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Vice President

May 31, 2017

Ms. Elizabeth Scheehle
Branch Chief
California Air Resources Board
1001 I Street
Sacramento, California 95814

sent via email: Elizabeth.Scheehle@arb.ca.gov

Re: WSPA Comments on ARB May 8, 2017 Carbon Capture and Sequestration Workshop

Dear Elizabeth,

The Western States Petroleum Association (WSPA) appreciates this opportunity to provide initial feedback on the California Air Resources Board (ARB) staff presentation at the Carbon Capture and Sequestration Workshop, held on May 8, 2017 in Sacramento, CA. WSPA is providing these comments as part of a continuous effort to provide feedback on Climate Change-related items presented by ARB. 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 appreciates ARB staff's thorough review of the information gathered through the series of workshops, dating back to February 2016, held on Carbon Capture and Sequestration (CCS) and their preliminary indication of provisions for inclusion in the final rulemaking later this year. The most recent workshop presentation, CCS Concept Paper, and CCS Summary Paper all indicate that ARB staff's thinking is progressing nicely toward the degree of specificity that will be needed in resolving several key issues while also recognizing that there are important areas where review is still ongoing where answers to stakeholder questions are currently unavailable.

General Comments

WSPA is pleased to see that ARB appears to recognize the degree of variability of key features among individual sites. However, we are concerned that, despite this realization, ARB may be leaning toward proposing very specific conditions that would apply to all situations. We continue to urge ARB staff to implement flexible, performance-based approaches wherever possible such as a risk-based approach for project selection and operation. Similarly, we want to ensure ARB maintains a technology-neutral approach going forward that will allow performance based criteria to be employed as technologies and materials evolve into the future.

WSPA agrees with many of the core issues raised by ARB staff. For example, we agree with the acknowledgement of the specific nature and unique requirements of individual sites both on the CO_2 capture and sequestration sides of the design principles and provisions into the Concept Paper. We also agree that ensuring safety and maintaining storage integrity are key sustainability principles in characterizing and selecting sites and implementing procedures to monitor operations and implement compliance reporting.

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WSPA would like to express the need for caution regarding some of the provisions in the current proposal that appear overly-conservative and potentially in conflict with a pragmatic approach that is needed to preserve the potential role that CCS can play in the future. We recommend that ARB begin with the fundamental principle that injected CO_2 remains sequestered unless data from monitoring and record keeping indicates otherwise. In this context, we find the following elements in ARB's current thinking potentially problematic:

- The 50 or 100-year post closure monitoring period.
- The requirement that CO_2 cannot be transferred from sequestration sites or that such sites (wells) cannot ever be reopened.
- The apparent prohibition against the use of old legacy sites due to the age of such wells.
- The inclusion of any mandated CCS controls or direct measures in the regulation.

Specific Comments and Suggestions

Risk-Based Site Analysis – Site Characterization

- A conservative, prescriptive "check box" approach is offered for "ideal sites" whereas a "flexible" approach would be followed for more complex sites. What is ARB's view of an "ideal" site, particularly in California?

- A secondary pressure containment reservoir with a seal would be required in the ARB staff proposal – this might eliminate a significant number of otherwise suitable sites. It would be better for the site developer to describe how pressure would be dissipated in the system, if the primary seal were breached.

- A pressure dissipation layer (with seal) below the injection reservoir to avoid induced seismicity is required – this should only be considered if injection is close to the crystalline basement which is otherwise covered by assessing induced seismicity risk.

Risk-Based Site Analysis – Area of Review (AoR)

- ARB Envisions a Class VI type AoR for CCS and carbon capture and utilization (CCU) – CO_2 EOR would have the advantage of being more tightly constrained already and having better data on plume location/trapping with the Monitoring, Reporting, and Verification (MRV) requirements.

- There appears to be a question of whether the location of the CO_2 plume should be used to establish AoR – A reservoir simulation would and should be used to accomplish both (this becomes critical with the post-closure MRV period).

Injection or Production Well Materials & Structural Integrity

- There is indication that CO_2 resistant cements will be required. Our experience has been that the quality of cement emplacement is more important and there may be complications achieving good cement jobs with resistant cements.

- Monitoring and remediation plans for potential leakage from wells will be required – curiously, other (non-well) leakage path monitoring measures are included in this section. WSPA would like to better understanding as to why ARB feels that they should be included.

