


Mr. Alexander Mitchell
Manager, Emerging Technology Section
Oil and Gas and GHG Mitigation Branch
Industrial Strategies Division
California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95812

February 3rd, 2017

Re: Common design principles for Carbon Capture & Storage Quantification Methodology

Dear Mr. Mitchell,

We, the undersigned, span a wide spectrum of capped and uncapped companies, academic institutions and non-profit organizations located in California, as well as across the nation, that believe Carbon Capture & Storage (CCS) can play a meaningful role in reducing emissions from large point sources that use fossil fuels in the power and industrial sector, as well as in decarbonizing transportation fuels, statewide, nationwide and internationally. In particular, we believe CCS can play a meaningful role in helping California achieve its 2030 and 2050 greenhouse gas (GHG) reduction targets – where

technically and economically feasible – while also helping other states reduce their GHG footprint by using the best science and methodologies available for CCS.

We are encouraged by the Air Resources Board's (ARB) progress towards drafting and adopting a Quantification Methodology (QM) for CCS, which would allow the technology to deliver carbon dioxide emission reductions under California's climate programs. We consider the adoption of the QM to be an important and essential first step towards realizing the substantial carbon reductions that are available to California through the use of CCS technology. As a future next step, we urge ARB to consider appropriate revisions to its climate programs that will increase the likelihood of CCS deployment and remove unintentional barriers.

We came together over recent weeks to discuss common principles upon which we believe the first version of the QM (the "Concept Paper") should be based. We respectfully submit those for your consideration, and stand ready to answer any questions.

Common principles for QM Concept Paper

- The QM should be performance-based to the extent possible and avoid limiting the choice of technologies or materials.
- Acceptable sequestration settings should be limited to those that can expected to yield secure long term storage.
- Pressure management through brine withdrawal should be allowed provided this does not compromise the security of storage of injected carbon dioxide (CO_2) and that withdrawn brine is regulated appropriately.
- Eligible projects under California's climate change programs that are located outside the state's borders should be allowed to participate and comply if the project manager provides sufficient documentation that the QM's objectives are met through equivalent requirements.
- The QM should be designed to accommodate site-specific geologic characteristics, as opposed to a one-size-fits-all approach.
- Concurrent production of oil and/or gas (enhanced oil/gas recovery) should be admissible under the QM.
    - ARB should not require Underground Injection Control permitting under Class VI for all such projects de facto.
- The following should be required for projects:
    - A risk assessment consistent with guidelines and principles outlined by national or international standards associations.
    - Characterization to determine that sites are capable of long-term containment of CO_2.
        - The "storage complex" should be defined in each case, and actions defined in case it is breached.
        - The potential for induced seismicity should be taken into account.
    - Identification and characterization of potential natural and man-made leakage pathways.

        - To inform the design and implementation of appropriate barriers to leakage including design, construction and operation parameters to prevent, mitigate and remediate the creation or activation of leakage pathways.
            - Leakage pathways may be physical (e.g. faults or fractures), man-made (e.g. wells) or logistical (e.g. production and release of CO_2 by another party after closure)
- Appropriate monitoring, measurement and verification systems.
    - Monitoring and modeling to predict and confirm the position and behavior of the CO_2 and other fluids in the subsurface during and after injection.
    - The emphasis on monitoring should be in the subsurface, where detection of fluid migration is best managed.
    - Surface monitoring should generally be reserved for cases where atmospheric leakage is suspected.
- Accounting and reporting of CO_2 quantities sequestered, injected, recycled, vented, and any other categories as appropriate.
- If a leak to the atmosphere is discovered, best engineering practices should be used to estimate and measure the quantity leaked using appropriate technologies.
- The use of "custody transfer" quality metering should be allowed and accuracy verification requirements should be consistent with existing state standards at limited locations:
    - Where CO_2 streams from different sources are comingled.
    - At manifolds at storage locations.
- Use of operations quality meters should be allowed at all other important measurement points:
    - Injection wellheads.
    - Inlet to capture facility.
- Fluid sampling frequency to determine the composition and mass of injected CO_2 should take into account the variability of the CO_2 source(s)
- Quantification of CO_2 emissions related to operations from surface equipment.
- Definition and agreement with the regulator of a site hand-over plan consistent with the risk-profile of the storage complex, including:
    - Post-injection site monitoring and modeling requirements until it can be shown that atmospheric leakage is not occurring nor is expected to occur.
        - Specifically, when monitoring data and reservoir simulations are mutually consistent at a given time (history match) and forward simulation shows that the system will behave in a desirable manner.
        - In some cases, an operator may be unable to remain on site after production of minerals has ceased. Requirements for such sites should be clarified.
- Financial responsibility requirements that ensure operators are capable of operating and decommissioning sites according to the requirements of the QM.

    - To the extent appropriate and applicable, requirements under existing regulatory programs should be used.
    - The climate/allowance financial assurance requirements should be based on the risk profile of leakage. For example, a fee could be levied (once, or annually) based on the risk profile of leakage, as opposed to a requirement to hold financial assurance for the projected value of allowances for the full amount of CO_2 injected over the entire life of the project.
- Requirements for the operational phase of projects should be allowed to be revised based on ongoing data gathering and simulation, and adjusted to ensure cost effectiveness, quality and usefulness.
- In enhanced recovery settings, certain characteristics such as the abundance of operational data or the presence of a high number of wells (and their condition) that could act as leakage pathways should be taken into account.
- The use of approved certification bodies should be considered as a requirement for projects.

Sincerely,

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[1] The views of the researcher do not necessarily represent the views of Stanford University.