Inclusion of Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities

Submission to SBSTA 32

March 2010

As requested in Decision -/CMP.5 on '*Further guidance relating to the Clean Development Mechanism'* (hereafter referred to as "Decision -/CMP.5"), Australia is pleased to submit its views relating to the inclusion of carbon dioxide (CO_2) capture and storage (CCS) in geological formations as a clean development mechanism (CDM) project activity. This submission builds on Australia's previous submissions to SBSTA at its twenty-ninth[1] and thirty-first sessions.[2]

Australia welcomes Decision -/CMP.5 that 'recognizes the importance of carbon dioxide capture and storage in geological formations as a possible mitigation technology'. Australia also notes that the UNFCCC, Intergovernmental Panel on Climate Change (IPCC), Carbon Sequestration Leadership Forum (CSLF), G8, Major Economies Forum, International Energy Agency (IEA) and the Global Carbon Capture and Storage Institute (GCCSI) all recognise CCS as a mitigation technology. Australia looks forward to working constructively with Parties to progress the inclusion of CCS in the CDM.

Australia notes analysis in the IEA '*Energy Perspectives Report*'[3] which concluded that CCS will need to contribute one-fifth of the necessary emissions reductions to achieve stabilisation in the most cost-effective manner. Australia also notes the IEA '*Technology Roadmap: Carbon Capture and Storage*'[4] which found that for the deployment of CCS in developing countries, CCS projects in these countries will need to be eligible for carbon market funding, either via inclusion in the CDM or through a new mechanism.

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[1] http://www.climatechange.gov.au/en/government/initiatives/unfccc/~/media/submissions/international/ccs-as-cdm-project-activities.ashx

[2] http://unfccc.int/resource/docs/2009/sbsta/eng/misc11.pdf

[3] IEA 'Energy Technology Perspectives 2008', http://www.iea.org/techno/etp/index.asp

[4] http://www.iea.org/papers/2009/CCS_Roadmap.pdf, p35.

Australia is one of 23 countries plus the European Commission which supported the CSLF[5] communiqué of 13 October 2009 which states that CCS should be appropriately recognised in any mitigation and technology incentive arrangements that are part of any agreement under the UNFCCC[6].

Inclusion of CCS projects in the CDM would provide an important financial incentive that would assist in offsetting the incremental cost for those developing countries that may wish to deploy this technology. While large scale deployment in developing countries is still expected to be some time away, an early signal on inclusion is critical to provide markets with improved investment certainty for investments in long-lived and large-scale CCS projects.

Inclusion in the CDM and/or other crediting mechanisms would also provide a rigorous project approval process which would support best practice global deployment of CCS technologies.

The CDM should remain technology-neutral and the inclusion of CCS as an eligible CDM project activity would support developing countries' access to technologies consistent with their preferred development path. It would also provide developing countries access to the economic incentives that are available for other emission abatement technologies.

Australia believes there are sufficient established technical and scientific data and analysis, methods and expert advice to address the concerns raised on the outstanding issues in Decision -/CMP.5, paragraph 29. This body of work shows that with the addition of some CCS specific modalities and procedures, CCS can be accommodated within the CDM. Further information on addressing the outstanding issues is available in **Attachment A** to this submission.

In particular, Australia acknowledges the report to the CDM Executive Board on '*Implications of the Inclusion of Geological Carbon Dioxide Capture and Storage as CDM Project Activities*'[7] *(referred to hereafter as* 'EB 49 Report'*)*; the IEA Greenhouse Gas R&D Programme (*referred to hereafter as* 'IEA GHG') report *'ERM-Carbon Dioxide Capture and Storage in the clean development mechanism'*[8] (*referred to hereafter as the IEA GHG report)*; the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[9] (*referred to hereafter as the 2006 IPCC Guidelines)* and the

[5] CSLF Members: http://www.cslforum.net/aboutus/index.html
[6] CSLF Communiqué: http://www.cslforum.org/publications/documents/London2009/final_approved_communique101309.pdf
[7] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf
[8] http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf
[9] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf

IPCC Special Report on '*Carbon Dioxide Capture and Storage*'[10] *(referred to hereafter as the IPCC SRCCS)* which offer guidance on the way forward for the inclusion of CCS projects in the CDM.