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Operations

- Focus on pressure management is reasonable (also see MRV comment below).

- An injected CO_2 purity standard may be introduced to prevent well integrity issues – Presumably SOx/NOx forming acids are of concern (H_2S is not particularly corrosive in solution) but depending on the mole percent, these may not add much more acidity potential than carbonic acid. The operator should be permitted to present a model showing acidity risk.

Monitoring, Reporting & Verification (MRV)

- Continuous pressure monitoring in all wells (injection, monitoring and if applicable production) would be required. This is reasonable to a point but may involve significant maintenance of equipment. Less costly "above zone" monitoring should be permitted as a trade-off in-reservoir monitoring wells.

- There are implied requirements for the type and location of monitoring instrumentation – this should be determined by the AoR analysis. The choice of technology should be based on relative risk and simulations (i.e., seismic does not work in some settings and technology is evolving).

- The 50- or 100-year post closure monitoring period that is reduced only with vague criteria is highly problematic. "Plume stability" is mentioned as a key criterion but this needs to be defined or are MRV data consistent with reservoir simulations (and this can be reliably projected into the future)?

- WSPA prefers a concise, model-based approach to proposing a default (and lower) number as a starting point for a check box or scorecard test.

- Pre-Injection: Based on technical analysis/modeling, set a preliminary post-closure period that would allow the proponent to develop a P10-, 50-, 90-probability model. While it is expected that ARB will incorporate a default post-closure period, the Lawrence Berkeley National Laboratory (LBNL) checkbox or "scorecard" could be used to determine whether this goes up or down from some more modest period.

- Have set review periods once injection starts (e.g., 1, 5, 10, 15, 20, 30 years) to propose adjustments to AoR and appropriate operating parameters and/or MRV deployments

- Five years before planned injection cessation review project migration forecast (AoR, CO_2 state and movement) and address potential hazards within adjusted AoR (e.g., wells, transmissive faults). Set a risk-based target post-injection time period.

- Perform periodic reviews to adjust target post-injection period up or down.

- Base granting a closure certificate and limited liability release on performance criteria

- ARB is apparently implying that leakage through the overburden to the surface should be monitored (i.e., set up in advance with baselines). A "deep and early" philosophy should be proposed whereby reservoir surveillance anomalies would trigger localized overburden surveillance. Soil/atmospheric gas grids and underground sources of drinking water (USDW)

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monitoring wells should be avoided (ARB has heard compelling R&D results from University of Texas – Bureau of Economic Geology on this item).

Economics

- The discussion of CCS economics on pages 24-26 of the Summary Paper focuses on capture cost, and at times, staff appears to equate capture cost with the full CCS cost. They only briefly touch on transportation and storage cost in the last two sentences of the section (on page 26): *"Transportation and storage costs highly depend on the distance between emission sources and storage sites, volume of CO_2 emissions (affect economies of scale), and the utilization of pipelines (underutilization increases transportation and storage cost). Additionally, there is cost associated with monitoring, and post-injection site care."* It is not clear whether ARB fully appreciates the potential significance of MRV costs, depending on the requirements they put in place. The relative cost of CO_2 transportation and MRV can be significant, especially for non-combustion CO_2 sources such as ethanol or natural gas processing plants.

- ARB characterizes hydrogen production as a "low hanging fruit" opportunity (page 25), while cement is one of the sectors where "capture cost is perceived to be significantly higher." Cement plants produce concentrated CO_2 streams and are at least as attractive for CCS as the current design of hydrogen plants. Presumably by "low hanging fruit" staff is referring to the "old style" hydrogen plants - steam methane reforming (SMR) with methanizer and CO_2 scrub - with almost pure CO_2 exhaust. The newer design plants are based on SMR + pressure swing adsorption (PSA) system with CO_2 concertation around 15-20%. Depending on their configuration, the exhaust coming out of cement plants can be as high as 33%.[1]

- In discussing the concept of a CO_2 pipeline network and injection hubs (page 4), ARB is exploring the concept of pipelines connecting CO_2 sources to appropriate injection sites "to reduce CCS costs and complexities." WSPA would like to see ARB elaborate on how this would work, and in particular, the MRV requirements for entities who inject CO_2 into the network.

