Update on London Convention Activities on CCS

Tim Dixon

IEAGHG

ECO2 Annual Meeting

3-5 June 2014

IEA Greenhouse Gas R&D Programme (IEAGHG)

- A collaborative international research programme founded in 1991
- Aim: To provide information on the role that technology can play in reducing greenhouse gas emissions from use of fossil fuels.
- Focus has been on carbon dioxide capture and storage

IEAGHG

- Flagship activities:
- Technical Studies >250 reports published on all aspects of CCS
- International Research Networks -
  - Risk Assessment
  - Monitoring
  - Modelling
  - Environmental Impacts
  - Social Science Research
  - Solid Looping
  - *Oxy-combustion*
  - *Post-combustion Capture*
  - *Wellbore Integrity (PTRC)*
- GHGT conferences
- GHGT-12 Austin, Texas
- 5-9 Oct 2014

Input to IEA, UNFCCC, London Convention, ISO

London Convention and Protocol

- Marine Treaty - Global agreement regulating disposal of wastes and other matter at sea
- Convention 1972 (87 countries)
- Protocol 1996 – ratified March 2006 (44 countries as of Jan 2014)
- Annual Meeting of the Contracted Parties. Annual meeting of Scientific Group.

- How it works:
- Prohibition on dumping of all wastes, except for those listed in Annex 1, which need to be permitted under conditions in Annex 2.

- Annex 1: dredged material; sewage sludge; fish waste; vessels and platforms; inert, inorganic geological material; organic material of natural origin; bulky items primarily comprising unharmful materials, from small islands with no access to waste disposal options

London Convention and Protocol and CCS

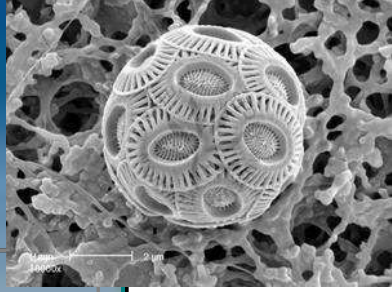
- Prohibited some CCS project configurations

