February 1, 2018

Submitted Via Email
Samuel Wade & Lex Mitchell
California Air Resources Board
1001 I Street
Sacramento, CA 95814
Samuel.Wade@arb.ca.gov
amitchel@arb.ca.gov

Re: Clean Air Task Force Initial Comments on Draft Accounting and Permanence Protocol for Carbon Capture and Geologic Sequestration under Low Carbon Fuel Standard

Dear Mr. Wade & Mr. Mitchell,

Clean Air Task Force (CATF) appreciates the continued opportunity to provide comments to California Air Resources Board (ARB) on the recently released draft Accounting and Permanence Protocol for Carbon Capture and Geologic Sequestration (QM) under Low Carbon Fuel Standard (LCFS) proposal. CATF has been engaged throughout the process of developing this rule, by providing technical presentations at two of the early workshops held in 2016,[1] submitting letters,[2] the latest of which was submitted in December 2017,[3] and having multiple in-person conversations.

With this letter, CATF requests an in-person meeting with you and other officials at ARB that you think would be required to further discuss the following recommendations and comments.

CATF is keenly interested in ARB's QM rulemaking as it is one of the first few climate programs to propose inclusion of credits for sequestered carbon. The ability for carbon capture and sequestration (CCS) projects to access LCFS credits will act as an economic catalyst to further the deployment of this critical climate solution.

---

[1] John Thompson, CATF, PowerPoint, "CCS Perspectives and Recommendations on Quantification Methodologies," (Feb. 12, 2016), *available at*: https://www.arb.ca.gov/cc/ccs/meetings/CATF_Presentation_2-12-16.pdf; Bruce Hill, CATF, PowerPoint "Considerations in Developing QM for EOR Storage," (Aug. 23, 2016), *available at:* https://www.arb.ca.gov/cc/ccs/meetings/CATF_Presentation_8-23-16.pdf.

[2] Bruce Hill, CATF, Testimony at ARB Public Workshop, (Feb. 12, 2016), *available at:* https://www.arb.ca.gov/cc/ccs/meetings/CATF_Comments_2-12-16.pdf; Bruce Hill, CATF, "Comments to ARB on Quantitative Methodology, Accounting," (Apr. 28, 2016), *available at:* https://www.arb.ca.gov/cc/ccs/meetings/Bruce_Hill_CATF_Comments_4-28-16.pdf; Letter from Jeffrey Bobeck, Global Carbon Capture and Storage Institute, *et al.*, to Alexander Mitchell, ARB, (May 30, 2017), *available at:* https://www.arb.ca.gov/cc/ccs/meetings/Various_Comments_5-30-17.pdf; Letter from Jeffrey Bobeck, Global Carbon Capture and Storage Institute, *et al.*, to Samuel Wade, ARB (Oct. 20, 2017), *available at*: https://www.arb.ca.gov/fuels/lcfs/workshops/10202017_coalition.pdf.

[3] Letter from Jeffrey Bobeck, Global Carbon Capture and Storage Institute, *et al.*, to Samuel Wade, ARB (Dec. 4, 2017), *available at*: https://www.arb.ca.gov/fuels/lcfs/workshops/12042017_coalition.pdf.

The key to a successful QM rule is to demonstrate permanent CO_2 emission reduction through sequestration. The most effective method of demonstrating permanence is a performance-based approach that cuts across every phase of a project from permitting to site closure, including:

- site assessment, identifying sources of risk;
- a monitoring plan that is based on risk analysis, with tools that have are appropriate to the geologic setting, and that that can be adjusted as needed; and
- a determination made by the Administrator that the subsurface CO_2 is secure.

CATF is concerned that ARB's current approach of using a fixed-time frame as means of demonstrating permanence is misguided, arbitrary, and runs the risk of failing to emphasize the key elements of an effective program. Rather than rely on arbitrary time periods, ARB must adopt a rigorous, performance-based QM. This approach will allow ARB to implement an effective QM that is both environmentally protective and economically workable.

A robust, performance-based QM would incentivize CCS on industrial sources of CO_2, such as ethanol facilities and oil refineries, significantly contributing towards meeting the LCFS program's 2030 targets. But, the impacts of an effective QM can extend far beyond California. CCS projects are critical not only for California and the U.S. to meet climate targets, but also are essential to meet climate targets globally.

