and/or compromising commercial decisions. A better approach would be a case-by-case risk assessment, whereby limits are imposed on certain elements on the basis of a specific site characterisation and accompanying risk assessment.

From Annex 2: A licence will contain conditions about the drilling and plugging of boreholes. Typically these will replicate conditions that already apply through the petroleum licensing arrangements and will include, for example, prohibiting the drilling and plugging of boreholes without agreement, obligation to keep geological information and samples and to provide access to that information by the regulator and NERC and an obligation to notify the regulator in the event that any petroleum, water, mines or workable seams of coal are encountered.

We agree that this is a sensible requirement.

From Annex 2: A licence will require an agreed monitoring plan to be implemented and the results reported to the regulatory authority. The purpose of the monitoring will be to compare that actual behaviour of the store with the modelled behaviour, to detect any leakage of carbon dioxide beyond the limits of the store, and detect any significant adverse effects on the surrounding environment.

1. The key to assuring storage security is appropriate site-selection and management. To use the analogy of motoring, site selection is ensuring that the type of car is fit for the purpose, management is driving the car safely on the road and monitoring is occasionally looking at the instruments on the dashboard to ensure that nothing is going wrong. All three are required to ensure the safe operation of the car.

2. The UN IPCC Special Report on CCS states that “the proportion of CO_2 retained by appropriately selected and managed sites is likely to exceed 99% over 1,000 years”. Hence, the focus of any CGS licensing framework should be on the appropriate selection and management of CO_2 storage sites. The default position for such sites is “no leakage” – appropriately selected and managed sites should be assumed to not leak unless shown otherwise. This concept should drive the implementation of any monitoring programme.

3. A site monitoring programme should be site-specific and risk-based, focusing on monitoring threats to storage security (such local pressures at the injection point, leakage at the wellhead, or signs of corrosion).

4. Every monitoring programme should require the acquisition of appropriate baseline data before CO_2 injection commences.

5. One of the main purposes of a monitoring programme is to facilitate the transfer of site stewardship from the developer to the nation at the end of the Closure period (at license relinquishment).

6. Every monitoring programme needs to retain flexibility to adjust to address changes to the assessed risk of leakage and the development of improved monitoring technology. However, there is no point in monitoring geologically stored CO_2 to a higher standard than anthropogenic emissions (which are usually calculated, rather than metered).

7. Care needs to be taken in how the 'limits of the store' are defined. The Directive defines leakage as 'any release of CO_2 from the storage complex' and the UK Energy Bill defines a 'carbon storage facility' as:

> '"carbon storage facility" means a controlled place, or part of a controlled place, in which carbon dioxide has been stored pursuant to a licence';

This definition could, arguably, be regarded as equivalent to the definition of the 'storage complex' in the Directive. It is proposed that the definition of 'the store' in the above provision be defined or may be modified to 'storage complex' to make it consistent with the Directive. A store should not be reported as leaking so long as the CO_2 is retained within the storage complex.

8. The costs and benefits of any monitoring programme should be justified on a site-specific basis and any changes in the agreed programme should be shown to be more cost-effective (rather than simply requiring the highest technically possible level of definition). There is no point in monitoring geologically stored CO_2 to a higher standard than anthropogenic emissions.

From Annex 2: A licence will require an agreed modelling programme to be carried out and the results made available to the regulatory authority. The aim of the model is to simulate the behaviour of the store, and the model will be refined according to the results of the monitoring arrangements. A licence will also place an obligation on the Operators to refine the model to incorporate improvements in predictive modelling.

It may be that a suite of models is required here, not just a single model; for example, to simulate the dispersion and migration of CO_2 over long- and short-timescales might require use of different models. The requirements of a model need to be articulated in advance and should not exceed the expectations of the technical community.

Guidance issued by the competent authority should specify what issues need to be addressed with respect to reference to numerical modelling; however, the Operator should be allowed some discretion as to how the modelling work is undertaken. Furthermore, the obligation on the Operators to refine the model to incorporate improvements in predictive modelling needs to better articulated, as the requirement is otherwise speculative and open-ended to interpretation.

From Annex 2: A licence will require specified records to be kept in specified formats and in specified locations and for these to be available to the regulator on request.

This is reasonable. It should be clear how long records need to be kept for.

Some of the notification obligations need to be further clarified in guidance, since they are currently vague and open to interpretation, e.g. the requirement to report an event which may cause pollution. This is ambiguous and provides uncertainty for Operators.

