Theme B - Geological Storage

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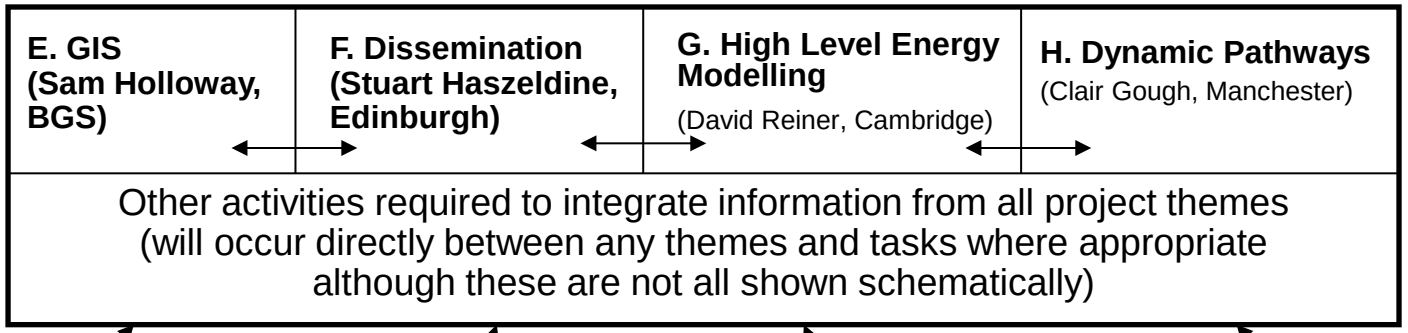
Theme B Objectives

- Refine current estimates of the storage capacities in saline aquifers and oil & gas fields.
- Reduce the uncertainty around potential leaks and long-term site performance.
- Assess the costs and additional economic benefits of geological storage.
- Improve data integration through GIS and DSS.

Suggested Structure with Carol's changed labelling…



A. Fossil Energy Systems and CO2 Capture and Transport (John Oakey, Cranfield)

A1. Fossil fuel supply (Tim Cockerill, Reading)

A2. CCS synergies with other low emissions technologies (Jon Gibbins, Imperial)

A3. Fossil fuels and CCS as bridge to H2 economy (John Oakey, Cranfield)

A4. Fossil fuel utilisation with CO2 capture (John Oakey, Cranfield)

A5. UK CO2 transport infrastructure (Martin Downie, Newcastle)

A6. UK real time electricity supply and CCS plant (Chee Chen, Manchester)

B. Geological Storage (Jonathan Pearce, BGS)

The workshop identified a number of areas of work that will be mapped to subthemes and given owners in due course. For further details contact Jonathan Pearce (jmpe@bgs.ac.uk)

i. Estimates of storage capacities

ii. Leaks and long term performance

iii. Monitoring and verification

iv. Remediation

v. Costs and economic benefits

C. CCS and the Environment (Carol Turley, PML)

Tasks and timeframes were discussed and reported back to the group. For further details contact Carol Turley (ct@pml.ac.uk)