To limit climate change to 2-degrees, the International Energy Agency finds that globally, CCS projects must capture 6 gigatons of CO_2 on an annual basis, by 2050 - half of which must be captured in India, China and the U.S.[4] Even considering CCS application solely in the industrial sector, the necessary deployment is still large in scale. If China's industrial emissions (in 2013) were a country, it would rank 3rd in the world, while U.S. industrial emissions would rank 6th.[5] All of these sources require carbon capture to mitigate their emissions. Only 4 out of 11 models run by the Intergovernmental Panel on Climate Change (IPCC) were successful in meeting the 450 ppm CO_2 concentration target to limit warming to 2-degrees above pre-industrial levels without CCS technology. These models also saw costs more than double, compared to scenarios that included CCS.[6]

California is therefore in a powerful position now to press CCS technology's trajectory along the learning curve through a QM that encourages deployment in California and other states, and eventually worldwide. Renewables-focused policies in the U.S. are responsible for more than half of all deployment of wind and solar PV technology across the country.[7] Similarly, there is an immediate need to extend policy support to CCS technology to encourage increased deployment, thereby expanding the climate solutions toolbox and increasing the probability of meeting climate targets globally.

---

[4] International Energy Agency, *Energy Technology Perspectives 2015*, at 10, fig. I.1, *available at*: http://www.iea.org/publications/freepublications/publication/ETP2015.pdf (and accompanying data "World 2-degree scenario"– "World," *available at*: "Access the Data" http://www.iea.org/etp/etp2015/).

[5] World Bank, Data – CO_2 Emissions, (last accessed Jan. 23, 2018), http://data.worldbank.org/indicator/EN.ATM.CO2E.KT?year_high_desc=true.

[6] Intergovernmental Panel on Climate Change, *Climate Change 2014 Synthesis Report Summary for Policymakers*, at 25 (2014), *available at*: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.

[7] Galen Barbose, Lawrence Berkeley National Laboratory "U.S. Renewables Portfolio Standards, 2017 Annual Status Report," (July 2017), *available at:* https://emp.lbl.gov/sites/default/files/2017-annual-rps-summary-report.pdf.

The following are CATF's specific recommendations to ARB on developing a robust and workable QM:

1. **Adopt an alternative, performance-based approach to QM**

CATF recommends an alternative, performance-based approach to the QM, particularly its proposed 100-year post-closure monitoring requirement. The requirement is currently not accompanied by a substantive basis and, absent a performance-based approach may unwittingly result in a sense of false security. CATF urges ARB to reconsider its draft approach to ensure that the requirements adequately take into account the variable geologic conditions from site to site, including, *inter alia*, characteristics of the storage reservoir, its injectivity, and the overlying trapping complex. Due to the unique nature of every storage complex and project, there can be no single *right* time frame for post-injection surveillance. In contrast, CATF recommends a performance-based approach, which will provide maximum security of CO_2 in the subsurface and, therefore, ensure permanent storage.

In Appendix A, CATF recommends a general approach to a performance-based QM. A performance-based approach cross-cuts every phase of a project from permitting to site closure. Briefly, the performance-based approach begins with the site assessment, followed by a demonstration and determination of the risk, followed by a "go/no-go" decision. The monitoring plan should be informed and based on the risk analysis, with strategies and tools that have been demonstrated to be sensitive to the injectate in the geologic setting. The process will inherently benefit from learning-by-doing and therefore the monitoring plan should remain flexible, such that it may be adjusted during that period for effectiveness and adapted to the post-injection period, until such time as a determination is made that the subsurface CO_2 is secure, and authorization to terminate monitoring is given by the Director. We direct you to *Jenkins et al.* (2015), a review of monitoring and verification programs worldwide, which illustrates the importance of well-selected, low-risk sites, and the importance of accompanying targeted monitoring directed at specific, predicted and measurable failure modes - as opposed to a simple, prescriptive, operational monitoring plan.[8]