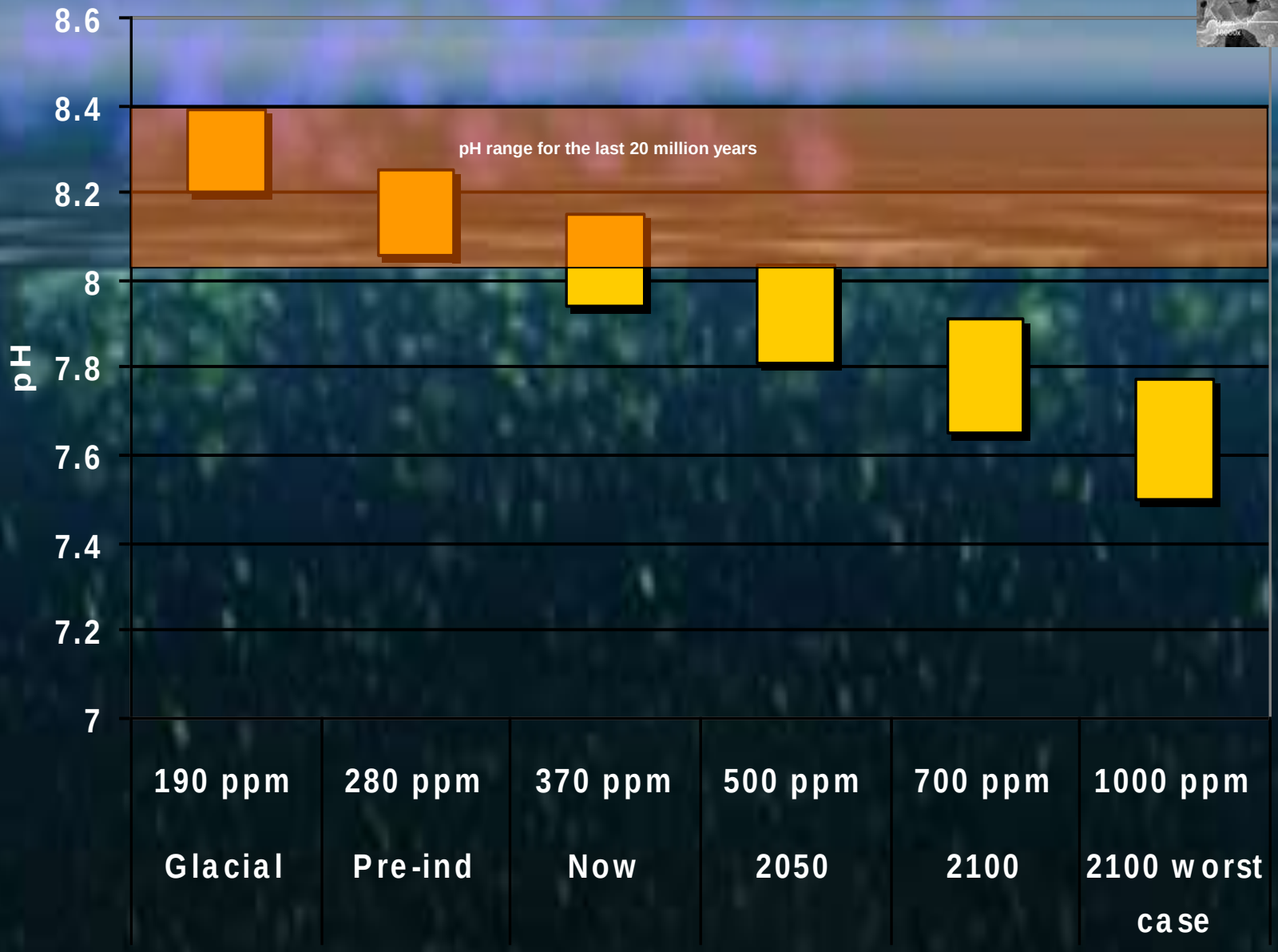
- CO2 Geological Storage Assessed by LC Scientific Group 2005/6
- 2006 - Risk Assessment Framework for CO_2

- To allow prohibited CCS configurations – Protocol amendment adopted at 28th Consultative Meeting (LP1), 2 Nov 2006 - came into force 10 Feb 2007 to allow disposal in geological formations

- CO_2 Specific Guidelines (2007)

Simulated and observed marine pH ranges till 2100





PML
2005

London Protocol Amendment

Allowed to dispose of " CO_2 streams from CO_2 capture processes for sequestration"

"Carbon dioxide streams may only be considered for dumping, if:

1. *disposal is into a sub-seabed geological formation; and*
2. *they consist overwhelmingly of carbon dioxide. They may contain incidental associated substances derived from the source material and the capture and sequestration processes used; and*
3. *no wastes or other matter are added for the purpose of disposing of those wastes or other matter."*

LC 28/15 (6 Dec 2006) Annex6

London Protocol – CO_2 Specific Guidelines

- "the CO2 stream, consisting of:

  1. CO2;

  2. incidental associated substances derived from the source material and the capture and sequestration processes used:

  .1 source- and process-derived substances; and

  .2 added substances (i.e. substances added to the CO2 stream to enable or improve the capture and sequestration processes);

- Acceptable concentrations of incidental associated substances should be related to their potential impacts on the integrity of the storage sites and relevant transport infrastructure and the risk they may pose to human health and the marine environment.

LC/SG 30/14 (Jul 2007) Annex 3.

