Update on IEAGHG Activities

Tim Dixon
IEA GHG R&D Programme

CSLF TG Meeting 7 October 2010

IEA Greenhouse Gas R&D Programme

- A collaborative research programme founded in 1991 as an IEA Implementing Agreement financed by its members
- Aim: Provide members with definitive information on the role that technology can play in reducing greenhouse gas emissions.
- Producing information that is:
  - Objective, trustworthy, independent
  - Policy relevant but NOT policy prescriptive
  - Reviewed by external Expert Reviewers
  - Subject to review of policy implications by Members
- Activities: Studies and reports (>120); International Research Networks : Wells, Risk, Monitoring, Modelling, Oxy, Capture, Social Research; Communications (GHGT conferences, IJGGC, etc); facilitating and focussing R&D and demonstration activities
- eg Weyburn; peer reviews.

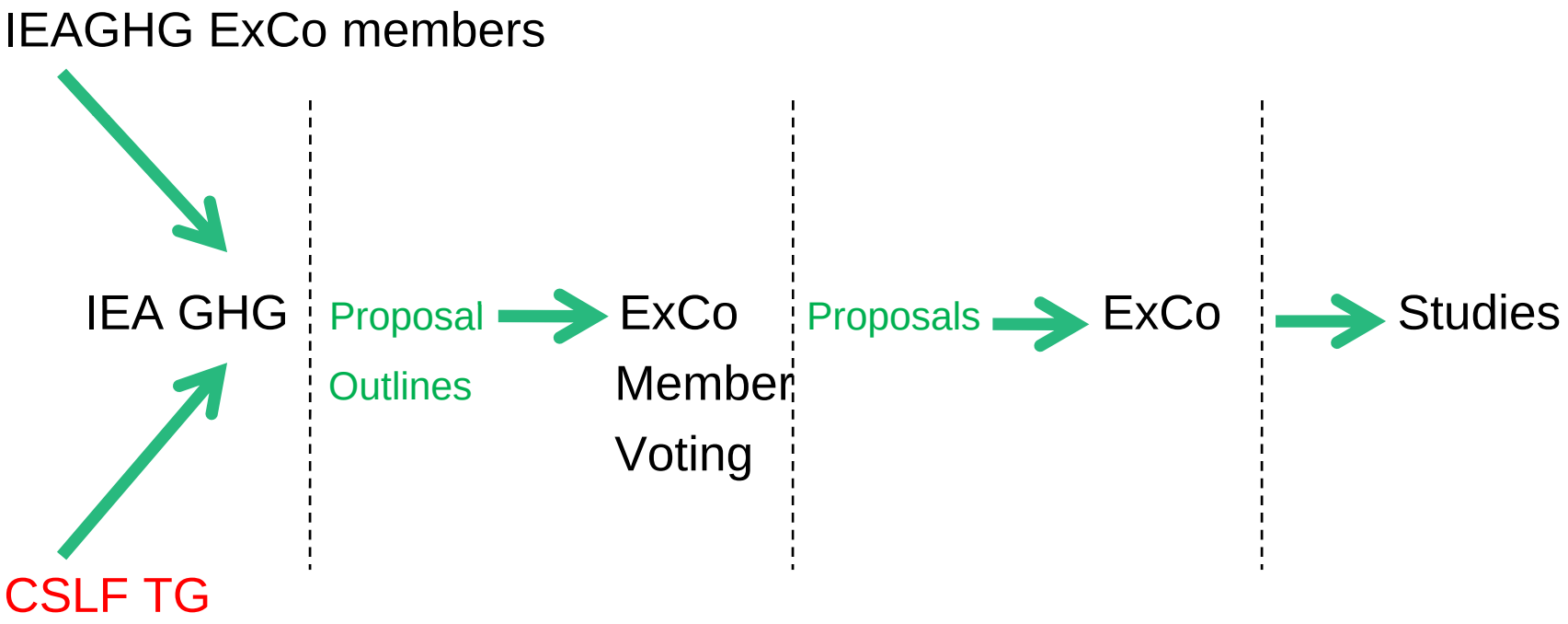

ALSTOM
B&W
power generation group
BG GROUP
bp
CEZ GROUP
Chevron
CIAB
VATTENFALL
ConocoPhillips
TOTAL
Enel
L'ENERGIA CHE TI ASCOLTA.
Statoil
eni
Evaluating technology options to mitigate greenhouse gas emissions
ieaghg
e·on
Schlumberger
EPRI
RWE
The energy to lead
REPSOL YPF
JGC
GLOBAL CCS INSTITUTE
ExxonMobil

Update on CSLF Collaboration with IEAGHG

Arrangement between CSLF Technical Group and IEA GHG

- How CSLF TG/PIRT and IEA GHG will interact for mutual benefit through increased co-operation
  - Mutual representation of each at CSLF TG and IEA GHG ExCo (no voting)
  - Liaison with PIRT co-chairs to discuss potential activities or projects – two way process
  - Activities would require approval by ExCo or TG
  - Due reference to org providing the resource
- Endorsed at ExCo Oct07 and TG Jan08

IEA GHG – Project generation



First study idea from CSLF: Storage Capacity Coefficients

- Report published and now available to CSLF TG/PIRT members
- ‘Development of Storage Coefficients for CO2 Storage in Deep Saline Formations’. IEAGHG Report 2009/13
- Presentation at CSLF TG Mar 2010

New Study Ideas Invited

- Two ideas provided by CSLF in 2010 :- Storage in Basalt; Storage in Shales