From Annex 2: A licence will set out notification obligations. These will include: a breach of a condition of the licence; an event causing, or which may cause, significant or continuous loss of carbon dioxide; an event causing, or which may cause, pollution; where significant environmental detriment from the activity becomes apparent and any substantial change in operation that requires variation to the licence
Care needs to be taken in how 'significant or continuous loss of carbon dioxide' is defined. Loss from where and to where? The definition of loss should preferably refer to leakage from the storage complex. How would 'significant' be defined?

From Annex 2: The licensee will be under an obligation to make financial provision for meeting duties under the licence and also the decommissioning obligations agreed as part of the decommissioning plan. This is intended to protect the public purse in the event of a failure by the licensee during the licensing period. The amount of the provision will take account of the cost of closing the store and decommissioning the associated facilities, and a risk adjusted amount for allowances that may need to purchased and surrendered under the EU-ETS in the case of a leak. The nature of the provision will be set out in the licence.

See comments on liability in Questions 31 to 35 above.

From Annex 2: A licence will specify the conditions that have to be met for the licence to be terminated. It will also place an obligation on the licensee to maintain a closure plan that demonstrates how and when the facilities will be decommissioned and the store secured.

We support this approach. The CCSA Handover Criteria document provides an evaluation of requirements. The criteria should be agreed upon license award, be simple, clear, objective and verifiable. Provided that the conditions of the licence have been met, and any reasonable request by the regulator in the context of evolving knowledge of the site has been responded to by the Operator, the site can be handed over to the State.

Any variation to the surrender criteria should not result in more onerous conditions being imposed unless it is decided that this is necessary to prevent significant harm to the environment, human health or interference with other uses of the sub-surface space.

From Annex 2: A licence will place an obligation on the licensee to undertake activities to high standards of management and control. This will include satisfying the regulatory authority that decisions and activities during the licensed period are taken with proper regard to the long-term safety and security of the store including after it is delicensed.

A licence will include arrangements for routine and non-routine inspections and place an obligation on the licensee to cooperate with inspectors carrying out their duties.

A licence will require the preparation and maintenance of a Risk Management Plan. The plan will incorporate site selection and assessment, monitoring and reporting plans, mitigation and remediation options plans, and a site delicensing plan which will be updated as necessary to maintain its effectiveness.

A licence will require the submission of a carbon dioxide Storage Development Plan to BERR for approval on the location, design, intended storage volumes and on the stipulated matters of the intended storage site and facilities

The above all seem reasonable and necessary.

Question 36: We would appreciate views on the appropriate licensing authority for offshore carbon dioxide storage

Regulatory competence is key to a stable, even-handed and enabling regulatory framework, and in the case of CCS is vital to ensuring that regulations are developed and applied with the required urgency. Reflecting on the specific identity of the regulatory authority the CCSA believes:

- In the interests of regulatory simplicity and accountability the CCSA would prefer that the Regulator is ideally a single body for the whole of the UK, without powers devolved to the regions.
- Whichever body is chosen to act as the regulatory authority it will be important for that body to work closely with all of the relevant bodies including making appropriate provision for consultation (para. 4.72)
- It will be necessary to take the requirements for CO_2 transport and storage activities into account in the proposed marine spatial planning process. However, it should be possible to devise some arrangement under which CO_2 storage installations (including above-seabed works) are the subject of a deemed marine licence to avoid the need for separate licence applications to the MMO or other authorities in respect of pipelines, platforms etc.

Recognising that offshore CO_2 storage operations will share many technical / operational parallels with offshore oil and gas production (large scale injection, storage and reservoir monitoring operations in the sub-seabed environment) the CCSA believes that the current regulator of offshore petroleum operations, the Department for Business, Enterprise & Regulatory Reform (DBERR), would be most appropriate Regulator.

The Consultation Document makes a number of key points that indicate BERR should be given this responsibility:

- Carbon dioxide storage, gas storage and oil and gas production (the latter two already under BERR responsibility) will often make use of either the same geological features or those in close proximity to one another

- The possibility that carbon dioxide storage will taking place in parallel with the production of petroleum (i.e. Enhanced Oil Recovery)

- Many of the techniques and knowledge of the geological structures required for licensing carbon dioxide storage have more in common with petroleum production and combustible gas storage than with traditional environmental control regimes

In addition, the CCSA proposes that there is a need for a License Register to be managed by the Licensing Authority (BERR), which would guarantee title. Ideally, such a License Register should also include oil and gas Licenses as well as other competing renewable uses.

SECTION 5

Question 37: We would welcome any information about the effect that this proposed permit review might have on potential storage site Operators.

The requirement for national authorities to submit draft storage permits and all storage site closure & transfer decisions to the Commission for review is said by the Commission to be justifiable on the basis of the additional confidence it will provide on the safety of the first generation of storage sites, and by the experience it will provide on site characterisation and monitoring.