Australia considers that based on the information, sources and expert bodies cited in this submission and elsewhere, the CMP should request SBSTA to prepare modalities and procedures for CDM project activities relating to CCS. The development of CCS modalities and procedures would allow options to address the outstanding issues could be identified, assessed and resolved. To assist in developing such a request, Australia has prepared core elements of a possible decision text for consideration at CMP 6 at **Attachment B**.

[10] http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf

Attachment A

Addressing issues highlighted in Decision-/CMP.5 '*Further guidance relating to the Clean Development Mechanism',* paragraph 29.

Australia considers that there exists sufficient established methods and expert advice to address the following nine concerns outlined in Decision-/CMP.5, paragraph 29, relating to the inclusion of CCS projects in the CDM:

a) Non-permanence, including long-term permanence;

b) Measuring, reporting and verification;

c) Environmental impacts;

d) Project activity boundaries;

e) International law;

f) Liability;

g) The potential for perverse outcomes;

h) Safety; and

i) Insurance coverage and compensation for damages caused due to seepage or leakage.

Key to the deployment of CCS projects that effectively address these issues will be the establishment of relevant governance arrangements in each Host Country. Australia notes the recommendation in the EB 49 Report that regulation of CCS in the host country for CCS project activities, with an appropriate regulatory body to administer it, is highly important. The report also recommends that a role of the Designated Operational Entity (DOE) would be to assess whether there is a regulatory framework in place in the host country to control the project, and whether the appropriate regulatory approval has been or can be given to the particular project.

Australia further recognises the need to develop regulatory capacities in developing countries interested in deploying CCS. There is a significant body of work underway through bodies such as the GCCSI and the CSLF which can provide support for developing countries that are developing

national CCS regimes. Further information on capacity building activities throughout the world is available in Australia's submission to SBSTA 31.[11]

Australia considers modalities and procedures for CCS CDM projects should require Host Countries to establish governance arrangements for the deployment of CCS.

Non-permanence, including long-term permanence

Some Parties have raised concerns over: the risk of seepage from CCS projects over the crediting period and the long-term; the risk of emission from abandoned and unmonitored wells; the risk of sudden, massive release of CO_2; and the implications these risks may have for inclusion in the CDM.[12]

The IPCC offers guidance on seepage (or permanence) in CCS projects. Based on observations and analysis of current carbon dioxide storage sites, natural systems, engineering systems and modelling, the IPCC SRCCS concluded that the fraction of injected CO_2 retained is very likely to exceed 99 per cent over 100 years (a very unlikely chance of more than 1 per cent seepage over 100 years).[13]

In terms of long-term permanence, the IPCC further concluded that the fraction of injected CO_2 retained is likely to exceed 99 per cent over 1000 years (an unlikely chance of more than 1 per cent seepage over 1000 years). It further concludes that, for well-selected designed and managed geological storage sites, the vast majority of the CO_2 will gradually be immobilised by various trapping mechanisms and, in that case, could be retained for up to millions of years.

The risk of non-permanence or seepage is a manageable risk. As indicated in the IEA GHG report, permanence is 'a function of good site selection, risk management and appropriate closure, and not an inherent feature of all projects'[14].

The IEA GHG '*Geological Storage of Carbon Dioxide: Staying Safely Underground'* report offers guidance on the risk of seepage. It explains: 'Most geologic storage projects are expected to take advantage of multiple trapping mechanisms. As a result of a combination of stratigraphic, structural, residual, solubility and mineral trapping, any CO_2 movement out of the formations is unlikely. Evidence shows that these kinds of

[11] http://unfccc.int/resource/docs/2009/sbsta/eng/misc11.pdf#page=10
[12] FCCC/SBSTA/2008/INF.3, http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[13] http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf, p246.
[14] http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf

movements are very slow for appropriately selected and designed sites that are operated and monitored properly. Moreover, the CO_2 will typically be stored in rock formations that have proven their ability to retain fluids, some for millions of years. Injected CO2 would not exist as an underground gas bubble that could rapidly burst forth to the surface'. The report further advises that 'best estimates of leakage rates by geologists are well below levels that would cause any significant increase in atmospheric CO_2 or risk to public safety'[15].

