



BP America, Inc.

Ralph J. Moran
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Via Email

Mr. Sam Wade
California Air Resources Board
1001 I Street, Sacramento, CA

Re: BP Comments on CARB's November 6th LCFS Workshop on the Accounting and Permanence Protocol for Carbon Capture and Geologic Sequestration under Low Carbon Fuel Standard

Dear Mr. Wade:

BP appreciates the opportunity to submit comments on the 2018 LCFS Preliminary Draft Regulatory Amendment Text regarding "Accounting and Permanence Protocol for Carbon Capture and Geologic Sequestration under the Low Carbon Fuel Standard" (Protocol) presented at the November 6th CARB Workshop.

BP commends CARB for inclusion of Carbon Capture, Use and Storage into the Low Carbon Fuel Standard, and looks forward to assisting the state in providing leadership in enabling the use of this important technology. Carbon Capture, Use and Storage (CCUS) has been widely acknowledged as a critical tool in meeting the Paris Climate Agreement goals. CCUS technologies are proven, reliable, ready and cost effective. However, in order to meet the Paris targets, scale-up needs to be accelerated and the technology requires targeted policy support like other low carbon energy technologies. CARB's recognition of the significance of this technology is an important step – though it is critical that the Protocol is designed to attract investment and to enable a critical mass of deployment. A protocol that is overly prescriptive has the potential to hinder rather than enable deployment of this potentially game-changing technology.

BP is an integrated and diversified energy company with a significant presence in the fuel supply market and experience in large-scale integrated CCUS projects. BP participates in the In Salah, Algeria CO₂ storage project (in operation 2004-2011) which is now in the post-injection site care phase. We also participate in the Bab, Abu Dhabi CO₂-EOR pilot project, in operation since 2006, as part of the Al Reyadah CCUS project.

We are currently exploring near-term CCUS deployment opportunities in our own operations, projects and products – such as applying CCUS to high purity CO₂ sources in

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upstream gas processing and downstream crude oil refining. BP is also active in the Oil and Gas Climate Initiative, which has earmarked some \$500 million in funding for potential investments related to CCUS. We believe that BP is well positioned to contribute to this dialogue, and we appreciate CARB's willingness to consider our input.

Our specific input on the draft Protocol is as follows:

Definition of CO2 storage complex and "CO2 leakage"

BP recommends that the Protocol eliminate the redundant storage complex criteria (dissipation interval + secondary confining layer) to maintain alignment with other established site characterization regulations (such as the Environmental Protection Agency's (EPA) UIC Class VI rules) and so as to avoid unnecessarily precluding qualification of proven, acceptable sites. There are an abundance of sites which have proven storage capability and capacity (such as oil and gas reservoirs) and thus, are known to be geologically sound but may lack the redundant set of criteria the Protocol currently requires.

Regarding the definition of "CO2 leakage," the language indicates that the purpose of the dissipation interval is to dissipate overpressure caused by CO2 or fluid migration along an unidentified leakage pathway. However, the definition of "CO2 leakage" refers to leakage *above* that dissipation interval and secondary confining layer. If CARB insists on requiring the redundant storage complex criteria, BP recommends that the Protocol clarify whether CO2 movement into the dissipation interval qualifies as a leak, and thus would trigger remediation activities. We propose that the term "CO2 leakage" be exclusively reserved for migration beyond the dissipation interval and secondary confining layer, and this usage should be consistently applied throughout the rules to avoid confusion.

Area of Review, GCS Project, Plume Stability, GCS Permanence

BP recommends that the Protocol allows for use of standard subsurface best practice with regard to the terms "area of review", "GCS project", "plume stability", and "GCS permanence". Each of these terms could be unreasonably interpreted and applied to impractical ends. For example, multiplication of worst-case scenario parameters for reservoir modelling could result in impractically large areal extents. The requirement for corrective action on "all wells within the AOR" in such scenarios could be provide little real benefit while significantly increasing cost.

Similarly, proving 100% permanence or 100% plume stability over any extended period of time is impractical and unnecessary. BP recommends that these requirements are revised to reflect application of standard subsurface practice. We suggest that the Protocol rely on definitions and guidance provided in existing regulations such as the EPA UIC Class VI rules.