It is also critical that ARB's rule consider differing needs of CO_2 storage in saline brines and depleted oil fields (including incidental storage during, and storage subsequent to production), and utilization of saline storage aquifers in stacked saline formations in enhanced oil recovery (EOR) fields. As described in Appendix A, there will be many common elements to monitoring, reporting and verification (MRV) plans in saline and depleted oil field settings, but risk elements will be different and will require different approaches. For example, in the case of CO_2 EOR projects or other brownfields designated for storage projects, the geology in the subsurface is typically well-known and understood from operations spanning decades and pressure in the subsurface is managed through simultaneous production of fluids. But these fields pose the risk of unknown or poorly plugged wells through which leakage to the atmosphere could occur. In the case of saline storage, there is less subsurface knowledge and there is no pressure management through production. However, in saline storage, such legacy wells are less likely. These key differences indicate that the two types of projects will benefit from fit-to-purpose site-selection and risk

---

[8] Jenkins, C., Chadwick, A., & Hovorka, S., *The state of the art in monitoring and verification—ten years on*, 40 INT'L J. OF GREENHOUSE GAS CONTROL, 312-49 (Sept. 2015), *available at*: https://doi.org/10.1016/j.ijggc.2015.05.009.

profiling activities and MRV plans. Allocating resources where they are needed most, based on local site characteristics, would be the most effective way to mitigate risk and ensure permanent geologic storage of CO_2.

ARB should adopt an approach to monitoring and verification based on the characteristics of each and every site, permitting only low risk sites, aiming to identify monitored deviations from expected subsurface CO_2 behavior that pose increased leakage risk early. Deviations should trigger attendant remediation steps, if needed, and a practical approach to quantification of any atmospheric leakage.

2. **CATF requests that ARB make available the Initial Statement of Reasons for the QM and specifically the 100-year requirement**

ARB proposes that the geologic carbon sequestration (GCS) operators "conduct leak detection checks at each well that is part of the GCS project, and in the near surface close to each well, annually for 100 years after injection is complete."[9] This requirement creates a significant deterrent to investment in and deployment of CCS under the QM—despite high LCFS carbon credits—and, hence, to achieving climate goals. If ARB retains the requirement, then it must demonstrate why it is necessary to demonstrate permanence despite its deterrent effect through substantial record evidence.

In accordance with Cal. Gov. Code § 11346.2, CATF requests that when ARB issues its proposed QM, it makes available to the public its initial statement of reasons for proposing the QM, specifically the 100-year requirement. This statement must include, among other things:

- The rationale for proposing the 100-year requirement, Cal. Gov. Code § 11346.2(b)(1);
- A statement as to why prescriptive standards are required, *id.*;
- "An identification of each technical, theoretical, and empirical study, report, or similar document, if any upon which the agency relie[d]" on for the 100-year requirement, *id.* at § 11346.2(b)(3);
- "A description of reasonable alternatives to the [100-year requirement] and the agency's reasons for rejecting those alternatives, *id.* at § 11346.2(b)(4)(A);
- A description of efforts "to avoid unnecessary duplication" of "federal regulations." *Id.* at § 11346.2(b)(6).

This information will give CATF, and the public, a better sense of the rationale underlying the 100-year requirements, and lead to more productive discussions on finalizing a robust, and consequential QM.

3. **Recognize that decisions related to the forestry protocol do not impact this rulemaking**

During a meeting with ARB in Sacramento on November 30, 2017, a group that included CATF discussed the possibility of making the post-injection monitoring requirements under the QM performance-based, and as a result, eliminating the 100-year monitoring requirement. ARB

[9] ARB, "Accounting and Permanence Protocol for Carbon Capture and Geologic Sequestration under Low Carbon Fuel Standard," at 96 (§ 5.2(b)(3)(H)).

mentioned during the meeting that the 100-year post-injection monitoring period was primarily based on a trial court's discussion of its existing urban forest offset protocol.[10] After reviewing the referenced case, CATF found that the trial court's limited discussion of this single offset protocol *does not* set a binding legal precedent necessitating 100 years of monitoring under the CCS QM protocol.