London Convention

- **CO_2 Specific Guidelines** (2007 and revised 2012)
  - Introduction
  - Waste Prevention Audit
  - Consideration of Waste Management Options
  - Chemical and Physical Properties
  - Action List
  - Site Selection and Characterisation (inc marine area and potential exposure)
  - Assessment of Potential Effects (inc risk assessment impact hypothesis)
  - Monitoring and Risk Management
  - Permit and Permit Conditions

Supporting guidance in Risk Assessment and Management Framework (2006)

LC Requirements relating to ECO2

- Characterisation of marine area
- Evaluation of potential effects [of leakage]
  - ⇨ Risk Assessment
    - ⇨ Impact Hypothesis – impacts on sensitive areas, habitat, biological communities
- Monitoring programme (non-prescriptive on techniques) :
  - Performance (in reservoir)
  - Migration (out of reservoir)
  - *Seafloor and water to detect leakage*
  - *Marine communities for effects*

May be included

OSPAR

- Marine Convention for NE Atlantic, 1992
- 15 nations and EC
- Prohibited some CCS configurations
- Considered CCS and CO2 impacts
- To allow prohibited CCS configurations:
- Amendments (to Annexes II and III) for CO2 storage adopted June 2007
- Needed ratification by 7 Parties (8 ratified as of Oct 2011)
- Amendments came into force July 2011

- OSPAR Decision – requirement to use Guidelines when permitting, including risk assessment and management process
- OSPAR Guidelines for Risk Assessment and Management of Storage of CO2 in Geological Formations – includes the Framework for Risk Assessment and Management (FRAM)
- OSPAR Decision to prohibit ocean storage

London and OSPAR Guidelines for Risk Assessment and Management

- Scope – scenarios, boundaries
- Site selection and characterisation – physical, geological, chemical, biological
- Exposure assessment – characterisation CO_2 stream, leakage pathways
- Effects assessment – sensitivity of species, communities, habitats, other users
- Risk characterisation – integrates exposure and effects – Impact Hypothesis - environmental impact, likelihood
- Risk management – incl. monitoring, mitigation
  - **Monitoring programme** (non-prescriptive on techniques) :
    - Performance (in reservoir)
    - Migration (out of reservoir)
    - *Seafloor and water to detect leakage*
    - *Marine communities for effects*

May be included

LC RAMF 2007 and 2013, OSPAR FRAM 2007

London Protocol Transboundary

London Protocol Article 6

"EXPORT OF WASTES OR OTHER MATTER

Contracting Parties shall not allow the export of wastes or other matter to other countries for dumping or incineration at sea."

- Prohibits transboundary transport of CO_2 for geological storage
- 2009 LP4 (30 Oct) - Amendment to allow CO2 for storage was adopted by vote.
- Article 6 , new para 2 : 'Export of CO_2 for disposal in accordance with Annex 1 may occur, provided an agreement or arrangement has been entered into by countries concerned'
- Agreement shall include : permitting responsibilities; for export to non-LP Parties provisions equivalent to LP's for issuing permits.
- To come into force needs ratification by two thirds all Parties
- Transboundary movement of CO_2 streams after injection is not export in the sense of article 6, of the London Protocol.

LP Transboundary

2013 Update

- 2012 - Revised CO_2 Specific Guidelines approved and adopted at LC-34,Oct29, London. Covering subsurface transboundary migration. **Transboundary storage offshore now possible**
- 2013 - New 'Guidance on Export of CO_2 Streams for Disposal' approved to cover responsibilities for 'arrangements or agreements' for export
- **All safeguards are now in place for transboundary CCS activity in the marine environment, including export.**
- **But – 2009 Transboundary amendment for CO_2 export needs 29 countries to ratify in order to come into force. Only 2 so far** (Norway, UK), 4 more on way
- **So export of CO_2 still not permitted for offshore storage – unless for utilisation eg EOR.**

LP Transboundary

- Mr. Koji Sekimizu, the IMO Secretary-General in his opening speech to the 2013 LP meeting.
- *"The London Protocol currently is also the only global framework to regulate carbon capture and sequestration in sub-seabed geological formations…….*
- *However, it remains a* ***serious concern*** *that, to date, only two of the 43 London Protocol Parties have accepted the 2009 amendment, which is a long way from satisfying the entry-into-force requirements. The importance of securing its entry into force cannot be over-emphasized, if the threat of acidification of the oceans from climate change is to be minimized."*