The only realistic avenues for releases of CO_2 are well bores (the injection well, for example), or faults that reach the surface or near-surface. The risk of a seepage event from a well bore would only likely present in the injection phase, where there is a driver for CO_2 movement, and before significant amounts of CO_2 had migrated over a larger area or otherwise stabilised or immobilised in the subsurface. Technology safety features are used at the injection point to prevent blowout, and backflow of injected fluids, in the event of equipment failure. Techniques also exist to monitor and assess the integrity of the well and equipment. Should unintended migration occur, remediation techniques are available such as adjusting pressure in the reservoir, and intercepting and sealing the seepage pathway. These methods are based on extensive experience in oil and gas fields.

Any risks of seepage, for instance from an abandoned well or fault, would be identified in a risk assessment. For example, risk assessments would identify an abandoned well, which would need to be properly sealed so as to prevent a seepage pathway. The risk assessment could even identify the likelihood of an earthquake event, the likely consequent volume of CO_2 loss should an earthquake occur, and the planned remediation[16]. However, it should be noted that seismic activity in itself would not automatically result in CO_2 seepage. This is demonstrated in Nagaoka, Japan, where a large earthquake occurred in the vicinity of the CO_2 storage site, and the $C0_2$ was unaffected. This is further demonstrated in existing oil and gas fields in seismically active areas around the world[17].

There is extensive expert guidance available on measures and practices designed to identify, address, and prevent the risk of seepage from CCS projects. Such measures include: appropriate site selection and characterisation; comprehensive risk assessments to assess all potential

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[15] http://www.co2crc.com.au/dls/external/geostoragesafe-IEA.pdf, p22.

[16] Jürgen E. Streit and Maxwell N. Watson, '*Estimating rates of potential CO2 loss from geological storage sites for risk and uncertainty analysis*', CRC for Greenhouse Gas Technologies, https://extra.co2crc.com.au/modules/pts2/download.php?file_id=569&rec_id=68

[17] http://www.co2crc.com.au/dls/external/geostoragesafe-IEA.pdf

seepage pathways; modelling of CO_2 behaviour; monitoring CO_2 behaviour; monitoring to detect any seepage; remediation planning and practices; safe seal and abandonment planning and practices; and post-closure monitoring and management planning and practices. Many practices have been adopted or adapted from the petroleum industry, which has over 100 years of experience in extracting oil and gas (and CO_2) and injecting fluids (such as water) safely and securely underground, including over 30 years experience of producing, transporting and injecting CO_2 for enhanced oil recovery.

The 2006 IPCC Guidelines address permanence in CCS projects, using a Tier 3 approach. They identify methodologies for estimating emissions (seepage) from CO_2 storage sites, even at low levels, should it occur[18]. Measures to redress certified emission reductions (CERs) in the event of seepage are explained in the section on 'Liability' below.

Australia believes CCS projects can and should be designed with the expectation of permanent CO_2 storage. Australia recommends modalities and procedures for CCS CDM projects approval procedures should require project participants, *inter alia*: to undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths; and to identify procedures for addressing any identified risks, including for safe sealing and abandonment of the reservoir and for monitoring and accounting seepage of CO_2 emissions.

Liability

Some Parties have raised concerns relating to the assignment of liability to account for emissions associated with seepage (or liability for non-permanence). Ensuring appropriate arrangements for liability to account for these emissions is essential in order to maintain the environmental integrity of the CDM.

Some parties have also raised concerns relating to broader project liabilities. Australia considers that these would be determined and assigned by national regulatory frameworks. Australia considers that the modalities and procedures should require that proposed projects are in compliance with all relevant national laws and regulations for the deployment of CCS.

Australia notes that some Parties consider that project proponents should assume liability for emissions, at least during the crediting period of the project. Other Parties consider that the host government should assume

[18] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf

liability, while others consider that the host government may not be in a position to manage this liability[19].

There are a number of potential options that have been canvassed for addressing liability for non-permanence[20], including that:

i. CERs equal to the quantity of seepage CO_2 could be cancelled by an entity responsible for the project to remediate any seepage amount, as recommended by the EB 49 Report. The liability could be placed on either the project participant, or the host Party, or a combination, with project participants responsible during the crediting period and host Parties over the longer-term.

ii. During the crediting period, emissions could be monitored and reported as 'project emissions', and accounted for by deducting the amount from the project baseline, as the IEA GHG report concluded.

iii. Temporary or time-bound units could be created, similar to those that already exist for afforestation and reforestation. These would require replacement in the event that seepage did occur. The liability for any seepage would be passed on to the buyer, providing little ongoing incentive for the project participant or host Party to take measures to avoid seepage. Given the potential for non-permanence is low, temporary units are likely to add unnecessary complexity. Also temporary units have already been shown to have reduced desirability in the market.