However, the requirement that both the Member State and the Commission undertake this task is without precedent and, most importantly, risks introducing significant and unnecessary delay in authorising / closing CO_2 storage projects. Whilst there is an argument that the process would only take a few months, the draft directive currently provides for a maximum of 6 months for this review to be performed. This constitutes an additional delay to an already full timetable for forming a CCS value chain. This delay will have financial implications for CCS Operators and may discourage investment in CCS infrastructure.

In accordance with the principle of subsidiarity, permitting should be a matter for individual Member States to decide. If the involvement of the EU does amount to duplication of a function already being performed by member states, it would also seem to be an unnecessary cost and it is unclear how the EU would be funded to perform this role.

In the UK context, the competent authorities will discharge their relevant functions in accordance with national legislation implementing the Directive and associated guidance issued by Government and in accordance with any international standards in place (e.g. as may be required by any storage requirements imposed under a future international agreement on climate change).

The Commission should instead consider its role to be that of reviewing national implementing legislation and guidance as a route to develop confidence and consistency in storage permitting and storage site closure processes. The Commission's role could then be that of "auditor", being to ensure the member state's are discharging their responsibilities appropriately, rather than as a primary reviewer of a storage application. If the EC has concerns that Member States are not implementing the requirements of the Directive they have the power to take infraction proceedings against Member States.

The communication of this information to the Commission would appear to be provided for by Article 36, except for policy documents and Government guidance to competent authorities, and it is proposed that these, together with any revisions or replacements, should be added to the items to be communicated to the Commission.

If the Commission is to have an active role ion vetting permits (which, as noted above, the CCSA does not endorse) it should do so in a manner which does not impact the existing timetable by committing to review applications in parallel rather than review the awards. This could be accommodated by a requirement to inform the Commission of storage permits to be granted, together with the relevant applications and supporting documentation and for the Commission to be able to make representations to the

competent authority within the period which the competent authority has for making the award under national legislation.

Question 38: Although we think the proposed Directive provides sufficient scope for Government intervention in the future should it be necessary, we would welcome any views you have on the way in which the transport and storage network might develop in both the UK and EU.

We think it highly likely that infrastructure development costs will determine that the first CCS projects are developed on a point-to-point basis i.e. a single, dedicated pipeline linking one CO_2 source with a singe storage site, for which the transportation and injection capacities will have been tailored to the expected CO_2 volumes and flow rates specific to the industrial activity at the source and to the reservoir characteristics at the storage site. For a given project such an arrangement is entirely logical, but does not optimally lend itself to later expansion in either onshore gas gathering or the offshore networking of storage sites In other words, development of the first CCS projects could risk undermining longer term prospects for development of a national CO_2 transportation and storage network.

Given that the locations of the largest emitters and large storage sites are already known we believe that significant economies of scale could be harnessed if sufficient early interest in shared infrastructure would lead to common gas-gathering, transmission and storage infrastructure. The extent of such networks needs to be considered now in the context of CCR, in particular the need to recognise potential pipeline routes when contemplating planning consent for other development.

The development of CO_2 networks sources and storage can be more rational compared to the natural gas network in Europe for two reasons. One is that the major sources and storage areas are known now, and secondly that it does not require an integrated network, but rather requires a number of low cost area networks. However, CO_2 gathering onshore, oversizing trunklines and networking storage sites would require a good deal of co-ordination between all players in the value chain, a degree of organisation that seems highly unlikely unless Government or its agencies could facilitate this. Alternatively, Government's pre-funding of shared infrastructure might also contribute to the early realisation of CO_2 infrastructure networks in the absence of sufficient momentum or critical mass from industry.

Finally it is necessary that the movement and storage of CO_2 beyond the country of origin is enabled. This is important in the short term, to enable demonstration plants, and in the long term to access lowest cost storage options. The provisions of OSPAR and the London Protocol also need to reflect this need.

In whatever form the transportation infrastructure develops, the CCSA supports the principle of transparent and non-discriminatory access to CO_2 infrastructure, but we also recognise that offshore storage Operators face a significant investment risk for which they need the contractual freedom to safeguard an adequate return. The Operators of onshore CO_2 sources also need the long-term certainty of access to sufficient transportation and storage capacity, or risk compromising the associated electricity generation or other industrial activity. Therefore, any requirement to accept CO_2 streams from different sources on a non-discriminatory basis should not prejudice the ability of CO_2 source and storage Operators to enter into long-term contractual agreements over access to transport and storage capacity. Under this type of regime, third-party access

may still be facilitated through the provision of Use It Or Lose It (UIOLI) arrangements, in which there is an obligation for contractually committed capacity to be released to the market, under transparent and pre-agreed rules, where that capacity is not being used.