IEAGHG Research Networks next meeting -

Monitoring Network + Modelling Network combined meeting

- 5-7 August, WVU, Morgantown, USA

covering:

- *Modelling:*
- Long-term predictability
- Heterogeneity and up-scaling capacity models
- Leakage pathways and fault transmissivity
- CO2-EOR

- *Monitoring:*
- Detection of leakage
- Quantification of leakage
- Offshore
- Cost-effectiveness
- Assurance

- Overburden
- Microseismicity
- Modelling to improve monitoring efficiency
- External perspectives
- Communicating to regulators

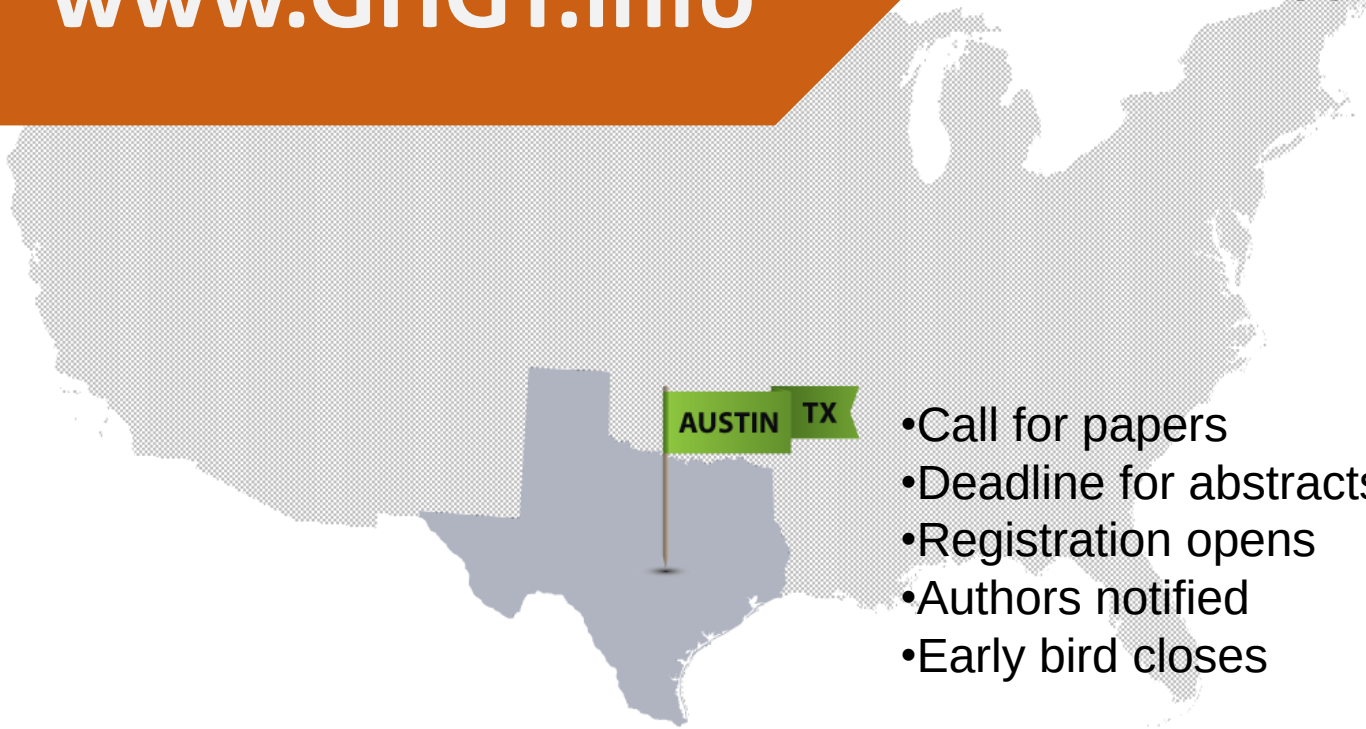
http://www.ieaghg.org/networks/monitoring-network

