



Monitoring and Verification

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Purpose

- Assure human and ecosystem health and safety
- Provide assurance that performance predictions are being met
- Provide early warning of leakage in the subsurface
- Verification for trading etc



Technology

- Well based technologies
 - Well integrity, bond integrity
 - Surface and internal changes
 - Reservoir fracture pressure
- Monitoring
 - Seismic
 - Non-seismic
 - Geochemical, surface and down-hole
 - Surface CO₂ detection



Monitoring detail

- Well-bore integrity
- Volumes injected
- Migration in subsurface
- Direct techniques
- Indirect techniques
- Subsea techniques
- Shallow subsurface
- Ground surface movement
- Air quality



Monitoring gaps

- Testing pre-existing and abandoned wells
- Frequency of monitoring
- Climatic variations
- Use of ecosystem changes
- Quantification of injected volumes
- Measurement of dissolved CO₂
- Field trials of surface CO₂ flux tools
- Subsea leaks – dissolved CO₂



Monitoring gaps

- If no leaks, then shallower techniques not-needed
- Identify leaks in subsurface
- Identify leaks along wellbore
- Fractures that may be intersected and nature of these fractures
- Surface or near surface leaks
- Define thresholds of acceptable leakage



Other needs

- Bring down cost of seismic surveys (although cost is minor component of total)
- Resolution of seismic
- Quantification
- Fracture identification
- Surface remote sensing techniques
- Well bore monitoring – outside casing
- Guidelines for pre-injection surveys
- Integration of monitoring techniques
- Leaks in subsurface environments
- Leakage thresholds
- Timelines for monitoring – understanding the monitoring required for assessment of performance of storage (not mentioned in text)



Suggestions

- Use of existing and suggested projects to test technologies (Otway Basin, Ketzin, Sleipner, Weyburn)
- Endorsement of IEA GHG Monitoring and Verification Network or other such networks