iv. A discount factor could be applied so that a proportion of CERs are not issued to account for potential future seepage. This option would require the likelihood of seepage or non-permanence to be assessed and potentially adjusted over time, as the monitoring results provide confidence of permanence. In establishing modalities to this effect, models of risk assessment such as those used in the insurance industry could be considered.

v. Similarly, a proportion of CERs could be put aside into a 'confidence buffer' at the time of issuance, to account for any future seepage. The 'confidence buffer' would provide a pool of credits that could be cancelled to take account of emissions associated with any seepage event. As with the previous option, the likelihood of seepage or non-permanence would need to be assessed. The

[19] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[20] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf, pp32-33 and p48, citing the IEA GHG Report.

proportion of CERs set aside could be adjusted over time to reflect changes to the assessed risk of seepage and taking account of the number of units already in the confidence buffer.

Australia considers that modalities and procedures for CCS in the CDM should establish arrangements to address liability for non-permanence. Host Parties would need to establish measures as defined in these modalities and procedures. In determining arrangements, options that promote the environmental effectiveness of the CDM, can be adequately implemented, and are attractive to the market, should be favoured. Australia would be open to further consideration of all options canvassed and to any other proposals from Parties that could achieve our stated objectives.

Some Parties have raised concerns surrounding liability arrangements for non-permanence where a CCS project crosses national borders[21] (also referred to as "trans-boundary" issues). Australia notes that guidance on cross-border CCS operations is available in the 2006 IPCC Guidelines[22], and that these provide an appropriate basis for considering liability arrangements. However, where trans-boundary issues arise that are not resolved to the satisfaction of the countries concerned, these projects could be excluded from qualifying for CDM registration until resolution is achieved. Projects that cross national borders may also raise issues of international law. Australia's preference for the treatment of cross border and international issues are contained in the section on 'International Law', below.

Measuring, reporting and verification (MRV)

The following concerns have been raised over measurement, reporting and verification:

i. that CO_2 stored in sub-surface reservoirs is not measured, only modelled;

ii. that monitoring would add unmanageable complexity to the CDM; and

iii. that the CDM institutional structures would need to be modified to accommodate CCS, such as modification of the roles of DOEs[23].

[21] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[22] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf, pp5.20-5.21.
[23] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf

CCS projects can and should meet robust MRV requirements. Australia notes that the technology and processes to provide accurate MRV for CCS already exists. The amount of CO_2 injected into a geological formation can be measured by equipment at the wellhead (meter) before it enters the injection well. The storage site is then monitored, and any subsequent emissions reported. The monitoring validates measurement. The 2006 IPCC Guidelines provides further guidance on sophisticated monitoring techniques.

The 2006 IPCC Guidelines can contribute to a framework for measuring, monitoring, reporting and verification for carbon capture, transport, injection and storage which could be used as the basis for CCS CDM MRV requirements. Australia further notes the finding of the EB 49 Report that the 2006 IPCC Guidelines methodology can be applied to CCS project activities under the CDM.

Australia also notes the EB 49 Report recommendation that monitoring methodologies should set overall objectives while leaving flexibility in the monitoring programme details, so as to allow the most appropriate monitoring techniques to be selected given specific geological situations.

Australia notes that MRV is already required of other CDM projects under existing CDM modalities and procedures via Project Design Documents (PDD) and the verification and certification process undertaken by DOEs. Australia considers that the additional measures specific to CCS projects are practical and manageable.

Australia recommends development of CCS CDM modalities and procedures in relation to measurement, monitoring, reporting and verification, consistent with the 2006 IPCC Guidelines.

Australia further recommends the development of procedures for the accreditation of DOEs incorporating the requirement that such entities possess the technical expertise necessary to discharge their validation and verification functions with respect to project activities relating to CCS in geological formations. The EB 49 Report also recommends CCS-specific DOE accreditation.

Environmental Impacts

The following concerns have been raised relating to environmental impacts:

i. the risk of catastrophic seepage event resulting in damage to the environment or human health/safety;[24]

ii. the lack of experience with CCS compared to current eligible CDM projects and the uncertainty surrounding risk of seepage make Environmental Impact Assessments (EIAs) challenging;[25] and

iii. that the Terms of Reference and review process for EIAs are currently solely within the purview of the host country. A substandard EIA could have regional or international implications, if it leads to poor site selection or operating practices that result in seepage; and

iv. the potential for 'impurities in the CO_2 stream'[26].

