Western States Petroleum Association
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Catherine Reheis-Boyd
President

July 5, 2018

Clerk of the Board
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: WSPA Comments on Carbon Capture and Sequestration element of the ARB Proposed 15-day Modifications to the Low Carbon Fuel Standard Regulation Amendments

Clerk of the Board:

The Western States Petroleum Association (WSPA) appreciates this opportunity to provide comments to the California Air Resources Board (ARB) regarding the Carbon Capture and Sequestration (CCS) element, of the ARB Proposed 15-day Modifications to the Low Carbon Fuel Standard (LCFS) Regulation Amendments. Specifically, the comments herein address Section 95490 (Provisions for Fuels Produced Using Carbon Capture and Sequestration) and Attachment B - Proposed Modifications to the Carbon Capture and Sequestration Protocol (CCSP) under the Low Carbon Fuel Standard. WSPA is a non-profit trade association representing companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas and other energy supplies in California and four other western states. WSPA will be providing additional comments regarding other aspects of the proposed 15-day modifications in a separate comment letter.

WSPA sees the CCSP as the roadmap by which successful projects could be permitted and constructed. However, there remain project requirements related to buffer account contributions and post injection site care and that could impact the feasibility of projects.

The Proposed 15-day Modification requires operators to surrender between 3 and 12% of credits into the Buffer Account as insurance against potential leakage or credit invalidation and to update the risk rating every time the project goes through verification.

In addition, it still requires 100 years of post-injection site care (PISC). The WSPA comment letter of April 23, 2018 on the CCSP portion of the Proposed Low Carbon Fuel Standard Regulation Amendments clearly expressed that these proposed leakage risk ratings are an arbitrary construction that has no basis in any CO_2 geological storage technical literature, expert opinion, or legal "precedent".[1] ARB neither cites nor even provides a correct interpretation of the examples in the putative Special Report on Land Use, Land Use Change, and Forestry (SR-LULUCF) analog from the Intergovernmental Panel on Climate Change.

[1] While ARB staff has cited legal and technical reasons to treat CCS the same as forestry, there is no legal nor technical basis justifying the same treatment:
https://www.arb.ca.gov/lists/com-attach/127-lcfs18-VjpQN1QhUmkGYQdq.pdf

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ARB also seeks to require a guaranteed additional credit reserve of 5% of total stored CO_2 to cover the risk of up to 100% reversal during the period from 50 years after injection has ceased up to 100 years after injection has ceased. The premise of 100% reversal is flawed. Only in very specific cases would it be even theoretically possible to get up to one-half back (e.g., structurally-closed depleted gas fields as opposed to "open", dipping reservoirs)[2] or, conceptually, from gas caverns.

WSPA continues to believe that the actual risks are substantially lower and the credit bank imposed by ARB is excessive.

Proposed Additional 5% Buffer Account Contribution

ARB uses a "model" to justify the proposed 5% buffer for the second half of the PISC. This assumes 20 projects (20 years injection @ 1 MT/year each = 400MT). Should one project have a complete (up to 100%) reversal, the other projects would need to have perfect containment to avoid exhausting the 5% buffer. Presumably, ARB would not permit a CO_2 storage project that was not designed for effective dispersal and trapping of CO_2 with time. After 20 years of operation and 50 years of PISC, the plume would be dispersed over a large area with a diminishing portion of free CO_2 present in thinning plume. WSPA is concerned that the "model" assumes complete failure, whereas the plausibility of an individual or portfolio of projects suffering reversal(s) on the multi-percentage scale should be considered.

Should a far field conduit be encountered, even an open borehole, a variety of processes including relative permeability effects and pressure decline with reservoir depletion would effectively limit CO_2 loss. The actual loss would be a function of specific reservoir properties and plume / pressure state in time and space, but these factors would be constrained in the initial risk assessment required for permitting and updated with surveillance driven numerical modeling. In addition, the model used to evaluate this risk does not consider mitigation of leakage events. In the case of an actual problem, mitigation would be required and would substantially reduce the actual volume of CO_2 leaked from the formation.