The trial court in that case did not conclude that 100 years of monitoring was necessary to establish the "permanence" of greenhouse gas (GHG) reductions; the "permanence" of the offsets was not even at issue. Rather, the court's holding stands for the proposition that a 100-year compliance requirement was a reasonable basis for establishing the "additionality" of urban forest offset projects that might be occurring anyway, but where there is no obligation to carry the activities forward into the future.[11] While this may set a regulatory precedent to a limited extent, it does not apply here. There are fundamental differences between forestry and geologic sequestration that need to be reflected in the QM.

Failing to recognize these differences and failing to tailor the QM to the factors relevant to geologic sequestration would be unreasonable and arbitrary and capricious.[12] ARB must build substantial evidentiary support for the 100-year provision, consider all relevant factors and demonstrate a rational connection between those factors, the provision, and the purposes of the Global Warming Solutions Act (GWSA).[13] The GWSA requires that emission reductions are "real, permanent, quantifiable, verifiable, and enforceable" and "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur."[14] ARB must demonstrate why the 100-year provision is necessary to meet these requirements.

In the context of the urban forest protocol, the court found the requirement for eligible trees to sequester carbon for at least 100 years justified by the record.[15] The court was compelled by the relevant factors for forests, explaining that "[p]arks can be turned into malls. Trees can die, burn, or be cut down. A municipality's current leadership could plant trees that are removed by new leaders following the next election."[16] These factors are not present in the context of geologic sequestration and a 100-year provision is not justified by the record.[17]

Conclusion

In conclusion, CATF urges ARB to replace the prescriptive 100-year post-injection monitoring requirement with a performance-based approach that allows for site closure based on a

---

[10] Statement of Decision, *Our Children's Earth Found. v. ARB*, Case No. CGC-12-519554 (Jan. 25, 2013); *see also Our Children's Earth Found. v. ARB*, 234 Cal. App. 4th 870 (2015) (affirming the trial court decision without discussing the 100-year monitoring requirement).
[11] *Our Children's Earth Found.,* at 30
[12] *Comms. for a Better Env't v. Cal. Resources Agency*, 103 Cal. App. 4th 98, 109 (2002)
[13] *Am. Bd. of Cosmetic Surgery v. Med. Bd. of Cal.*, 162 Cal. App. 4th 534, 547-48 (2008)
[14] GWSA § 38562(d)
[15] *Our Children's Earth Found.,* at 31
[16] *Id,* at 30
[17] Letter from Jeffrey Bobeck, Global Carbon Capture and Storage Institute, *et al.*, to Samuel Wade, CARB, at 29 (Dec. 4, 2017), *available at*: https://www.arb.ca.gov/fuels/lcfs/workshops/12042017_coalition.pdf (describing how geologic sequestration of CO_2 differs from sequestration of CO_2 through trees).

demonstration of CO_2 plume stability and subsequent storage integrity and permanence. We find that our recommendation aligns with the California legislatures direction to "substitute[e] performance standards for prescriptive standards wherever performance standards can be reasonably expected to be as effective and less burdensome."[18]

However, if ARB intends on finalizing the 100-year requirement, it must be based on factors relevant to geologic sequestration and supported by a robust record, which must be made available during the public comment period.

Please do let us know when would be the best time for an in-person meeting with ARB to discuss CATF recommendations and comments.

We look forward to continuing our work with ARB on the QM and appreciate the ongoing opportunity to provide feedback and recommendations.

Respectfully,

____

Deepika Nagabhushan
Energy Policy Associate
dnagabhushan@catf.us

James P. Duffy, Associate Attorney
Bruce Hill, Chief Geoscientist
John Thompson, Director, Fossil Transition Project
Kurt Waltzer, Managing Director

[18] CA Govt. Code § 11340.1(a).

APPENDIX A

Phases of a Performance-Based Approach:

I. **Identifying an Area of Study and Surveillance.** The area/subsurface volume for subsurface characterization, risk analysis, and monitoring, should be established, prior to approval of a project, based on reservoir knowledge, predicted subsurface CO_2 behavior and risk factors.