As mentioned above, CCS project management measures and practices are designed to identify, address, and prevent the risk of seepage from CCS projects. Such measures include: appropriate site selection and characterisation; comprehensive risk assessments to assess all potential seepage pathways; and modelling of CO_2 behaviour. Risk assessments and modelling would indicate that it is extremely unlikely that catastrophic seepage could occur due to the geological trapping mechanisms which prevent CO_2 movement and release (as in natural systems). Further CCS project management also involves: monitoring to detect any seepage; remediation planning and practices in the event of any seepage; safe seal and abandonment of the site; as well as post-closure monitoring and management planning and practices.

The issue of environmental impact has also been considered in the EB 49 Report which recommends that an EIA be carried out for each CCS CDM project, governed by national host government regulations and based on the risk assessment procedure that should be outlined in any CCS CDM methodology and PDD. The requirement for assessment of environmental impact during the project approval process, similar to existing modalities and procedures for other CDM projects, would allow for concerns relating to the environmental impact of CCS activities to be considered during CCS CDM project validation and registration. Further, stakeholder consultation, including with any affected local and indigenous communities, should be described as a requirement in the CCS project approval process, as is required under current PDD guidelines.

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[24] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf

[25] Issues raised under points (ii) and (iii) are noted in '*Possible implications of the inclusion of CCS as CDM project activities*', Report of the 50th meeting of the CDM Executive Board, 13-16 October 2009, Annex 11, http://cdm.unfccc.int/EB/050/eb50_repan11.pdf

[26] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf, pp35-36.

Australia notes the recommendation in the EB 49 Report that no waste or other matter should be added to a CO_2 stream of a CCS CDM project activity for the purpose of discarding that waste or other matter, and that acceptable levels of impurities in CO_2 streams should be determined based on their potential impacts on transport and storage integrity. It is furthermore recommended that operators of potential CCS projects under the CDM prove that their CO_2 streams are sufficiently pure and that they have adequately considered the relationship between CO_2 stream purity and the surrounding cap rock, including environmental and other risks of CO_2 storage.

Australia considers that modalities and procedures for CCS CDM project should require that the project participants, *inter alia*, undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths, and environmental, health and safety impacts; and undertake and report on public and stakeholder consultation, including with any affected local and indigenous communities.

Project activity boundaries

The following concerns relating to project boundaries have been raised[27]:

i. the need to ensure all relevant project-related emissions are captured;

ii. that a reservoir may cover different countries or international waters, and that after storage the plume may migrate without regard for plans or political borders;

iii. that 'there are difficulties in defining the project boundaries if there are several different injection points from different project activities in different time frames'; and

iv. the project boundary 'is difficult to define in a situation in which potential leakage or seepage may result in international impacts'.

Australia considers that project boundaries for CCS activities under the CDM should encompass all GHG emissions under the control of the operator including: the capture, transport, intermediate storage facilities, and injection systems; and the storage reservoir. Project boundaries for the storage reservoir would be defined by the site characterisation, including

[27] http://cdm.unfccc.int/EB/050/eb50_repan11.pdf

any potential seepage pathway, modelled CO_2 migration path, and any potential secondary containment formations.

The 2006 IPCC Guidelines provide methodologies for estimating CCS project-related emissions. CCS CDM project methodologies should be consistent with these. We note that emissions resulting from fossil fuels used for capture, compression, transport, and injection of CO_2 are addressed in the energy chapter of the 2006 IPCC Guidelines.

Guidance on how to report on cross-border CCS operations is also available in the 2006 IPCC Guidelines[28]. The 2006 IPCC Guidelines also offer guidance on instances where more than one country utilises a common storage site, and in the case where a storage site occurs in more than one country. These guidelines could be followed for defining project boundaries. However, where trans-boundary issues arise that are not resolved to the satisfaction of the countries concerned, these projects could be excluded from qualifying for CDM registration until resolution is achieved.

Australia considers that modalities and procedures for CCS CDM projects should require project participants to, *inter alia*, define physical and operational project boundaries as outlined above.