Emissions Boundary

- In addition to emission accounting methodology, defining CCS system boundaries is a key focus area in ARB's development of CCS procedures and protocols. In the Concept Paper (page 3). it discusses different CCS system boundaries for the Cap & Trade program vs the LCFS: "Under the Cap & Trade QM, the system boundary will be defined to align with the entities that generate a compliance obligation and is likely to include the sequestration site, subsurface, and equipment" vs "Under the LCFS, staff plans to draw a system boundary that includes the substantial sources of emissions for CCS projects, essentially capture, compression, transport, and injection of CO_2." WSPA would like ARB to discuss the differences and the potential for added accounting work.

- *"Staff is considering a project system boundary that begins with generation and capture of CO_2. Emissions upstream of CO_2 generation would be assigned to the primary product causing those emissions."* It is unclear how this would work in the case of natural gas processing plants where geologic CO_2 is separated and then either released to the atmosphere or routed for sequestration or other use. WSPA requests clarification as to how the released CO_2 will count against the plant or whether the plant will get credit for capturing the natural CO_2. In doing so, perhaps there is a

[1] CO_2 Capture Technologies for Cement Industry, Bosoaga, Masek, Oakley, February 2009.

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need for ARB to distinguish between geologic and combustion CO_2. Obviously, there will be emissions associated with the CO_2 separation, capture, or compression steps that also need to be addressed.

- It seems unreasonable to have both operators and pore space owners jointly responsible for permanence of sequestration. Although the example given may be reasonable (pore space owner notifies ARB about planned drilling post-closure), there may be other provisions that are untenable for both parties.

Credit Allocation

- While we recognize that the Quantification Methodology's (QM's) current purpose is to address the credit process in LCFS, WSPA sees its value in setting a reasonable standard for both LCFS and Cap & Trade. WSPA agrees that capture and storage facilities do not need to be co-located. We suggest that rather than making the storage facilities a "co-applicant" and thereby complicating the process, that the storage facilities will have their own permits. Alternatively, WSPA suggests that storage facilities should be permitted and designated as an applicant.

- For refineries that would capture CO2 from steam methane reforming units, heater stacks or co-generation units, it is not clear how credits would be calculated under the LCFS program. Would the credits be calculated per section 95489(f) of the existing regulations (Refinery Investment Credit Pilot Program) or would the credits be subject to a more specific calculation?

- ARB proposes to provide credits to the capture facility based on the principle that the capture facility is removing CO_2 from its emission stream. This may work based on a simple case where there are not two potential options for credit generation. However, if there are potential LCFS credits options between CO_2 sources, such as ethanol and EOR, this division could be managed via contract.

  For example, if an EOR source manages CO_2 from several sources, then all may not be subject to LCFS crediting. If the EOR facility, for example, sends crude oil to CA, then some credits should be allocated to that crude. There may be cases where the EOR facility is better equipped to provide the application information to ARB rather than an ethanol plant. In all cases, the applications will be reviewed and tested for environmental integrity. WSPA suggests a flexible system to facilitate CCS and credit generation without pre-judging the best place to give credits at the start.

- WSPA requests feedback from ARB as to whether ARB will encourage the development of CO_2 pipelines for the gathering of the CO_2 produced at the refineries in the Los Angeles and San Francisco Bay areas, and for the transportation of the CO_2 to the appropriate fields for injection and sequestration.

- ARB should clarify its plans to account for captured CO_2 that is ultimately used for industrial processes with "temporary storage" such as chemicals, plastics, fuels, and food & beverage industries. The same applies to those semi-permanent storage products, such as carbonates and construction materials.

- There appears to be insufficient support offered by ARB on the position that permanent closure of CO_2 EOR sites would be required or that transfer of CO_2 from field to field would be disallowed. It would seem more appropriate for ARB to provide the flexibility to review and evaluate the

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specifics of the change in status being proposed rather than an outright prohibition or counting the CO_2 as emitted.

WSPA appreciates this opportunity to provide our initial input regarding the Carbon Capture and Sequestration Workshop. If you have any questions, please contact me at (805) 701-9142 or via e-mail at tom@wspa.org.

Sincerely,

cc: Xuping Li, ARB (Xuping.Li@arb.ca.gov)
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