Question 39: We would welcome information about forthcoming or planned CCS projects that might require transboundary cooperation between competent authorities.

Some countries will have good sources of CO_2 (large volume, high purity). Some countries will have good geological storage options (well-characterised, good seal integrity). Both ingredients are required for a successful CCS project and it is helpful if the two ingredients are either co-located or close together (minimises pipeline costs and permitting delays). The situation will likely occur where a good source in one country is close to a good store in another country (but not in the first country). The commercial viability of a portfolio of CCS projects in Europe would be improved if trans-boundary shipment of CO_2 streams (both onshore and offshore) is permitted and a level playing field exists for the regulation of both Capture and Storage. Industry welcomes government efforts to develop open and common standards for CO_2 Capture and Storage across Europe – particularly in the matter of storage security.

Question 40: Assuming EU legislative barriers to onshore storage of carbon dioxide are removed by the Directive, do you agree with the Government's assessment that offshore storage should be the priority in the first instance? Do you envisage any other barriers to onshore storage of carbon dioxide?

The draft EC Directive does not preclude the onshore storage of CO_2; however, it appears that the UK Government has concluded that the most appropriate sites for carbon dioxide storage in the UK territory are offshore. Whilst it is likely that off-shore storage sites will be the first to be developed it is important that preparations for onshore storage are also taken forward. However, the CCSA has concerns that provision for onshore storage in the current legislative and regulatory package could seriously complicate and delay the implementation of the offshore CO_2 storage regime.

Onshore geological formations/groups which have good storage characteristics (e.g. Permo-Triassic Sandstones) are heavily utilised for groundwater abstraction (including public water supply) at shallow depth. It is likely that members of the public, regulatory bodies, representatives from the water industry, NGOs, conservation organizations would be concerned about the potential impacts of 'leakage' from a storage site on groundwater quality within shallower aquifer systems.

There is likely to be a lot of public opposition raised to the onshore geological storage of carbon dioxide. Concern is likely to be raised with respect to health & safety and environmental impacts and the perceived impacts on property prices, apart from general "NIMBY" attitudes. As CCS is in its infancy the potential exists for provisions for onshore storage to attract substantial negative publicity which might further deter private investment in the deployment of this technology.

In view of the above, the CCSA would prefer that further official public discussion and consultation about on-shore storage of CO_2 are deferred until the regulatory regime for offshore storage of CO_2 is in place, because of the risk of delay to the latter if onshore storage is addressed in the same package of measures.

It should not be assumed from the above that public opinion will not be a barrier to offshore storage of CO_2: there are public perceptions of dumping waste at sea, and perceived safety issues associated with pipelines to address in the context of offshore storage. Whilst we recognise that the consultation is aimed at regulatory issues public acceptability of storage sites and pipelines also needs to be taken into account.

However, onshore storage should not be neglected. The legal and regulatory issues for onshore storage would in many ways be far more complex than for offshore, and these will take time to sort out.
There is a qualitatively different issue about perception of risk onshore because small leaks (in the context of a CO_2 store) could cause serious hazards to people if leaked CO_2 accumulated in buildings or in depressions in the ground. The regulatory arrangements would be different as well: the Environment Agency (in England and Wales) would be the obvious choice as environmental regulator, via an extension of the existing Environmental Permitting Regulations.
It is probable that further UK legislation would be needed to facilitate onshore geological storage of CO_2. Issues which could require primary or secondary legislation or Government policy action, and which should be addressed by the relevant Departments at an early stage, include:

1. The compatibility or otherwise of proposals for deep geological storage of CO_2 with existing landowners' proprietary rights. Given the typically fragmented nature of the latter, serious difficulties could be anticipated in obtaining agreement with all affected landowners. In the absence of legislation on the subject, claims for "compensation" would no doubt arise for the "loss" of something deep below ground which landowners have never actually enjoyed. Steps would need to be taken to enable CO_2 storage to proceed without the necessity of obtaining the consent of all owners of land overlying the area into which stored CO_2 would be likely to penetrate.

2. Although the sinking and equipping of CO_2 injection boreholes is clearly "development" within the meaning of Section 55 of the Town and Country Planning Act 1990 (as amended), it is not clear whether the injection of CO_2 and its consequential dispersion through deep geological strata would also constitute development for this purpose. It would be desirable to clarify this point.

3. In the absence of specific legislative provisions to the contrary, the development consent for the onshore storage of CO_2 would take the form of an ordinary planning permission. Consideration should be given to whether CO_2 storage projects should be treated as major infrastructure projects to which the procedures to be introduced by the current Planning Bill, with development consent applications being determined by the proposed Infrastructure Planning Commission, should apply. Given that, for example, underground natural gas storage is included in the Planning Bill, it would appear logical that onshore CO_2 storage projects, subject to a minimum capacity threshold, should be subject to the provisions of the Planning Bill as eventually enacted and require development consent from the proposed Infrastructure Planning Commission.