International law

The following issues have been raised relating to international legal obligations:

i. 'an international regulatory and institutional framework may be required to deal with the international implications[29]'; and

ii. cross-boundary or trans-boundary issues.[30]

Currently, CO_2 storage in areas of national jurisdiction is generally regulated under national systems of law. It is expected that the regulation of CCS CDM projects would reside with an appropriate regulatory body in the host country.

Australia notes the recommendation in the EB 49 Report that 'regulation of CCS in the host country, with an appropriate regulatory body to administer it, is highly important for CCS CDM projects. ...An objective of any DOE validating a CCS CDM project activity would be to assess whether there is

[28] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf, pp5.20-5.21.
[29] http://cdm.unfccc.int/EB/050/eb50_repan11.pdf
[30] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf, p12.

a regulatory framework that could be considered sufficient in place in the host country to control the project, and whether the appropriate regulatory approval has been or can be given to the particular project'.[31]

Australia acknowledges that the need to develop regulatory capacities in developing countries interested in deploying CCS is well recognised and there is a significant body of work underway through bodies such as the GCCSI and the CSLF. Further information on capacity building activities is available in Australia's previous submission to SBSTA 31.[32]

Where domestic regulatory regimes are adequate, there would not appear to be an issue with CCS projects within national jurisdictions. There may however be concerns related to the legal implications of storage and seepage which occurs in international waters, or crosses national boundaries[33].

Existing international legal obligations are relevant to these concerns and CCS projects need to comply with applicable international legal obligations. For example, the United Nations Convention on the Law of the Sea (UNCLOS) divides the sea into jurisdictional zones and the sovereign rights and obligations that apply in those areas[34]. UNCLOS is relevant to implementation of States' legal obligations concerning the marine environment by establishing what areas are within and beyond national jurisdiction.

The London Protocol[35] and the OSPAR Convention[36] permit, and regulate, the long-term safe storage of carbon dioxide streams in geological formations. The London Protocol requires Parties to take effective measures to prevent, reduce and, where practicable, eliminate pollution caused by dumping at sea. The Protocol limits the types of materials that may be considered for dumping to those listed in Annex I of the Protocol. The Protocol was amended by Contracting Parties at their first meeting held in London from 30 October to 3 November 2006. Annex I of the Protocol – Wastes or other matter that may be considered for dumping – includes in the category of 'wastes or other matter', carbon-dioxide streams sequestered in sub-seabed geological formations (otherwise known as offshore geosequestration). Only CO_2 and incidental associated

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[31] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf, pp10-11.
[32] http://unfccc.int/resource/docs/2009/sbsta/eng/misc11.pdf#page=10
[33] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[34] http://www.un.org/Depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm
[35] 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972. http://www.imo.org/includes/blastDataOnly.asp/data_id%3D16925/LC1972.pdf
[36] The OSPAR Convention is a regional convention which applies in the north-east Atlantic. The full title of the convention is the Convention for the Protection of the Marine Environment of the North East Atlantic. http://www.ospar.org/content/content.asp?menu=00310108000007_000000_000000

substances derived from the source material may be considered for geosequestration purposes. No wastes or other matter may be added to the CO2 stream for the purposes of disposal. The amendment took effect on 10 February 2007.

This means that States Parties can regulate CCS in sub-seabed geological formations, for permanent isolation.

A '*Risk Assessment and Management Framework for CO_2 Sequestration*' has been developed under the London Protocol, and *'Guidelines for Risk Assessment and Management of Storage of CO_2 Streams in Geological Formations'* have been developed under the OSPAR Convention.

The London Protocol (as further amended in 2009) allows for the export of CO_2 streams for disposal, provided an agreement or arrangement has been entered into by the countries concerned[37]. Australia further notes that the 2006 IPCC Guidelines address the treatment of cross-boundary CCS projects, including where the reporting responsibilities lie where more than one country is involved.

The London Protocol and OSPAR Convention, and the 2006 IPCC Guidelines provide guidance when considering any trans-boundary issues that need to be addressed for CCS CDM projects.

In the event that trans-boundary issues arising from a project are not resolved to the satisfaction of the countries concerned, the project could be excluded from qualifying for CDM registration until resolution is achieved.

Australia also notes the recommendation in the EB 49 Report that '[d]ue to additional legal implications for cross-border storage it is suggested that CCS projects in the first and a second commitment period would be limited to take place within national boundaries and with no risk of migration across national boundaries'.