- Proposals submitted for Sep 2010 ExCo voting. Some voting in support, but did not reach threshold to proceed to studies. Will be resubmitted for next ExCo (April 2011)
- Additional new study ideas invited from CSLF TG/PIRT
- Outline required by Jan 2011

Update on IEAGHG activities

Current Studies (1)

Recently completed and/or published

- Corrosion and selection of materials for CCS – Innetech, Aug 2010
- Injection strategies for CO2 Storage Sites - CO2CRC, Aug 2010
- Building a Global pipeline infrastructure - Element Energy, Aug 2010
- Workshop on environmental impact of amine emissions – Aug 2010
- Life cycle analysis of CCS, literature review – FZJ, 2010
- Geothermal energy and CO2 storage – IEAGHG, 2010
- Removal of impurities from CO2 – Advantica, Sep 2010
- Retrofit and repowering with CCS - IC Consulting, Nov 2010
- Evaluation of the water usage and loss of power plants with CO2 Capture - Foster Wheeler Italia, Sep 2010
- Pressurisation and brine displacement – Permedia, Oct 2010
- Potential effects of CO2 waste stream impurities on geological storage – NRCan, Oct 2010

Current Studies (2)

Underway

- Quantification techniques for CO2 leakage - CO2GeoNet, March 2010
- Biomass and CCS – Ecofys, Dec 2010
- Potential Risks to Potable Groundwater from CO2 Storage – CO2GEONET, Jan 2011
- Global storage resource gap analysis (GCCSI) – GeoGreen, Mar 2011
- Emissions of substances other than CO2 from power plants with CCS – TNO, Mar 2011
- Cap rock systems – CO2CRC, Apr 2011
- Capacity constraints barriers to implementation of CCS – Ecofys, Apr 2011
- Monitoring for substances mobilised by CO2 storage – CO2CRC, May 2011
- Chemical emissions from post-combustion capture and deep removal – CSIRO, May 2011
- Impacts of high concentrations of SO2 and SO3 and CO2 capture systems - Doosan Babcock, March 2011
- CO2 Capture in the Iron and Steel Industry – MEFOS, Jun 2011
- Impacts of CO2 on rotating equipment – Foster Wheeler, Jun 2011

Current Studies (3)

Pending

- Storage cost calculator
- Ethical attitudes and CO2 storage
- Operating flexibility of CCS in future energy systems

- Financial mechanisms for long term liability

Current Studies (4)