4. Planning policy provision needs to be made for onshore CO_2 storage, whether through a National Policy Statement under the Planning Bill provisions, a Planning Policy Statement issued by DCLG, or both, as the case may be.

5. Under Section 85 of the Water Resources Act 1991 (as amended) it is an offence to cause or knowingly permit any poisonous, noxious or polluting matter to enter any controlled waters, which include water in any underground strata, without any limitation as to depth. The injection of CO_2 would appear to be contrary to this provision. This issue would be resolved if CO_2 storage were made a Part A(1) activity under the Environmental Permitting Regulations 2007, because the existence of an environmental permit authorising the release concerned makes that release lawful.

6. Interfaces with other underground activities including mining, onshore oil and gas exploration and production, and gas storage, and the UK legislation governing them.

7. Arrangements for environmental regulation of onshore CO_2 storage, most likely via amendments to the Environmental Permitting Regulations; and

8. The safety regulation of onshore CO_2 storage activities.

The relevant Government departments need to start addressing these issues in a joined-up way and developing proposals for the facilitation and regulation of onshore CO_2 storage now, for later consultation.

This is in addition to addressing the safety and public perception issues surrounding CO_2 pipelines whether serving onshore or offshore storage schemes.

The view expressed in this paper cannot be taken to represent the views of all members of the CCSA. However, they do reflect a general consensus within the Association.

ANNEX 1

July 2008
Ref: JC/PW

CCSA POSITION STATEMENT
JUNE 2008
ON
INCENTIVES TO FACILITATE THE EARLY INTRODUCTION
OF CCS PROJECTS IN THE UK

1. The need for CCS

1.1 It is now widely agreed, by the International Panel for Climate Change, Stern, the International Energy Agency and others that there is an urgent need to mitigate climate change by deploying carbon capture and storage (CCS) worldwide. CCS allows the continued use of fossil fuels in power generation combined with very low CO2 emissions. In many parts of the world there are inadequate alternatives to fossil fuels and in others the use of fossil fuels, especially coal, can bring advantages, including enhanced security of supply, through providing diversity of fuel source. CCS enables large scale electricity generation from coal to continue in a carbon constrained world. In many countries CCS is the only feasible option for large scale, secure, low carbon power generation.

1.2 CCS is supported by the European Union (EU) as part of its policy to limit greenhouse gas emissions and associated climate change. The EU Heads of State have agreed that 10 – 12 commercial scale CCS demonstration plants should be operational by 2015, and have discussed mandation of CCS by 2020. The European Parliament are discussing the legislation needed including the possibility of mandation. The current, urgent needs are to deploy existing technologies and capabilities in large scale operation, particularly power generation, and to develop and prove emerging technologies, confirming their performance and associated costs.

2. The Need for Incentives

2.1 The current and forecast carbon price in the Emissions Trading Scheme (ETS) is not yet high enough or reliable enough to stimulate the development and deployment of CCS projects. Most commentators suggest that it will be post 2020 before the ETS alone is sufficient to drive investment in CCS projects

2.2. Even then it is far from clear that investors will be prepared to invest taking on the challenge of managing the “First of a Kind” costs and risks involved. CCS projects are capital intensive and there is no competitive advantage for the generating companies who are the main investors in being the first to adopt this technology.

2.3 As evidenced by the number of large scale, credible CCS projects that were under development prior to announcement of the BERR CCS Competition rules and the number of projects that have entered the Competition, there are many developers in the UK who would proceed in the short term if appropriate incentive mechanisms were put in place.

2.4 There is therefore a need to put in place now mechanisms to facilitate the earlier introduction of a demonstration tranche of CCS projects. These mechanisms can provide a bridge until the EU ETS is fully able to support the investments required, allowing commercial CCS projects to be constructed and demonstrated in the UK, a decade earlier than would happen if reliance is placed solely in the EU ETS. The UK could make material carbon emissions savings whilst allowing coal to be used in the generation mix maintaining fuel diversity and increased energy security.

2.5 This paper outlines the mechanisms that the CCSA considers would be most likely to be effective in attracting the private sector investment required. It results from extensive analysis and discussion involving a substantial cross section of the membership of the CCSA and provides an Association view of possible mechanisms that could be used to incentive and accelerate the introduction of CCS projects.

3. The potential for CCS investment in the UK

3.1 A range of capture technologies suitable for CCS exists, including pre and post combustion capture, and oxyfuel processes. While the extent varies between these technology types, all stages of the CO2 chain – capture, transport and storage – have been proven at commercial scale, but there is little or no experience of integrating them in a chain which includes large scale power generation.