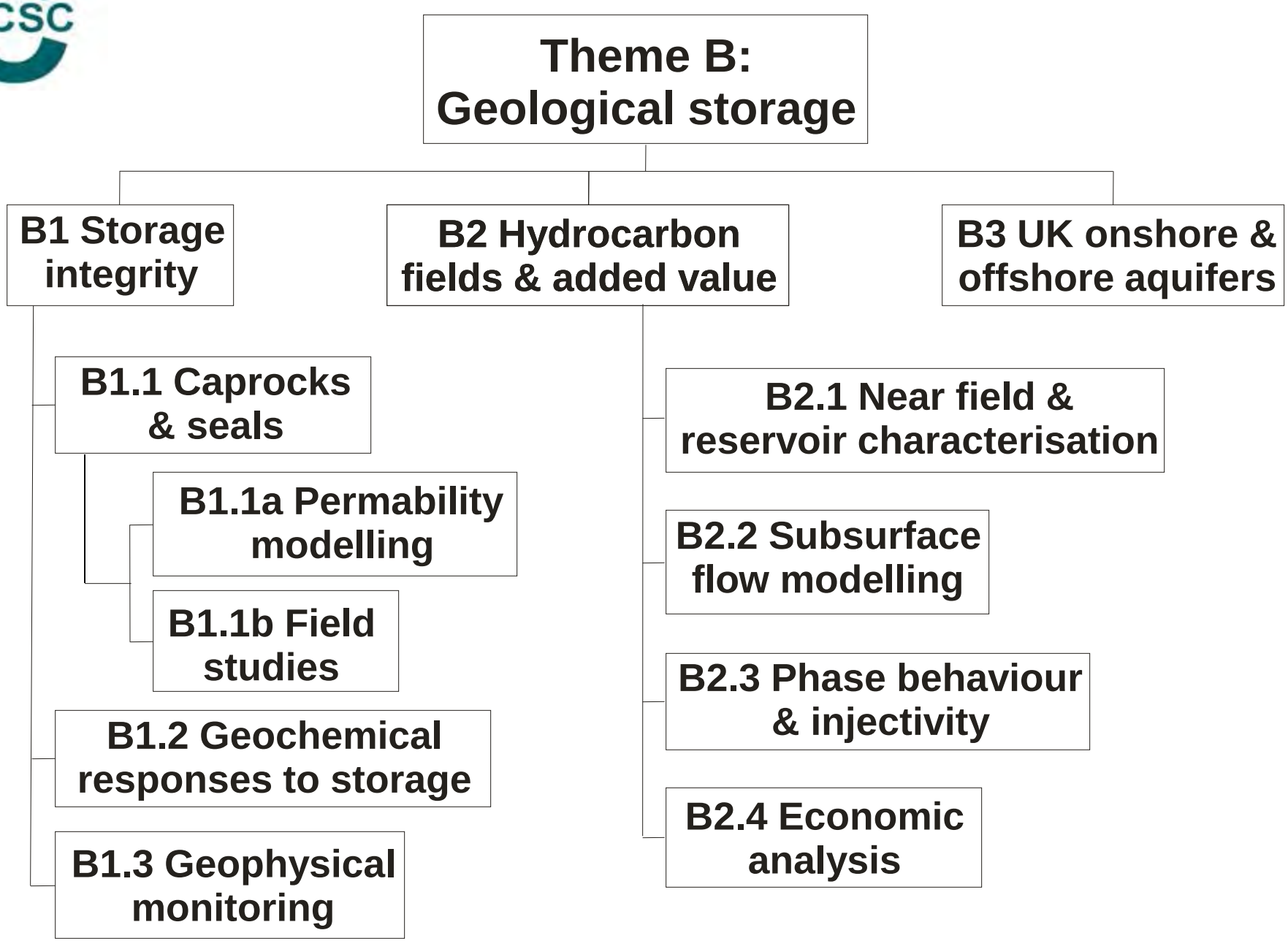
D. Social Processes in relation to CCS (Simon Shackley, Manchester)

G1. Media (Simon Shackley, Manchester)

G2. Business Models (David Reiner, Cambridge)

G3. Responsiveness to events (David Reiner, Cambridge)

Note: Simon Shackley is planning to go on sabbatical later this year. During that time David Reiner (Cambridge) will be responsible for overseeing this theme and Sarah Mander (Manchester) will lead work on the media (G1).



B1 CO_2 Storage integrity

- B1.1 Caprocks and Seals
  - Model development to estimate relative permeabilities of mudstones from
    - Capillary pressure-saturation data
    - Pore network modelling
  - Field studies of areas where CO_2 naturally leaks through mudstones
- B1.2 Geochemical responses to storage
  - Pilot kinetic experiments
  - Database of fluid thermodynamic and reaction-kinetic properties
  - Geochemical and isotopic monitoring of fluid flow and reactions
- B1.3 Geophysical monitoring
  - 3D(4D) wave propagation modelling using Sleipner data
  - Passive seismic interpretation using Weyburn data.

