California Carbon Capture and Storage Review Panel

TECHNICAL ADVISORY COMMITTEE REPORT

Enhanced Oil Recovery as Carbon Dioxide Sequestration

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CALIFORNIA CARBON CAPTURE AND STORAGE REVIEW PANEL

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1. Crediting and Regulating Sequestration at CO_2-EOR Sites.

To achieve California's aggressive greenhouse gas (GHG) emissions reductions goals, deployment of carbon capture and sequestration (CCS) technology may be necessary. CCS involves injecting carbon dioxide (CO_2) underground for the purpose of permanent geologic sequestration in saline formations or oil and gas reservoirs. CCS regulations must ensure both the safety of CCS operations and the permanence of sequestration.

Although CCS is an emerging technology for climate protection, the fossil fuel industry has been injecting CO_2 underground for enhanced oil recovery (CO_2-EOR) for decades. In principle, CO_2-EOR using anthropogenic CO_2 could achieve sequestration even though current practices do not usually account for it. CO_2 is not used in EOR operations in California today, but the state's climate policies are driving interest in doing so. For that reason, policies encouraging and regulating CCS must address how to treat EOR and its existing industry, infrastructure, and regulations. In particular, policymakers must determine whether and how CO_2-EOR sites should be credited with sequestration.

There are many ways that California could address this question that can be placed in two main categories. The first possible approach would be to require CO_2-EOR to meet all of the same regulatory standards as sequestration in saline formations, including site permit requirements, human health and safety protections, and monitoring, verification, and reporting plans. The second possible approach would be to customize these kinds of standards in a way that would allow CO_2-EOR to receive sequestration credit while remaining within the regulatory framework already established for EOR operations.

The long-term success of CCS as a climate protection strategy depends on limiting sequestration credit to situations where there is assurance that injected CO_2 will be permanently contained. In the nearer-term, however, the success of CCS also depends on establishing the viability of the technology and deploying in time to help meet California's greenhouse gas (GHG) emissions reductions goals. Therefore the question of how to treat EOR under CCS regulations requires balancing the need to engage and utilize the existing infrastructure of EOR without compromising the integrity of GHG emissions targets.

In addition to the broad question of how to treat CO_2-EOR in the context of CCS, this paper considers specific programs in California in which this question might arise:

- the cap-and-trade proposal emerging from GHG emissions reduction targets from Assembly Bill 32;
- the GHG Emissions Performance Standards for long-term power purchases established by Senate Bill 1368;
- the Low Carbon Fuel Standard established by Executive Order S-01-07; and

- permitting authority over CO_2 injection wells and the role such permits play in sequestration credit for compliance with any of the above programs.

This paper summarizes the regulatory landscape for geologic sequestration of carbon dioxide, identifies possible regulatory approaches to CO_2-EOR as sequestration, and describes the major advantages and disadvantages to these approaches. The key questions to consider are:

- **What kind of permitting requirements should there be for CO_2-EOR facilities that seek credit for CO_2 sequestration?** Should permitting requirements for CO_2-EOR facilities seeking sequestration credit be the same as other EOR facilities, the same as sequestration in saline formations, or something in between?

- **What kind of monitoring, verification, and reporting (MVR) requirements should there be for CO_2-EOR facilities that seek credit for CO_2 sequestration?** Should MVR requirements for CO_2-EOR facilities seeking sequestration credit be the same as other EOR facilities, the same as sequestration projects in saline formations, or something in between?

- **What type of credit should be considered in California?** If CO_2-EOR facilities get credit for sequestration in California, what kind of credit would they get? Would injected CO_2 count as avoided emissions or emissions offsets under a cap-and-trade program? Would sequestration credits from CO_2-EOR be sufficient to allow a power plant to pass the GHG-intensity screen imposed by SB 1368? Can CO_2-EOR assist with compliance with the Low Carbon Fuel Standard?