3.2 Pre-combustion capture technologies are ready now for full scale commercial deployment and there are a number of IGCC projects of up to 800MWe ready to proceed in the UK, i.e. only awaiting suitable economic incentives.

3.3 The responses to the BERR CCS competition have demonstrated that there are a significant number of post combustion and oxyfuel CCS projects which could be developed to commercial scale ca 2014 – 2016. However the competition is a “one off” and there is, as noted above, a more general need and opportunity to incentivise a series of projects in the transition to full commercialisation and deployment of CCS.,

3.4 CO2 storage has been demonstrated in the USA, Canada, Norway, and Algeria. Studies have confirmed that there exists a variety of excellent storage/EOR options in the North Sea, i.e. the UK is extremely fortunate to possess very considerable offshore CO2 storage capacity, in principle more than enough to meet UK needs for perhaps a century or more.

3.5 Support for CCS to date has been for RD&D activities. In the long term (post 2020) the EU ETS should provide the market pull necessary to drive extensive deployment. The current challenge is to move from RD&D to more extensive deployment on the most rapid timescale possible. The growth from single projects to widespread deployment in the UK will be less costly and happen more quickly if the opportunity to develop transport and storage infrastructure hubs and clusters are taken building on the requirements needed for the initial projects. A few carefully selected CCS projects could facilitate a much wider network able to collect CO2 from a number of capture sources for storage in a number of key storage locations, including mature oil fields where enhanced oil recovery may be undertaken.

3.6 Policy makers are targeting 2020 as the year by which full commercialisation of CCS should be achieved, and confidence in the investments established. If this is interpreted

as ensuring that several projects operate from ca 2015 for several years, then the investment for these projects will need to be sanctioned ca 2009. The need for clarity on incentives for these projects is therefore urgent. In particular it is not practical to await the operational outcome of the "one off" Competition (ie post 2014) before wider incentivisation is contemplated. Indeed in any event the BERR Competition is of limited use in establishing the costs and defining the issues of relevance to pre-combustion project investments.

4. The costs and funding of CCS projects

4.1 Carbon Capture and Storage incurs significantly higher costs than unabated fossil fuel combustion. There is both a capital penalty (for capture, transport and storage) and ongoing costs resulting from the reduced generation efficiency and associated with operating the CO2 capture, transport and disposal process. Hence CCS power generation is uncompetitive with unabated fossil fuel generation unless the price of carbon or other measures offset these costs.

4.2 Carbon prices under the EU ETS provide helpful support. However, the further out the period, the more regulatory and other uncertainties exist concerning the scheme's operation, especially during and after phase 3, which ends in 2020. As plants typically have an operating life of over 30 years this uncertainty covers most of their operating life. Furthermore, the EU ETS is not designed to give specific signals for the introduction of new technology. It is widely acknowledged in the major economies that additional incentives are required for new low carbon technologies. Such incentives are, of course, already in place for renewables and for high quality CHP plant.

4.3 Precise CCS costs can only be determined following front end engineering and design (FEED) studies and are then subject to variability in the markets for engineering, equipment and construction. However, typical costs are broadly estimated to require CO2 prices in the range €50 – 100/t CO2. The actual number is dependent on the specific project details and the means and basis by which the benefits of the carbon support are reflected in the project investment returns. The CCSA agrees with the conclusion made in the 2007 White Paper on Energy which indicated that the cost of carbon abatement from CCS is less than that from renewable generation, in many cases considerably less.

5 The design of the incentives for CCS

5.1 In the long term, once the technologies are fully proven and costs have benefited from the learning from early projects, the EU ETS should provide the market incentive for CCS, and investors will be able to judge that the carbon price will support the investment and continuing operational costs involved. Current incentives should therefore be designed to manage the introduction of the first projects and bridge the gap before the carbon price in the EU ETS justifies the costs involved. Hence the support should be time limited. The proposals which follow relate to the deployment of a first demonstration tranche of CCS projects.

5.2. The incentives provided should generally:

- Not specify technologies, since it is currently too early to determine which technologies will eventually be preferred and in any event different technologies may be preferred for differing applications eg new build or retrofit.

- Provide appropriate incentives for efficient construction and operation.
- Facilitate price competition to ensure value for money is achieved
- Be compatible with the EU ETS, allowing a phase out of the support over time
- Be market based, relating directly to the carbon market
- Be State Aid compliant
- Create minimal distortion to the carbon and electricity markets
- Be simple and able to be implemented on a timescale consistent with investment decisions in 2009 or 2010.
- Result in a material saving of CO2

Government currently supports several low carbon technologies and the CCSA strongly endorses the principle that there should be, as far as possible, fair treatment of all low carbon technologies as all are needed to address climate change and those not supported are actively disadvantaged.