II. **Site Selection and Screening and Prioritization.** Only the most secure sites should be used for carbon storage. Selecting an appropriate site—whether it be a saline brine aquifer or a depleted oil field— is a key step toward *prevention* of leakage and demonstrating permanence. For a variety of reasons, not all sites will be appropriate for subsurface storage. Therefore, operators should demonstrate a knowledge of the subsurface, risk factors and the predicted behavior of injected CO_2 in the potentially impacted storage volume. Leakage risks will vary with location, storage type, knowledge of the subsurface and prior history of the resource. Risk factors may include induced seismicity potential, nearby environmental sensitivity, water resources, legacy wells, fractured caprock or monitoring being infeasible. There should be a "go/no-go" decision rather than a focus on later mitigation steps.

III. **Risk-Based Approach to Monitoring, Verification and Accounting.** Applicants should be directed to develop a model of the subsurface storage compartment and trapping complex, including failure scenarios, thereby identifying areas of elevated risk, and then apply monitoring tools sensitive to those specific risks. ARB's approach to monitoring CO_2 injected for the purposes of carbon storage should be based on the site-specific details of the geology and existing infrastructure, such as legacy wells. The QM should require surveillance of geologic resources and surface operations for evidence of unexpected behavior of injected CO_2 that poses risk based on a specification—*i.e.* adverse CO_2 migration/leakage at a given horizon, which could be monitored, for example, "above zone." Monitoring should not be "kitchen sink," but, instead, targeted at vulnerabilities and accompanied by action steps that would be triggered in the event of unexpected CO_2 behavior resulting in higher risk of leakage to the atmosphere or to water resources. In the event of leakage to the atmosphere, injection should be suspended until the leakage is contained and source of leakage repaired/remediated.

IV. **Recommended Post-Injection Care Approach.**[19] Methods utilized during the operational phase of the program, and deemed effective, should continue into the post-injection and post-closure phase of a project until such time as the operator has demonstrate permanence, to the satisfaction of the Director, by showing that:

[19] Dr. Susan Hovorka, University of Texas at Austin Gulf Coast Carbon Center advised CATF on this approach. We recommend that ARB seek the assistance of Dr. Hovorka as a trusted advisor in rule development.

- The CO_2 plume is adequately consistent with the evolved model. Measured plume evolution should match predicted plume evolution. The measurements made should be sensitive to detecting a plume that is non-conformant in important ways,[20] and will likely include:
    1. CO_2 saturation inside the plume (as measured by saturation logs at injection well(s) and monitoring well(s);
    2. Geometry of the CO_2 plume (direction and rate of lateral migration); and
    3. Pressure evolution at injection well(s) and monitoring well(s); and

- The CO_2 plume has stabilized:
    1. In saline applications, both the plume and the pressure front have stabilized;
    2. In EOR fields, the subsurface CO_2 between the injector wells and producer wells, in a pattern, have come to equilibrium. Methods may be derived from existing conformance metrics. *See* discussion, below.

- Monitoring methods should demonstrate that CO_2 is not expected to migrate in the future in any manner that would result in leakage to the atmosphere. This should include a comprehensive assessment of well integrity of all wells that penetrate the injection zone in the AoR.

Following cessation of injection, ARB's draft proposed rule states that monitoring wells should remain open for 15 years. CATF asserts that monitoring wells should remain open for no prescribed minimum period, but, instead, until such time as a determination is made by the Director that the CO_2 plume is stable or is satisfactorily trending toward equilibrium with the host rock. This time frame may be shorter or longer than the prescribed period. While monitoring wells may require 15 years, ARB provides no basis (and there exists no technical basis) for the requirement of a specific timeframe with no accompanying alternative demonstration.

Mountaineer Project (2009-2011): A Saline Project PISC Example. A lessons-learned assessment of the AES Mountaineer saline storage project in West Virginia that operated from 2009-2011, permitted under a West Virginia DEP UIC Class V (experimental) permit illustrates groundwater monitoring and an alternative post-closure demonstration in practice. [21] (Note: the 2017 LBNL recommendations report provided to ARB[22] suggests requiring a five-year minimum for monitoring. After a five-year period, if scientifically justified, an applicant would be able to submit a determination of stability/permanence of the CO_2 plume, along with supporting monitoring and modeling data).