Risk management practices that enable performance-based assurance of safe and secure CO2 storage

BP commends CARB for applying a site-based risk assessment that accounts for both probability and consequence of potential issues. However, the proposed matrix is missing the time element. The Protocol must include the concept of time (e.g., remote = <1% in 100 years, or 1000 years) to ensure consistent and appropriate use of the matrix. BP

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recommends that the Protocol refer to existing industry standards, such as those from OSHA or API, for incorporating the concept of time-based risk. For example, the standard definition of leakage is leakage of >1% of the stored CO₂ over 1000 years.

Corrective action on existing wells

The Protocol must consider a broader range of existing well scenarios and identify reasonable desired outcomes. For example, if the broadest interpretation of Area of Review was applied, addressing all wells in the AOR may be unreasonable and cost prohibitive. Moreover, there are wells that may no longer have surface access, or official records may be incorrect. Cement and/or plugs in previously plugged and abandoned wells may not be CO₂ compatible, but may not pose a real leakage risk. Mitigation of every possible issue across all wells may be impractical, and the Protocol must recognize this by providing alternate means of site qualification and/or liability assurance in these scenarios. Furthermore, it is appropriate to stage the remediation of existing wells, such that those closer to the injection site are considered early in project development, but more remote wells are addressed at an appropriate time based on information gained during operation about how the CO₂ plume is moving in the subsurface.

Pre-injection testing

Oxygen activation log

The Protocol must recognize that oxygen activation logs are monitoring tools which can identify changes over time, but are not suited to demonstrating integrity upon completion of an injection well. BP recommends removal of this requirement.

Fracture pressure testing

BP recommends the Protocol reconsider the requirement to perform fracture pressure testing of the confining layer. Performing such a test could create a containment risk and thus should be removed.

Executive Officer witnessing of all logging and testing

BP recommends that this requirement be removed from the Protocol. Development of geologic CO₂ storage projects, including well testing and logging, includes a high degree of schedule complexity which requires the coordination of many parties including the operator and various contractors. As such, the timing of these activities are often subject to change and the schedule must remain flexible to allow efficient project development. The requirements of locking down opportunities to witness the logging and testing could create unnecessary schedule complexities and delays, with questionable added benefit. BP recommends that if witnessing of logging and testing is desirable, witnessing by a state-licensed engineer is sufficient.

Injection well construction requirements

In requiring cementing to surface and recognizing the potential use of multiple strings of casing, the Protocol should recognize that in the multiple casing string scenario, cementing to surface is not always practical and may in fact undermine well integrity. BP recommends that this requirement be modified to recommend normal industry best practice with appropriate materials for well construction in the specific situation. The Protocol should also provide clarity around the annulus packing. There are a variety of references to cementing to surface, “fluid packed”, and implications of fluid/gas packed. Rather than

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specifying these requirements, BP asserts that the operator should be allowed to propose the solution that best maintains well integrity and supports monitoring.

CO2 injection stream requirements

BP is concerned about the narrow acceptability of CO2 injection stream conditions. The assumption of 100% pure CO2 could unnecessarily preclude or greatly increase the cost of CCUS projects. The rules should also permit injection of gas-phase CO2 for scenarios where injection may necessarily be gas phase (e.g., early injection into a depleted gas field). BP recommends that CARB refer to EPA UIC Class VI guidelines regarding CO2 injection streams.

Continuous monitoring of injection rate, volume, and pressure

The requirement of continuous (once every 15 minutes minimum) monitoring is onerous and unnecessary for the purpose of sufficiently understanding and controlling the operations. BP asserts that less frequent monitoring is sufficient and consistent with standard operations of this scale.

Annual well integrity testing

BP recommends that the Protocol reconsider the requirement for annual external mechanical integrity tests. A requirement for annual testing can create well integrity problems and operational safety concerns. BP also suggests that the Protocol consider the associated impact of unnecessarily shutting in wells on the broader CCUS system (capture and transport infrastructure), which is best left operating in steady-state mode. It should be left to the operator to determine a frequency that is sufficient to ensure mechanical integrity.