5.3 The CCSA have studied in some depth the applicability of a wide range of potential mechanisms and concluded that there are several viable options which it would support as meeting the above objectives. Ideally, the incentives should be designed to address both the additional capital costs and the continuing operating cost disadvantages. It is recognised that there can be political objections to each of the support options and it may well be that a package of measures is appropriate. For example the EU could choose to provide EU wide support which could meet part of the CCS cost and individual Member States could provide the balance of support using mechanisms that relate to the electricity market situation that pertains in each country. Not all of the options below can provide sufficient support alone, however in combination it is firmly believed that a suitable package can be assembled.

5.4 Capital Support

5.4.1 Tax structures, e.g. enhanced capital allowances where the expenditure on CCS projects can be offset against tax in the year in which the expenditure is made, can be appropriate in mitigating the costs and early deployment risks, depending on corporate tax positions. This approach is well established to support the introduction of other low carbon and new technologies for example biomass and wind projects

5.4.2 Capital grants are also suitable approaches to achieve early incentivisation of projects which inevitably suffer a capital disadvantage. This approach has been used to support the introduction of other low carbon technologies for example early offshore wind projects

5.4.3 The CCSA also notes that government backed ‘carbon bonds’ or low rate UK Government or EU loans if available would also be of benefit if the rate offered is attractive enough. The CCSA welcomes the statements made by the European Investment Bank that it is considering making available lower cost loans to CCS projects which meet EU policy objectives.

5.4.4 It should be noted that new funds greatly in excess of the sums envisaged here will be accumulated by government as a result of carbon allowance auctions. This auction revenue is new and hence is currently unallocated. It is raised directly from those who are potential investors in CCS and provides a source of funds which, if recycled, would

be more than sufficient to meet the cost of supporting an introductory tranche of CCS projects.

5.5 Revenue Support

5.5.1 The CCSA would support a CCS support mechanism – such as a feed in tariff or premium price as paid to renewables – which resulted in an additional payment per MWh or in proportion to the carbon abated, or a Contract For Difference (CFD) with the carbon price. The CCSA believes that these mechanisms should support the development of all new low carbon power generation.

5.5.2 The CCSA has concluded that payment via the allocation of free carbon allowances (inside the overall cap) for the carbon abated from compliant CCS projects for a period is another possible mechanism capable of contributing to the level of support required. The CCSA notes the current proposal that free allowances will continue to be a feature of the ETS in phase 3, e.g. outside of the power sector and possibly for the heat content of CHP.

5.5.3 CCS projects should, in the CCSA view, be exempt from the climate change levy and receive a waiver of business rates. This would simply place CCS support on the same basis as high quality CHP schemes (which even if fired by gas would be expected to emit at least double the CO2 per MWh of a coal based CCS plant). Prospective CCS projects would clearly need to be offered Levy Exemption Certificates well beyond the planned review date.

Conclusion

Incentives are required to take CCS from demonstration projects to commercial investments underpinned by the EU ETS post 2020. In the UK a tranche of projects in parallel with the BERR Competition project should be incentivised. The environmental benefits, and the government related costs should be assessed on the same basis as other forms of low carbon power generation, including renewables, as CCS Projects have the potential to make an early and material contribution to the UK's emission reduction targets. Policy makers should reach clear decisions early enough to enable investment decisions to be made in 2009 so that CCS can be operating in 2013 - 2015 when the shortfall in generation capacity is expected to make the capacity reserve margin unacceptably low.

The CCSA is pleased to commend this set of options for the UK government to consider and pursue. The CCSA emphasises that a number of large scale CCS projects can be brought forward now which can make a material and early contribution to carbon reduction targets. Government is urged to agree to support further CCS projects and put in place the conditions to allow its growth. The CCSA is pleased to offer its services and those of its members in working with government to deliver early deployment of these important pathfinder CCS projects.

ANNEX II

July 2008
Ref: JC/PW

CCSA Position on Incentives for CCS Projects Through Allocation of EU Allowances

The Carbon Capture & Storage Association would like to offer the following comments on incentives for Carbon Capture & Storage. It is hoped that these comments will prove useful to policy makers.

1. The CCSA would like to express categorical support for the principle of establishing a centrally coordinated incentive mechanism in Europe to support early investment in CCS projects.

2. Any such mechanism should be efficient in the application of funds, limited to a number of early projects in the first instance, not distort the working of the EU ETS nor impede the adoption of complementary low carbon technologies.

3. The CCSA supports the proposed principle of using EU Allowances to provide support for a number of early projects as one of a number of incentive mechanisms.