---

[20] *E.g.* it is important to model conditions where plume would migrate out of AoR and then utilize the monitoring strategy to determine if they are/are not occurring.

[21] McNeil, Caitlin *et al.*, *Lessons learned from the post injection site care program and the American Electric Power Mountaineer Product Validation Facility*, GHGT-12 63 ENERGY PROCEDIA 6141-6155, (2014) *available at*: https://www.researchgate.net/profile/Caitlin_Mcneil/publication/272380415_Lessons_Learned_from_the_Post-injection_Site_Care_Program_at_the_American_Electric_Power_Mountaineer_Product_Validation_Facility/links/554a0a100cf2e859ce18b4c8.pdf?disableCoverPage=true.

[22] *See* LBNL report(s) at: ARB, "Carbon Capture and Sequestration Documents," *available at*: https://www.arb.ca.gov/cc/ccs/documents/ccsdocs.htm (last accessed Jan. 24, 2018).

The objective of the project was to evaluate the feasibility of commercial scale storage of 1.5 million metric tons per year in a second phase. During the pilot, a combined total of approximately 38,000 metric tons of CO_2, captured at the West Virginia Mountaineer coal-fired power plant, were injected into a sandstone and dolomite formations through two wells at approximately 2,300 to 2,500 m depth. The project utilized both shallow and deep monitoring wells. The UIC permit required that post-injection monitoring continue for 20 years or until it could be demonstrated that the project does not pose endangerment to an underground source of drinking water (USDW). The permit also allowed that the monitoring period could be shortened if site closure conditions were met earlier. The post-injection site care criteria for this were threefold:

- The CO_2 plume has stabilized,
- the pressure front has stabilized, and
- there is no endangerment to a USDW.

<u>Groundwater Monitoring</u>. The groundwater monitoring program included shallow groundwater wells above the injection site at multiple locations. Baseline monitoring was conducted prior to injection. The goal was to demonstrate that there would be no impact to the USDW from the project. Although the monitoring project was designed on the somewhat outdated premise that surface monitoring would be an effective metric to assess groundwater contamination from a project, the project utilized stable oxygen and hydrogen isotope analyses aimed at identifying storage integrity based on the integrity of the geologic system and wells.

<u>Pressure monitoring and modeling</u>. The project also collected continuous downhole pressure, at five wells, and data from the injection reservoir in order to compare pre-injection formation pressure with post-injection formation pressure. This data demonstrated that the pressure front had stabilized and the CO_2 plume had stabilized - two of the three post-injection criterion. The data further showed that following the cessation of injection, that pressures decreased in both formations reached stable levels at +- three psi (0.1 %) of initial reservoir pressure within about 3 years as documented in 2014. The deep pressure monitoring showed that there was hydraulic connectivity between the reservoirs and the results were consistent with the modeling for radial plume migration, thereby validating the model. During the post-injection monitoring, the pressure had declined and flat-lined to the initial formation pressure, matching the prediction of the model as illustrated in figure 7 from the paper, inserted in the text below.

In summary, the requirements and goals for post-injection site care were met at Mountaineer, and all obligations and regulatory requirements were fulfilled. the CO_2 plume was demonstrated as stable and there was no demonstrated endangerment to the USDW. This allowed the project to close after 3 years, well before the 20-year timeframe in the UIC permit.