GHGT-12 AUSTIN, TX

www.GHGT.info

5–9 October 2014

AUSTIN, TX – USA



•Call for papers	27th September 2013
•Deadline for abstracts	10th January 2014
•Registration opens	7th March 2014
•Authors notified	2nd May 2014
•Early bird closes	13th June 2014

Thank You

Any questions?

tim.dixon@ieaghg.org
www.ieaghg.org

Unresolved issue – Transboundary CCS

London Convention and Protocol

- Transboundary amendment (2009) to allow CO2 export. Needs 29 countries to ratify to come into force. Only 2 so far, 4 more on way.
- IEA legal report on Options for Enabling Transboundary CO2 Transfer before LP amendment ratification, using 1969 Vienna Convention on the Law of Treaties :
  - Option 1: Interpretative resolution
  - Option 2: Provisional application
  - Option 3: Subsequent agreement through an additional treaty
  - Option 4: Modification of the operation of relevant aspects of the London Protocol as between two or more contracting parties
  - Option 5: Suspension of the operation of relevant aspects of the London Protocol as between two or more contracting parties
  - Option 6: Conducting CCS through non-contracting parties

Ocean Fertilisation and other Geo-engineering in the London Convention and Protocol

- Ocean fertilization: any activity with the intention of stimulating primary productivity. Does not include conventional aquaculture.
- Eg the intentional introduction of nutrients such as iron to the ocean to stimulate phytoplankton. Iron is often the limiting nutrient for their growth. Phytoplankton growth results in increased CO2 removal from the atmosphere for their photosynthesis.

- Geo-engineering: Marine geo-engineering means a deliberate intervention in the marine environment with the purpose of manipulating natural processes, including to counteract anthropogenic climate change and/or its impacts, and that has the potential for widespread, long-lasting or severe effects.

Ocean Fertilisation and other Geo-engineering in the London Convention and Protocol

- 2007. Consideration by the LC Scientific Group – statement of concern *"knowledge about the effectiveness and potential environmental impacts ……..was insufficient to justify large-scale operations"*
- 2008 Ocean Fertilisation Resolution "*given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed"*
- 2010. Developed an 'Assessment Framework' (2010) under which scientific research could be permitted
- 2012. "*The Parties… express grave concern regarding the deliberate ocean fertilization activity that was recently reported to have been carried out in July of 2012 in waters off the Canadian west coast. This activity, ….. involved the deliberate introduction into surface waters of 100 metric tonnes of iron sulfate. The Parties recognize the actions of the Government of Canada in investigating this incident*."
- 2012. Considered expanding to regulation of all marine geo-engineering activities

Ocean Fertilisation and other Geo-engineering in the London Convention and Protocol

- 2013. Proposal adopted to add Article 6bis to prohibit marine geoengineering unless listed in Annex 4 and permitted using generic Assessment Framework (to prevent pollution or reduce to a minimum).

- Annex 4 lists one activity – Ocean Fertilization
- Only for research purposes.
- Requires permit which uses Ocean Fertilization Assessment Framework

- Allows for the addition of other marine geoengineering activities in the future. Which will need specific assessment frameworks.

- Provides for a global, transparent and effective regulatory and control mechanism for marine geoengineering activities which have potential to cause harm to the marine environment.

Useful information sources and references

- IEA Regulatory Network http://www.iea.org/ccs/legal/index.asp
  (CCS Legal Review, Webinars, Model Regulatory Framework)
- UCL Carbon Capture Legal Programme http://www.ucl.ac.uk/cclp/ and http://www.globalccsinstitute.com/networks/cclp

- Dixon, T, et al. *International Marine Regulation of CO2 Geological Storage*. Elsevier Energy Procedia 1 (2009) 4503-4510
- Dixon, T. et al. *Trials and Tribulations of Getting CCS in an ETS*. Elsevier Energy Procedia 1 (2009) 4443-4450
- Dixon, T. et al. *Getting Science and Technology into International Climate Policy: CCS in the UNFCCC*. Elsevier Energy Procedia 37 (2013) 7590-7595