New

- Post-combustion capture process scale-up challenges and strategy
- Abstraction of formation brine from CO2 geological storage
- Capture for gas-fired power plant
- Potential for reducing the life cycle emissions of CCS plant
- Use of renewable energy in CO2 capture
- Ship transport of CO2

IEA GHG Research Networks

- Bring together international key groups of experts to share knowledge and experience
- Identify and address knowledge gaps
- Act as informed bodies, eg for regulators
- Benefit experts and wider stakeholders
- Depend on experts' time and inputs – valuable and widely appreciated
- **Research Networks:**
  - Risk Assessment
  - Monitoring
  - Wellbore Integrity
  - Modelling (storage)
  - Post-Combustion Capture
  - Oxyfiring
  - High Temp Solid Looping Cycles
  - Social Research

Modelling Network

- Second meeting of modelling network held in University of Utah, Salt Lake City, February 16 – 17, 2010
- 60 participants
- Four sessions:
  - Modelling Methodology and Recent Advances
  - Intergrated Roles and Objectives
  - Real Storage Projects: Case Studies
  - Best Practice and Modelling Protocols
- 2011 meeting: Perth, W Australia. 25-27 April

Session 3 Experiences

- Objectives of modelling must be defined. Fluid models often not critical to history matching, but heterogeneity is important.
- Models provide range of possible outcomes, can be refined with time.
- Initial pilot/demonstration injection projects vital to obtain data.
- Current models give good estimations, despite knowledge gaps.
- Quality of input data is vital for modelling and it is important to understand the limitations of simulations and associated outputs.

Session 4: Best Practice

- Talks from SACS/CO2Store, Weyburn-Midale, US Regional Partnerships
- Discussions highlighted possible role of network:
  - placing and regional efforts in international context;
  - Promoting recommendations for best practice.

Wellbore Integrity Network

- Sixth meeting of wellbore integrity network held in Noordwijk Ann See, The Netherlands, April 28 – 29, 2010
- 59 participants
- Four sessions:
  - Regulation and Classification Guidelines
  - Experimental Developments
  - Projects and Practical Experiences
  - Summary and Discussion
- 2011 meeting: Perth, W Australia. 25-27 April

