

CCS Monitoring Plan Development

ARB Technical Discussions in Support of CCS QM Development

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August 5, 2016

Drawing on Experience

- WRI CCS Guidelines
- DOE Regional Carbon Sequestration Partnership Initiative and Best Practice Manuals
- Carbon Sequestration Council joint comments on UIC Class VI and GHG Reporting Rules
- Initial work on Elk Hills monitoring plan
- Oxy Denver Unit MRV Plan
- ISO 265 for CO₂ Capture, Transportation, and Geological Storage

Starting Observations

- This process is in support of ARB development of a CCS Quantification Methodology (QM) not a UIC permitting program
- CCS refers to the full chain of capture, transport, and storage however the focus of the technical discussion is on the storage component
- ARB questions also raise the issue of CCUS in the form of EOR

Main Points Regarding CCS/CCUS Monitoring Plans

- Base monitoring plans on site conditions
 - Site characteristics
 - Operational history
 - Operational plans / procedures
- Focus on cost-effective approaches
 - Impacts CO₂ purchase price
 - Impacts economic drivers for capture projects
- Retain flexibility to adopt/encourage monitoring improvements

1. Assess Site Conditions

- Determine site specific potential leakage pathways as well as existing infrastructure and procedures to monitor them.
- Elements of review include:
 - Site Characteristics – Questions
 - How well is the site characterized?
 - Any characteristics of importance (e.g., existing traps, extensive confining layer(s), faults, fractures, history of seismicity, non oil/gas wellbores)?
 - Boundaries?
 - Other reservoir constituents of interest (e.g., H₂S)?

Site Conditions(cont.)

- Operational History - Questions
 - Nature of operations?
 - Level of documentation?
 - Potential for unknown wells, induced fractures, or other issues?
- Operational Plans and Procedures - Questions
 - How will reservoir pressure be managed?
 - Procedures for modeling, monitoring and maintenance?

2. Develop Tailored Monitoring Program

- Determine the cost-effective suite of monitoring tools and approaches to provide data for quantifying storage and detecting potential leaks
- Site assessment allows focus on site specific concerns rather than generic concerns
- Site assessment may favor or rule out different technologies (e.g., surface flux, 4-d seismic)
- Generally, higher degree of certainty at sites with “good bones” and extensive operational history means more finely tuned monitoring

3. Build on Existing Infrastructure and Procedures

- In cases of CCUS, existing infrastructure/procedures may also be utilized to provide monitoring data regarding storage
 - Injection pressures
 - Routine facilities inspection and maintenance
 - HSE monitoring for constituent gases such as H₂S
- Focus shifts to ensure data collection and storage integrity rather than new monitoring wells

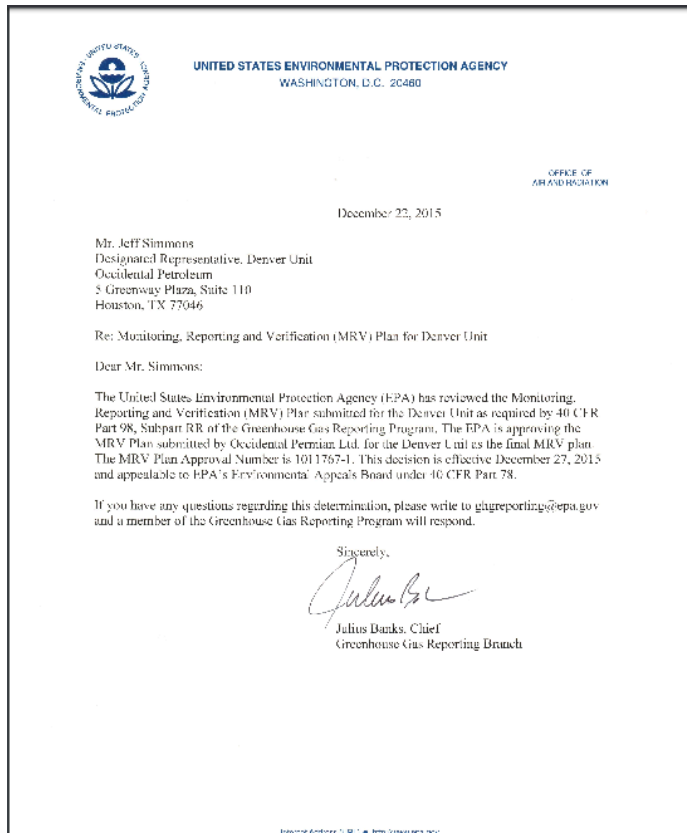
4. Anticipate Tech Improvements

- Significant improvements in CCS/CCUS technical knowledge and technology are on the horizon (from CCS/CCUS R&D and other areas of subsurface activity)
- For example:
 - Katherine Romanak's presentation on attribution efforts at Weyburn
 - LDAR programs in oil and gas industry
 - More to come from DOE RCSP and NRAP programs, the oil and gas industry
- Don't stifle innovation by locking in or excluding specific technologies

EPA GHG Reporting as Example

- Subpart RR monitoring plans include the following elements:
 - Delineation of maximum and active monitoring area
 - Evaluation of potential surface leakage pathways
 - Strategy for detecting and quantifying leaks
 - Strategy for developing baselines
 - Site specific considerations for quantifying stored CO₂
 - Well identification
 - Commencement date

Oxy's Denver Unit MRV Plan As Example



- Site assessment showed good bones and strong history
- Ongoing operations provided foundation for monitoring
- Interaction with EPA was invaluable learning experience for EPA and Oxy

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Questions?

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