In order to address any possible international legal issues, Australia recommends modalities and procedures for CCS CDM projects approval procedures should require host countries, *inter alia* to:

i. establish governance arrangements for the deployment of carbon dioxide capture and storage;

[37] Note that in adopting the amendment to Article 6 of the London Protocol, Contracting Parties **noted**: "that the transboundary movement of carbon dioxide after injection (migration) is not export for dumping and therefore not prohibited by Article 6;" and **stressed** that management of shared formations is an important issue that should be addressed to ensure appropriate environmental protection. The amendment will enter into force for those Parties which have accepted it, after two-thirds of the Parties have deposited their instruments of acceptance with IMO. The amendment has not yet entered into force.

ii. establish measures to identify and address any trans-boundary seepage paths and/or potential impacts; and

iii. declare that, where trans-boundaries issues exist, the measures to address the issues have been agreed with all countries concerned consistent with applicable international obligations.

Modalities and procedures for CCS CDM project approval procedures should also require project participants to undertake comprehensive risk assessment and rigorous identification of project boundaries, and declare that the proposed project will comply with all applicable national laws and regulations for the deployment of CCS.

The potential for perverse outcomes

Concerns have been raised over perverse outcomes of inclusion of CCS in the CDM relating to:

i. CDM market implications;

ii. the increase of fossil energy production; and

iii. subsidisation of Enhanced Oil Recovery projects (EOR).[38]

Analysis contained in the EB 49 Report (including analysis in the UNFCCC's technical paper on '*Investment and financial flows to address climate change*'[39]) shows that inclusion of CCS is not expected to significantly impact on CER markets in the short to medium term, with uptake in developing countries being gradual over time.

Analysis by expert organisations such as the IPCC and the IEA unambiguously demonstrates that achieving an ambitious long-term global goal that would hold the increase in global temperature below 2 degrees Celsius will require deployment of the full range of low emission technologies across developed and developing countries. This analysis shows that fossil fuels will continue to supply a large share of global energy needs, particularly in rapidly industrialising developing countries. Deployment of CCS technologies under the CDM would mean that a proportion of this fossil fuel use is low emissions and climate friendly.

In its assessment of energy technologies for reducing GHG emissions by half in 2050, the IEA projected that CCS will need to contribute one-fifth of

[38] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[39] FCCC/TP/2008/7, Investment and financial flows to address climate change, November 2008.

the necessary emissions reductions to achieve stabilisation, which equates to global deployment of CCS capture of over 10 gigatonnes of carbon dioxide in 2050, with a cumulative storage of around 145 $GtC0_2$ from 2010 to 2050[40]. It also found that under this scenario developing countries would account for a growing proportion of CCS over time.

Based on these expert views, CCS deployment offers an important opportunity to make a significant contribution to the UNFCCC objective of stabilising atmospheric GHG concentrations, and particularly in reducing 'peak' greenhouse gas emission levels given many Parties will remain highly dependent on fossil fuels in the near-term.

The inclusion of CCS projects in the CDM would provide an important incentive for potential investments in projects for those developing countries that may wish to deploy this technology. This incentive can offset the incremental cost of the technology and provide markets with improved investment certainty, which would aid business planning for investment in long-lived and generally large-scale CCS projects.

Ultimately, the CDM should be technology-neutral and not prescribe or proscribe particular technologies. The inclusion of CCS as an eligible CDM project activity would support developing countries' access to technologies consistent with their preferred development path and would provide developing countries access to the economic incentives that are available for other emission abatement technologies.

Australia also considers that the perceived encouragement of projects such as EOR is not a reason for the exclusion of CCS from the CDM, as this issue is adequately addressed in the current CDM requirements to prove additionality.

Safety

Some Parties have raised safety concerns related to the inclusion of CCS in the CDM, notably in relation to the risk of catastrophic release of sequestered and stored CO_2.

As previously noted, CCS geological storage sites take advantage of trapping systems which prevent CO_2 movement and release, as in natural systems. As previously noted, the IPCC concludes that the fraction of injected CO_2 retained is very likely to exceed 99 per cent over 1000 years. Further, experts advise that best estimates of seepage rates by geologists

[40] http://www.iea.org/techno/etp/index.asp

are well below levels that would cause any significant increase in atmospheric CO_2 or risk to public safety[41].