Additionally, the list of required tests is overly prescriptive, not performance-based, and not clearly designed to promote well integrity. For example, radioactive tracers can test for well connectivity, not well integrity, and casing inspections logs would require otherwise-unnecessary deconstruction of the well. Some well construction options (such as single or multiple string designs) will render some tests inconclusive or difficult to interpret. BP recommends that the operator be allowed to identify, within the submitted plan, the appropriate integrity testing for the specifics of the well design and condition.

MMV requirements

BP has significant concerns over the extensive requirements around monitoring and plume tracking. Specifically, methods such as regular surface seismic data acquisition and interpretation and downhole seismic monitoring require significant investments of time and cost that could be prohibitive without yielding sufficient quality information. BP appreciates that the text permits an “alternative test approved by the Executive Officer” but is concerned about the extensive precedent set by the list provided. Furthermore, application of these requirements to an offshore site could represent an untenable cost hurdle with little demonstrable benefit.

Probabilities of leakage over time

BP is concerned about the proposed CO₂ accounting which assumes that leakage is equal to the monitoring detection limit. The risk management precedent, which BP recommends, is no more than one half of the detection limit.

Site closure requirements

BP recommends that the Protocol waive the requirement to plug and abandon wells within 24 months after injection ceases. In many cases, monitoring of downhole pressure from these wells will be the best indication of the plume and pressure front. The Protocol should eliminate this requirement in order to promote a cost-effective monitoring strategy.

BP is concerned about the language around discretion to revoke and potentially reissue a Permanence Certificate, with public comment. This creates an opportunity for organizations fundamentally opposed to CCUS to cause unwarranted delays and increased costs. BP recommends that Permanence Certificate reconsiderations remain solely with CARB staff.

Lack of framework for offshore CO₂ storage

While BP is appreciative of the effort to qualify CCUS sites, the proposed text provides no framework for offshore CO₂ storage – and some language (e.g., baseline surface and near-surface monitoring) may preclude offshore storage. BP recommends that the Protocol close this gap. Options would be to incorporate the necessary requirements for offshore storage qualification, or to modify the proposed text to explicitly only apply to onshore.

Prorating of CO₂ storage credit based on CA import

BP commends CARB for permitting the qualification of CCUS projects located beyond the California borders. However, BP recommends that the Protocol permits a mass balance approach to pro-rating of a regulated party's CA sales volumes in order to fully recognize the fungibility of gasoline and diesel.

Qualification of existing CCUS projects

BP appreciates that the Protocol recognizes the efficiency and efficacy of conversion of existing infrastructure for CCUS purposes. The Protocol allows submission of previously-obtained well testing and logging results for wells transitioned from pre-existing injection; BP recommends the Protocol extends this to submission of previously-obtained core and fluids data as well.

Relationship to EPA UIC program

Lastly, BP would like the Protocol to recognize the amount of technical validation that has gone into various other CCUS regulations, such as the EPA UIC Class VI rules and Mandatory Greenhouse Gas Reporting rules. In order to avoid a patchwork of different and contradictory regulations, BP recommends that CARB rely on the existing rules as much as possible to ensure safe and practicable CCUS deployment.

Conclusion

In closing, we would like to reiterate our support for the adoption of a well-designed CCUS protocol and we commend CARB for taking on this complex protocol development. Given the widely acknowledged importance of the deployment of CCUS technology in

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meeting the goals of the Paris Climate agreement, as well as the fact that many other states and even countries look to California to provide leadership on climate policy – we cannot overstate the need to ensure that this Protocol succeeds in encouraging investment in CCUS projects. In order to succeed, we believe the Protocol needs to:

- Enable and encourage CCUS projects
- Be risk and performance-based
- Not be overly prescriptive
- Make use of existing protocols, regulations, and industry standards to ensure consistency and best practice across a range of operational situations

To that end, we believe that the Protocol can benefit greatly from additional interaction with industry experts and we strongly urge CARB to take the time to get the Protocol right.

As always, please feel free to contact me if you wish to discuss these comments in more detail.

Sincerely,

Ralph J. Moran
BP America, Inc