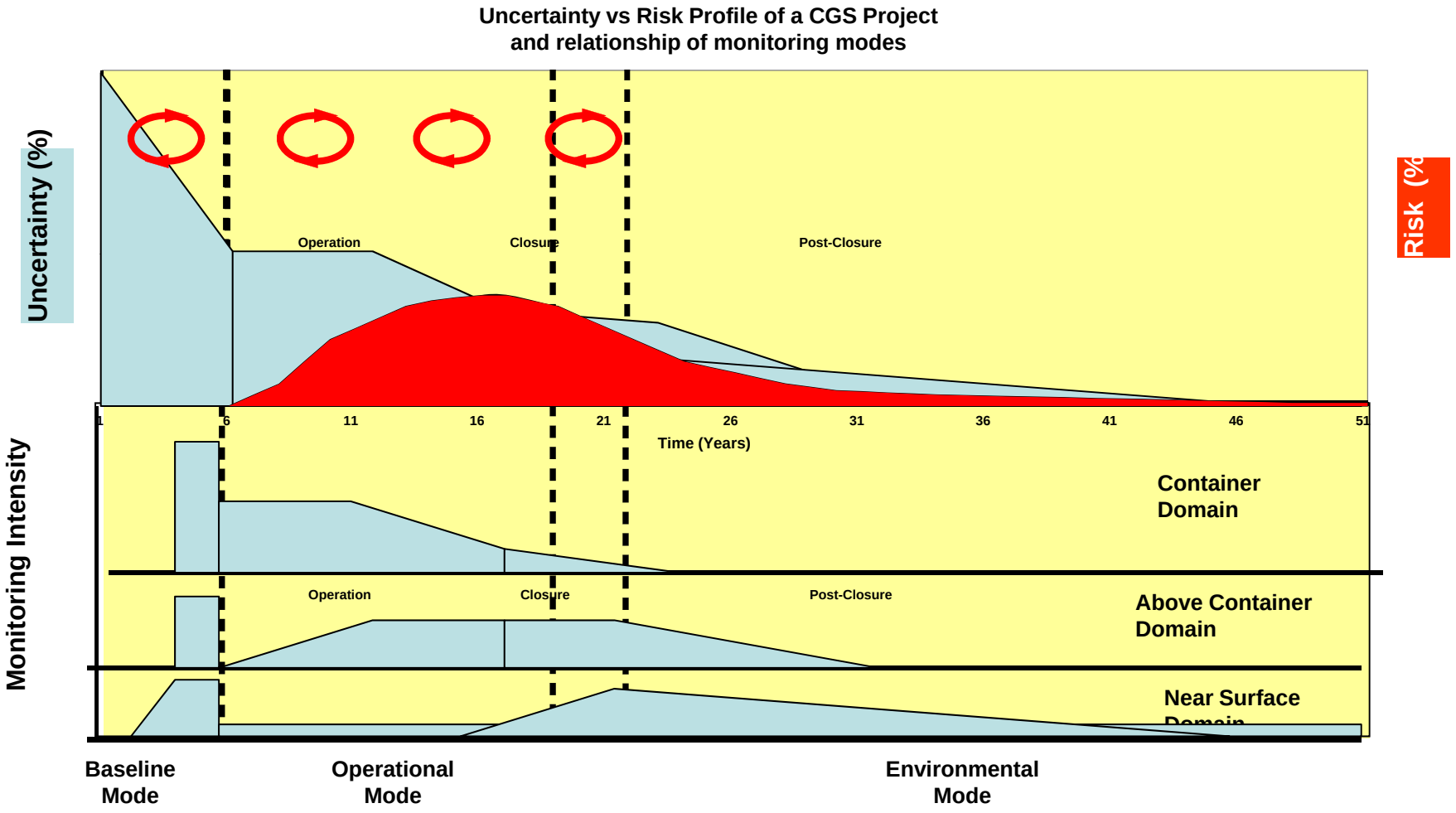
Summary

- New purpose-built wells for CO_2 storage unlikely to pose major risks
- Old wells will often require remedial work
- Increased recent focus on self-healing micro-annuli
- Presentations at the meeting included some new topics and ideas, e.g. Shale encroachment as a remedial tool
- Viable future for the network

Monitoring Network

- 6th Meeting of the Monitoring Network
- Natchez, Mississippi 6th -8th May 2010
- 6 Sessions:
  - Reports from Previous Meetings
  - Results from International Monitoring Projects
  - Results from US and Canadian Monitoring Projects
  - Monitoring in an Evolving Regulatory and Political Environment
  - Post-Injection Monitoring
  - Emerging and innovative monitoring techniques

Risk Profile



Meeting Outcomes

- Big shift in the breadth and quality of work being done. More details, knowledge and projects from which to learn.
- Needs to be more data integration of geochemical, geophysical and modelling work, and more research on permanent installations and microseismics.

- **Next Meeting – Potsdam, Germany June 2011**

Site Visit to Cranfield

Feedback from 5th Risk Assessment Network Meeting

COLORADOSCHOOLOFMINES
EARTH ENERGY ENVIRONMENT

IPAC-CO2 International Performance Assessment Centre For Geologic Storage of CO2

- Held 17th – 19th May in Golden, Denver, Colorado
- Hosted by the Colorado School of Mines
- Sponsored by the International Performance Assessment Centre for the Geological Storage of Carbon Dioxide (IPAC-CO_2)
- 50+ participants

Agenda

Session 0. Introduction and reports from other initiatives.

Session 1. Regulatory Requirements

Session 2. What can risk assessment deliver?