The IPCC also found that with *'*appropriate site selection based on available subsurface information, a monitoring programme to detect problems, a regulatory system and the appropriate use of remediation methods to stop or control CO_2 releases if they arise, the local health, safety and environment risks of geological storage would be comparable to the risks of current activities such as natural gas storage, EOR and deep underground disposal of acid gas'[42]. As previously stated, many CCS practices have been adopted or adapted from the petroleum industry, which has over 100 years of experience in extracting oil and gas (and CO_2), and injecting fluids (water, gas, etc.) safely and securely underground, including over 30 years of producing, transporting and injecting CO_2 for enhanced oil recovery. It should also be noted that CO_2 is neither explosive nor flammable (unlike natural gas) and that people live near and literally on natural gas storage sites worldwide.

Safety risks should be assessed and addressed in each project. Australia considers that modalities and procedures for CCS CDM project approvals should require that the project participants, *inter alia*, undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths, and environmental, health and safety impacts.

Insurance coverage and compensation for damages caused due to seepage or leakage.

The use of insurance coverage and compensation for damages caused due to seepage or leakage has been raised in regard to CCS CDM projects.

Australia notes the finding in the EB 49 Report that liability risk can be reduced or removed from host countries with the use of instruments such as long-term financial bonds or insurance or contractual arrangements with the project operator. This is also explored in the IEA GHG report which considered that the management of contingent liability for seepage could be achieved through the establishment of *inter alia*: insurance, indemnities, escrow or contingency funds, and/or credit reserves. These measures should be considered.

[41] http://www.co2crc.com.au/dls/external/geostoragesafe-IEA.pdf
[42] http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf, p12.

Attachment B

Core elements of draft text for CCS in the CDM

The CMP:

1. *Notes* the final report to the Clean Development Mechanism Executive Board on "Implications of the Inclusion of Geological Carbon Dioxide Capture and Storage as CDM project activities".[43]

2. *Decides* that activities relating to carbon dioxide capture and storage in geological formations, including saline aquifers and excluding ocean sequestration, should be eligible as project activities under the Clean Development Mechanism.

3. *Requests* the Subsidiary Body for Scientific and Technological Advice to recommend modalities and procedures for Clean Development Mechanism project activities relating to carbon dioxide capture and storage in geological formations, with a view to forwarding a draft decision on this matter to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol for adoption at its seventh session, including modalities and procedures in relation to:

a) Definitions;

b) Role of Conference of the Parties serving as the meeting of the Parties;

c) Role of the Executive Board;

d) Accreditation and designation of operational entities;

e) Role of designated operational entities;

f) Participation requirements;

g) Validation and project registration;

h) Monitoring during project operation and following project closure;

i) Verification and certification;

j) Addressing non-permanence of carbon dioxide capture and storage project activities.

[43] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf

4. *Requests also* the Subsidiary Body for Scientific and Technological Advice, in preparing its recommendations pursuant to paragraph 3, to incorporate in the Clean Development Mechanism approval procedures and the project design document, as appropriate, requirements that the project participants, inter alia:

a) Define physical and operational project boundaries;

b) Undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths, and environmental, health and safety impacts;

c) Identify procedures for addressing the risks identified in subparagraph 4 (b) including for safe sealing and abandonment of the reservoir and for monitoring and accounting seepage of CO_2 emissions;

d) Declare that the proposed project will comply with all applicable national laws and regulations for the deployment of carbon dioxide capture and storage; and

e) Undertake and report on public and stakeholder consultation, including with any affected local and indigenous communities.

5. Further requests the Subsidiary Body for Scientific and Technological Advice, in preparing its recommendations pursuant to paragraph 3, to incorporate requirements that the host countries, inter alia:

a) Establish governance arrangements for the deployment of carbon dioxide capture and storage;

b) Establish measures to identify and address any trans-boundary seepage paths and potential impacts in accordance with applicable international obligations;

c) Declare that measures identified pursuant to subparagraph 5(b) above have been agreed with the countries concerned consistent with applicable international obligations; and

d) Affirm the declaration of the project participants pursuant to subparagraph 4 (d) of this decision.

6. *Requests also* the Subsidiary Body for Scientific and Technological Advice, in preparing its recommendations pursuant to paragraph 3, to incorporate in the Clean Development Mechanism procedures for the

accreditation of designated operational entities (DOE) the requirement that such entities possess the technical expertise necessary to discharge their validation and verification functions with respect to project activities relating to carbon dioxide capture and storage in geological formations.