A recently published paper[3] uses CO_2 flux data from natural and engineered systems, as input to predictive statistical simulations using various scenarios (e.g., density of abandoned wells, regulatory rigor). The "Storage Security Tool Calculator (SSC)" tool is available to test scenarios. The authors' main conclusion was:

> "Even when applying these conservative input parameters, results from the SSC illustrate that CO_2 storage in regions with moderate abandoned well densities and ***that are regulated using current best practice will retain 98% of the injected CO_2 over 10,000 years in more than half of cases, and result in maximum leakage of 6.3% of the injected CO_2 in fewer than 5% of cases (emphasis added).*** As expected, we find that unregulated storage is less secure. Here, however, over 10,000 years, only 22% of injected CO_2 will leak in half of cases, with the possibility that up to 33% of the injected CO_2 could leak in 5% of cases. This leakage is primarily through undetected and poorly abandoned legacy wells, and could be reduced through identification and remediation of leakage if a comprehensive site screening and monitoring program is deployed. Importantly, natural subsurface trapping mechanisms mean that this leakage will not continue indefinitely. Consequently, even with mitigation actions restricted solely to repair of abandoned wells that blow out, regions with a legacy of poorly

[2] Snippe & Tucker, CO_2 Fate Comparison for Depleted Gas Field and Dipping Saline Aquifer, Energy Procedia, December 2014

[3] https://www.nature.com/articles/s41467-018-04423-1

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> regulated subsurface operations can reliably and robustly store and retain 78% of injected CO_2. We find that regulators can most effectively improve CO_2 storage security by identifying and monitoring abandoned wells, and perform reactive remediation should they leak."

Further, CCSP Section 2.2 (Risk Assessment) methodology does not appear to be internally consistent. Specifically, ARB will not approve projects unless there is greater than a 90% chance that the loss will be less than 1% over the project life and subsequent century. Mathematically, it is very difficult to define a risk profile for the remaining 99% of stored CO_2 that results in expected losses of 8-16% (i.e., the minimum and maximum Buffer Account rates +5% post-closure premium).

Notwithstanding these significant concerns, WSPA presents in this comment letter for ARB consideration alternatives for PISC and options for Buffer Account contributions.

Alternatives for Post-Injection Site Care

WSPA suggests the following alternatives to the PISC requirements for ARB consideration:

Alternative 1. For the post-injection site care (PISC) and site closure requirements to address activities that occur following cessation of injection: The owner or operator must continue to monitor the site for up to 100 years following the cessation of injection, or as approved by the EO, an alternative timeframe, until it can be demonstrated that plume stability has been achieved and no additional monitoring is needed to ensure that the project does not pose an endangerment to the atmosphere or subsurface resources; following this, they must plug the injection and monitoring wells and close the site.

Alternative 2. For the post-injection site care (PISC) and site closure requirements to address activities that occur following cessation of injection: The owner or operator must continue to monitor the site for up to 100 years following the cessation of injection or after a review period as outlined below. The 100 years will include a review every 25 years after cessation of injection, an assessment of plume stability status, for which if it is demonstrated that CO_2 plume migration and pressure changes are small and predictable, no additional monitoring is needed to ensure that the project does not pose an endangerment to the atmosphere or protected subsurface resources. The owner or operator must plug the injection and monitoring wells and close the site.

Alternative 3. The post-injection site care (PISC) and site closure requirements address activities that occur following cessation of injection: The owner or operator must continue to monitor the site for up to 100 years following the cessation of injection until it can be demonstrated that plume stability has been achieved; following this, the owner or operator must plug the injection and monitoring wells and close the site. Periodic aerial survey inspections at 5-year intervals would be conducted to ensure continued mechanical integrity of the plugged system.

Options for Buffer Account Contributions

Given the stage of this process, at a minimum, WSPA requests that ARB consider the following options to providing credits to the Buffer Account:

Option 1. A simple solution is to give developers the option to: contribute to the Buffer Account at the rates established through the table in Appendix G or allow for the purchase private insurance that guarantees the credit availability up to the rates assessed in Appendix G. ARB should be indifferent to holding credits in the Buffer Account compared to an insurance policy that guarantees remittance of an equivalent number of credits in the event of a reversal. If the insurance contract lapses during any

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verification period, the operator could be required to remit the corresponding amount of credits cumulatively due to the Buffer Account. If ARB is the named beneficiary to the insurance contract, it could hold the contract and monetize enough credits earned each year to pay the premium and maintain the policy current. Such insurance products are not yet commercially available in which case the operator could have the option to switch to an insurance scheme from the Buffer Account method when desired.

Option 2. Reduce the potential burden imposed upon the Buffer Account and therefore the level of the Buffer Account rates by first reducing the number of credits issued in the year when any leakage is detected from the total quantity of CO_2 stored during that crediting period. Only when quantities leaked exceed the total amount of CO_2 injected/stored during the current period would the state draw from the operator's Buffer Account contributions.

Option 3. Grant the operator the option to pay 5% per year into the Buffer Account or self-insure and retain the risk of 100% reversal for the final 50 years of the PISC or purchase insurance covering the risk of 100% reversal upon completion of the final risk assessment when ARB authorizes closure of injection and monitoring wells.

WSPA looks forward to ARB's responses to our comments. If you have any questions, please contact me at this office, or Tom Umenhofer of my staff at (805) 701-9142 or via email at tom@wspa.org.

Sincerely,

cc: Tom Umenhofer - WSPA

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