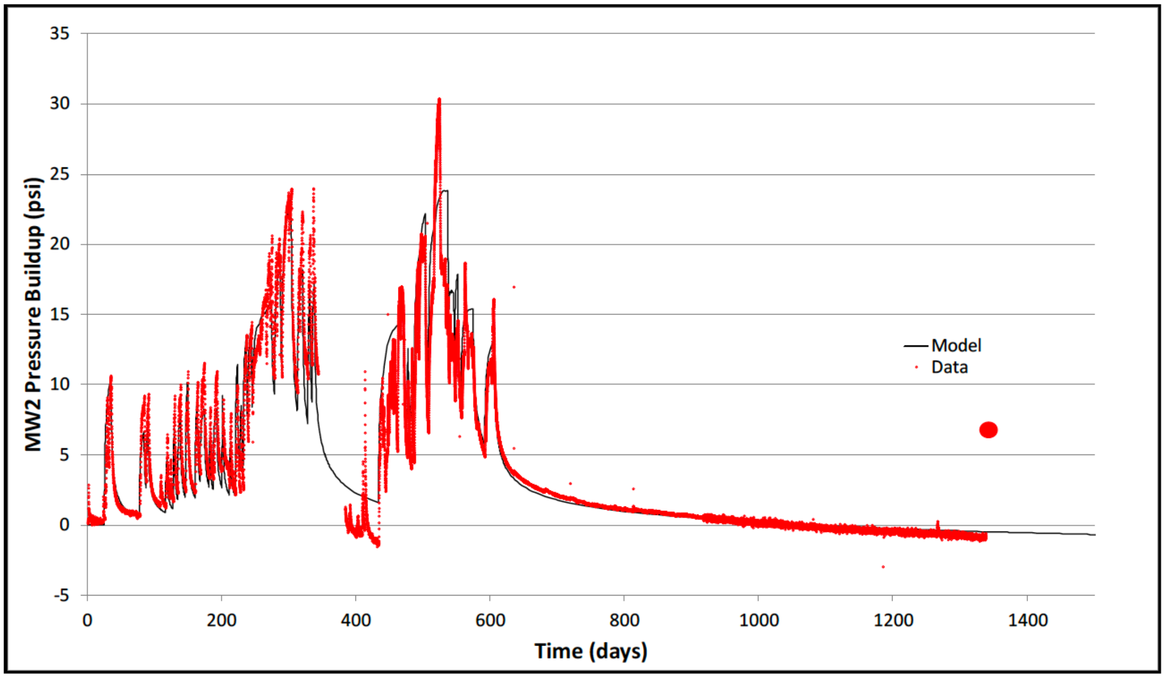

Fig. 7. Comparison of model predictions and observations for pressure response at MW-2 (Copper Ridge dolomite) [8]

Considerations for Enhanced Oil Recovery (EOR) Projects. As noted above, CATF's analysis of the pre-proposal suggests that it does not take into account the significant differences in needs between storage of CO_2 in saline aquifers versus depleted oil fields during EOR. While the final rule could take the approach of calling out special approaches and needs for EOR, an entirely performance-based approach would not require special treatment. In other words, if the project assessment, monitoring and closure requirements match the project attributes and risks, then appropriate tools and strategies will be applied. The current draft rule appears to be applicable to saline projects that do not have the same attributes as oil fields, *e.g.* plume and pressure front, etc.

In EOR, the caprock and seal are known to have held hydrocarbons typically for millions of years. The injectivity is proven and the capacity is known based on previous volumes of fluids produced. Pressure is managed through production of fluids. The potential risk lies in the legacy wells, and therefore there should be a significant burden of proof on the applicants to establish the integrity of old penetrations in these brownfields. Because production controls the movement of the CO_2 plume and keeps it, and the pressure, managed and localized to production wells, there is no pressure front risk as in saline aquifers and so less focus is necessarily distant from the injection site. Therefore, pressure front metrics are less relevant to subsurface CO_2 security.

To be most effective EOR surveillance should focus on three areas:[23]

[23] Hill, B, Hovorka, S. & Melzer, S., *Geologic Carbon Storage through Enhanced Oil Recovery*, 37 ENERGY PROCEDIA 6808-30 (2013) *available at*: http://www.catf.us/resources/publications/view/181

1. Mining of project data that tracks CO_2 conformance in the subsurface. An operator should be encouraged to demonstrate to ARB, the security of the CO_2 based on project conformance metrics;
2. Leakage from legacy wells, based on the site assessment, monitoring methodologies, focused on leakage around well sites; and
3. Keeping CO_2 within the boundaries of the project lease. Pattern balance (conformance) may be a useful indicator of the integrity of the CO_2 plume. That is, fluids injected should equal fluids removed. If produced fluids are substantially out of balance with injected fluids, the burden should be on the operator to determine whether there is a loss of CO_2 outside the lease, and accounting provisions should be developed to adjust net CO_2 stored, use of an injection water curtain as long as is necessary, or, if necessary, project shut down.