4. To ensure that such a mechanism does not result in the expansion of the overall EU ETS cap, the CCSA recommends that EU Allowances to support early CCS projects are sourced from the New Entrant Reserve (or other existing source of allowances). The maximum possible amount of allowances should be ring fenced within the currently proposed NER subject to the need to enable expansion in other activities.

5. The timescale considered in making project investment decisions of this type normally extends many years over the working life of the project. The CCSA would like to point out that this support would therefore be needed beyond the end of Phase III of the EU ETS.

6. Individual Member States have the ability to provide additional fiscal support and some Member States may be able to benefit from other EU programmes. In view of this, the European mechanism should be additional and complementary to support for the initial 10-12 projects from individual Member States.

7. The detail of the total incentive package requires further development but should incentivise the development of the complete capture, transport and storage chain. It needs to be flexible enough to reflect capital and operating costs throughout the value chain whilst contributing to necessary future infrastructure. The CCSA would welcome further discussion on this.

ANNEX III

August 2008
Ref: JC

Supporting CCS Demonstration Projects in Europe –
'The Flagship Programme'
A CCSA position paper

It has been agreed by the European Spring Council of Ministers 2007 that a demonstration programme of 10-12 commercial scale CCS projects should be brought into operation in Europe by 2015 (also termed the Flagship Programme). The purpose of this paper is to examine the implications of this policy and how projects might come forward for support.

The biggest barrier today to the demonstration programme is the lack of funding for projects at both EU and member state level. These demonstration projects cannot be economically justified on a purely commercial basis, and financial support over the lifespan of the early projects will be required. If a suitable funding mechanism is not in place in the very near future, the ability to deliver the 10-12 projects envisaged by the EU will be in jeopardy. This will put the longer-term ambition of developing CCS as a commercial deployment option post 2020, all but out of reach. A funding mechanism for CCS projects should be rules based and predictable at the outset so that project developers have a clear idea of the risks of not achieving support before committing to large development costs.

Opportunities for CCS to make a real contribution to climate change mitigation at an early stage in Europe should be recognised and seized by the Flagship Programme. The Programme will need to be delivered with the utmost dispatch recognising the following principles:

1. CCS is a potentially viable option in climate change mitigation, and demonstration and development of the technology should be the highest priority.

2. CCS has the potential to allow continued use of fossil fuels in a low/zero carbon environment, retaining fuel diversity and energy security.

3. CCS could be a viable and cost-effective mitigation technology. One of the purposes of the demonstration projects is to prove this fact.

4. European business needs to be in a leading position on CCS in major world energy markets.

With these four principles in mind the following is an initial list of guidelines recommended by the CCSA to help ensure prompt and effective delivery:

1. In order for the first projects to demonstrate CCS at scale there should be a guideline on the minimum size of project that is accepted in the programme. The minimum size should relate to a commercial sized module.

2. Whilst the aim of the Flagship Programme is to deliver 12 demonstration projects by 2015, early consideration needs to be given to the transition from demonstration to deployment in accordance with the long timescale for project development.

3. One aim of the programme should be to encourage diversity of technology in capture, transport and storage. However, this should in no way involve deselecting projects that involve technologies already supported. The progress of the programme should not be held up due to the absence of any particular technologies.

4. The programme should endeavour to support a range of technologies but not at the cost of ring-fencing support for technologies that do not come forward in the time frame. The programme should encourage duplication of concepts especially from different suppliers in order to encourage diversity of supply and price competition.

5. If financial support from the European Commission is dependent upon Flagship Programme approval then the programme should not discriminate in relation to the number of submissions from any Member State. The objective must be to deliver as many projects as possible as soon as possible in those Member States that are in a position to take early action.

6. Some account needs to be taken of the strategic positioning of the projects in terms of their contribution to future infrastructure. Clusters of projects should be encouraged to optimise infrastructure utilisation and demonstrate shared access. Cross-border shipment of CO2 may also be included.

7. Projects that may not qualify for EC funding but are funded wholly from commercial and Member State sources should not be disadvantaged by State Aid decisions in the Flagship Programme.

8. The process of selection should not present a hindrance in time to project development. It should reflect the urgent need to develop and demonstrate this technology if the EU's timeline is to be achieved.

9. Projects selected for the Flagship Programme should be expected to make public the overall design concept and share operating experience over the first five years of operation. It is proposed that a separate EU technology transfer programme is established to collect and publicise this information. However, projects should not be expected to make public proprietary technology.

10. To encourage Member States to support CCS projects a mechanism needs to be established whereby early mover States are not disadvantaged relative to other States which have taken no action. This principle should apply to projects within or outside the Flagship Programme.