B1 Storage Integrity

- B1.1a Permeability modelling (Andy Aplin)
  - New relative permeability model for mudstones based on experimentally derived pressure-saturation data.
  - Permeability is derived using a specific inverse functional technique.
  - Model provides good results on different mudstones and compares well with Van-Genuchten Model (used for clayey soils)
- Influence of faults on CO2 Injection
  - Leeds employed a post-doc to look at the influence of faults on CO2 injection.
  - Statoil to give Martin Blunt the Gullfaks model so he can investigate the optimum methods for EOR.
  - Generated a database of fault properties to use in the Gullfaks simulation model to investigate the effect they have on EOR

B1 Storage Integrity

- B1.1b Field Studies (Stuart Haszeldine, Zoe Shipton)
  - Post-doc, Stuart Gilfillan, now recruited.
  - Our intended work plan will focus on :
    - Fractured caprock and gas leakage chimneys
    - Fault properties
    - Fault damage zone properties
  - The final outcomes are intended to be
    1. Assessment of different trap (sealing) types for CO2
    2. Will CO2 injection change the sealing properties of the trap?
    3. Recommended work practice to assess and minimise leakage risk
    4. contribution to quantifying FEP analyses of critical risk pathways

B1 Storage Integrity

- B1.2 Geochemical responses to storage
  - Leeds and Cambridge appointed post-docs
  - Using North Sea reservoir water chemistry database to inform experimental programme
  - Identifying rate-controlling steps in reactions between CO2 and formation waters
  - Bulk of results will be available in 15 months.

B1 Storage Integrity

- B1.3 Geohysical monitoring
  - Paper completed on mathematical modelling of the Sleipner plume in collaboration with Mike Bickle.
  - *Modelling Carbon-Dioxide Accumulation at Sleipner: Implications for Underground Carbon Storage*. Mike Bickle, Andy Chadwick, Herbert E. Huppert, Mark Hallworth and Sarah Lyle

B2 Hydrocarbon fields and added value from CO_2

- B2.1 Reservoir characterisation of candidate North Sea fields
- B2.2 Subsurface flow modelling
  - Reservoir modelling
  - Coupled geochemistry, dispersion and phase exchange between CO_2, hydrocarbons and porewater
- B2.3 Phase Behaviour and injectivity in CO_2/EOR process
  - Multiphase compositional phase behaviour model
  - Verified against laboratory measurements

B2 Hydrocarbon fields and added value from CO_2

- B2.2 Subsurface flow modelling (Martin Blunt)
  - Performed a reservoir simulation study of CO_2 injection for storage and EOR in the Maureen field in the North Sea.
  - Proposed design criteria to maximise both CO_2 storage and incremental oil recovery.
  - Presently awaiting data from other fields to extend this study.

B2 Hydrocarbon fields and added value from CO_2

- B2.4 Economic analysis (Alex Kemp)
  - Estimates of capture and transportation to EOR fields and storage sites.
  - Estimate benefits of additional oil and decommissioning deferral.
  - Calculations of national costs and returns including reduction of CO_2 emissions and taxation impacts.

B2 Hydrocarbon fields and added value

- B2.4 Economic analysis (Alex Kemp)
  - Modelling Future Production from UKCS including Timing of Cessation of Production and Availability of Infrastructure
    - Modelling of future production with a newly-updated field database is now nearly completed.
    - The financial simulation modelling shows prospective production of oil, gas and NGLs to 2035 by different categories of fields.
    - The dates of likely production termination are estimated for all fields individually and may be used in studies on the potential EOR and for measuring the time window of opportunity for instigating CO_2 injection and EOR schemes.

B2 Hydrocarbon fields and added value

- B2.4 Economic analysis (Alex Kemp)
  - Supply/Cost Curve Modelling
    - An economic model of the Supply/Cost Curve for CO_2 Capture Sequestration and EOR in the UKCS is now nearly complete.
    - Alex needs high-quality cost information relating to the four main cost centres.
    - In turn this depends to some extent on inputs from other members of the consortium.
    - Similarly, with regard to the likely size of EOR, inputs from other members of the consortium are essential.
    - Some help with the subject of injectability would also be helpful.

B3 UK offshore & onshore aquifers:

- Characterise selected offshore sites
- Improve previous estimates of UK storage capacity
- Upgrade existing decision support tool.
  - Current & planned sources
  - Pipeline routes
  - Sinks
- Improve GIS functionality to provide information on:
  - Technical aspects
  - Economic aspects
  - Environmental aspects
  - Social aspects

B3 UK offshore & onshore aquifers

- A basic web-enabled GIS is now on the BGS web site http://www.bgs.ac.uk/co2/ukco2.html
- The Esmond field eclipse model was sent to HW so an MSc student can look at it.
- Sam negotiating with BGS about putting additional datasets on the web-enabled GIS
- BGS looked at the Sherwood Sandstone Group petrology and log porosity in the Southern North Sea and will be producing a paper on it.