Towards Modalities and Procedures that Address Long-term Risks
OVERARCHING RECOMMENDATION

• Establish best practice criteria with input from a panel of geographically diverse independent experts in the following fields:
  – Engineering
  – Geology
  – Law
  – Social Science
  – Environment
  – Finance
OVER TIME, RISK DECREASES

Figure Courtesy of Julio Friedmann, LLNL
NRAP INTEGRATED ASSESSMENT MODELLING

Integrated Assessment Model
- Storage site described by subsystems
- Subsystem behavior can be treated in detail
- Uncertainty/heterogeneity handled by stochastic descriptions of subsystems

Storage Reservoir

Potential Receptors or Impacted Media
- Groundwater Protection
- Wellbore Integrity
- Natural Seal Integrity
- Reservoir Performance

Release and Transport

NRAP Technical Working Groups
- System-Level Risk Modeling
- Strategic Risk-Based Monitoring

Slide courtesy of Grant Bromhal, NETL
RECOMMENDATIONS TO ENSURE PERMANENCE

• Establish CCS project criteria to ensure that best practices for the following are employed.
  – Criteria for site selection based on geologic characteristics of the site
  – Operational and long-term monitoring
  – Risk assessment
• Long-term stewardship, including the availability of resources for long-term monitoring
RECOMMENDATIONS TO ENSURE PERMANENCE VIA LONG TERM MONITORING

- Establish monitoring criteria for CCS projects that ensure a site-specific MMV plan is developed and implemented which:
  - covers the area of injected fluid and any displaced fluids
  - requires data reporting and review
  - Establishes criteria for determining when monitoring can end
## LIABILITY (DECEMBER 2010, CCS IN THE UNFCCC)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>CCS Liability Framework</th>
<th>Application</th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>The Australian Government accepted 80 percent, and the Western Australian Government 20 percent, of any post-closure liability for CCS in the long term</td>
<td>Gorgon LNG project</td>
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<tr>
<td>Canada</td>
<td>No unique liability for CCS, governed by same rules as oil and gas operations, although provincial rules are under consideration in Alberta and Saskatchewan</td>
<td>All CCS projects</td>
</tr>
<tr>
<td>European Union</td>
<td>Liability and responsibility for CCS is transferred to the member state’s “competent authority”, after operator proves that there is no risk of leakage and 20 years of post closure monitoring are complete.</td>
<td>All CCS projects</td>
</tr>
<tr>
<td>United States</td>
<td>State-level policies are in place in seven states which include a variety of policy approaches from operator retains liability to state accepts full liability/responsibility. No national framework for CCS liability exists.</td>
<td>All CCS projects in select states</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Adopted the EU directive, with the government acting as the “competent authority”</td>
<td>All CCS projects</td>
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</tbody>
</table>
RECOMMENDATIONS FOR LIABILITY

• Develop and agree to procedures for evaluating host country post-closure stewardship mechanisms

• Support projects only where adequate management of liability is evident
Site Selection

Monitoring Plans

Risk Assessment

Injection Simulation

Area of Review

Regulatory Framework

Liability and stewardship

Public engagement

Site-specific geological Characteristics

Data routinely collected and reported

Beyond the CO₂ plume

Reviewed and renewed with time
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