Session 3. Risk Communication

Session 4. Update from real projects

Session 5. Induced Seismicity/Geomechanics

Session 6. Long-term risk management

Session 7. Conclusions and recommendations

Session 7. Conclusions and recommendations

- Recurring Learnings:
  - Need to address adequacy of existing and emerging regulations: pro-active
  - Important to build trust with public, and take care with terminology used.
  - Need to define reasonable levels of acceptability
  - Need for data from projects to improve understanding of risk profiles.
- Gaps:
  - Need for more information on monitoring performance
  - Need for greater interaction between RA Network and Monitoring Network
- Recommendations:
  - Further work needed on metrics for quantification of risk
  - Benchmarking between projects: open knowledge sharing
  - Use analogues to understand processes in addition to models
  - Define terminology and ensure consistency (IEAGHG Report)
  - Encourage greater industry presence at RAN workshops
  - Provide information for regulators: in-depth training

1st Post-Combustion Capture Conference (PCCC1)

- Building on the success of the international capture network (12th meeting was held in Regina September 2009);
- PCCC1 will be hosted by Masdar in Abu Dhabi;
- 17th-19th May 2011;
- Sponsors
- Future: Tsinghua University in China showed an interest in hosting the 2nd conference.

Major Themes

- Solvent development
- Capture process concepts and process integration
- Solvent degradation
- Equipment corrosion
- $2^{nd}/3^{rd}$ generation capture technologies
- Pilot plant and demonstration projects
- Process scale-up and risk analysis
- Capture process modelling
- Environmental impacts and chemical emissions

Dates to Remember

PCCC1
Post Combustion Capture Conference

Call for Abstracts

OPENS ON 1st October 2010!

01/10/2010	**Abstracts submission opens**
01/12/2010	**Conference registration opens**
15/01/2011	**Abstract submission deadline**
15/03/2011	**Notification of acceptance for presentations**
01/04/2011	**Early bird registration closes**
17-19/05/2011	**1st post-combustion capture conference**

Update to the Oxyfuel Combustion Research Network Activities

- 2010 Activiities:
  - Asia Pacific Programme – OFWG Capacity Building Course

- 2011 Activities
  - 2nd Oxyfuel Combustion Conference (OCC2)
  - Special Workshop on SO2/SO3/Hg/Corrosion issue in Oxyfuel Combustion

Oxyfuel Combustion Conference 2

ieaghg

Callide Oxyfuel Project

Call for Abstracts

2nd International Oxyfuel Combustion Conference

12th – 16th September 2011

Capricorn Resort, Yeppoon, Australia

xstrata coal

VATTENFALL

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Leakage Impacts Workshops

- **2nd workshop on Natural Releases of CO_2**
- Building knowledge for CO_2 Storage EIAs
- Maria Laach, Germany. 2-4 Nov 2010
- Hosted by CO2GeoNet/BGR

- Regulatory requirements
- Marine releases, magnitudes, impacts
- Terrestrial releases, magnitudes, impacts
- Mobilisation of brine and metals
- Near surface vs deep subsurface mechansims
- Monitoring

Site visits

IEAGHG Summer School Svalbard 2010

- 4th International Interdisciplinary CCS Summer School in Longyearbyen, Svalbard, Norway August 2010
  - 221 applications received and 56 students selected
- So, now have a IEAGHG CCS Summer School alumni of 226
- Mentored Student programme at GHGT-10

Greenhouse Gas Technologies Conference (GHGT)

- Premier International GHG conference
- Main focus is on CCS
- Held every two years
- GHGT-8, 2006 – Trondheim, Norway
  - 950 Delegates
- GHGT-9, 2008 – Washington, USA
  - 16th – 19th November
  - 1500 Delegates
- **GHGT -10, 2010 – Amsterdam, Netherlands**
  - **1600 Delegates (55 countries)**
  - **269 oral papers**
  - **698 poster papers**

IEA GHG Collaborations

- GCCSI
- EU ZEP, and EU CCS Demonstration Network
- IEA, and IEA Regulators Network
- CSLF
- APP Programme – Oxy Fuel working group
- IPAC
- CO2GeoNet
- UNFCCC and London Convention


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