2. The Current Regulatory Landscape for Geologic Sequestration and CO_2-EOR.

a. **Federal.** At the federal level, CCS and CO_2-EOR are affected by efforts to establish regulations for wells used for geologic sequestration of CO_2 under the long-established Underground Injection Control program under the Safe Drinking Water Act and emerging regulations designed to control GHG emissions under the Clean Air Act.

i. **Safe Drinking Water Act,[1] Underground Injection Control (UIC) Program.** Currently, wells used for EOR are classified as Class II.[2] The U.S. Environmental Protection Agency (EPA) has proposed a new Class VI category for wells used for the geologic sequestration of CO_2. Under the proposed rules, Class VI would not apply to CO_2-EOR sites. Instead they would remain Class II wells.[3] Since the UIC

[1] Safe Drinking Water Act of 1974, 42 U.S.C §§ 300f - 300j-26, 300h(b)(2)(2006).

[2] 40 C.F.R. Pt. 146, Subpart C (§§ 146.21 to 146.26).

[3] "Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells", 73 Fed. Reg. 43491-541 (July 25, 2008).

program is authorized by the Safe Drinking Water Act, the rules are limited to managing health and safety issues related to drinking water. For that reason, EPA has limited authority to address risks associated with CO_2 leaking to the atmosphere in the UIC rules.

As currently proposed, EPA would treat CO_2 injection wells used for EOR completely separately from CO_2 injection wells used for geologic sequestration. Class II rules would continue to regulate and permit injection of CO_2 for EOR purposes as long as any fossil fuel production is occurring. The proposed Class VI rules would apply to any well in which CO_2 is injected for geologic sequestration and no oil or gas production is occurring.[4] However, EPA asked for comment on the merits of this approach "since owners or operators of some Class II [EOR] wells may wish to use wells for the purposes of production and [geologic sequestration] prior to the field being completely depleted."

ii. **Comparison of UIC Class II and Class VI requirements.** Both Class II and the proposed Class VI rules derive their authority from the Safe Drinking Water Act, and therefore focus on protecting underground sources of drinking water and not prevention protection against leakage of CO_2 to the atmosphere. In general, however, the Class VI rules would impose more stringent standards than the Class II rules, including requiring more extensive monitoring plans and more robust well construction requirements. In addition, the Class VI rules are conceived with sequestration in mind, while the Class II rules are designed for oil and gas production.

iii. **Multi-Stakeholder Discussion Recommendations.** The Class VI proposal may be modified when EPA issues its final rules. For example, the Carbon Sequestration Council's Multi-Stakeholder Discussion group (MSD) recommends that EPA clarify UIC rules to allow for a site where active oil or gas production is occurring at the same time as CO_2 sequestration under Class II permits.

Unlike EPA's proposed rules, MSD's recommendation contemplates simultaneous sequestration and oil production. Under MSD's proposal, Class II would include wells used for EOR in which sequestration is occurring during or in connection with EOR, provided that "(i) there is a reasonable expectation of more than insignificant future production volumes [of oil or gas] or rates as result of carbon dioxide injection and (ii) operating pressures are no higher than reasonably necessary to produce such volumes and rates."[5] The MSD stakeholders agreed that wells not meeting these requirements

[4] 73 Fed. Reg. at 43502.

[5] This "bright line" rule was proposed in Carbon Sequestration Council's December 23, 2008 letter to EPA making recommendations for the proposed Class VI regulations (p. 1-2), available at http://www.carbonsequestrationcouncil.org. It should also be noted that this same "bright line" has implications for property rights at EOR sites. Most oil and gas leases automatically terminate when production ceases in paying qualities (meaning operating costs exceed revenue from production).

should be subject to additional requirements. Other wells used for geologic sequestration of CO_2 would be Class VI (unless they were considered "experimental" and subject to Class V rules). This proposal is meant to achieve:

- Clarity for early movers planning projects in oil and gas reservoirs.
- Assurance of acceptable regulatory requirements for sequestration in oil and gas reservoirs (Class II regulations are a known quantity).
- A clear distinction between Class II and Class VI wells based on the type of reservoir (oil and gas versus saline formation).

Stakeholders involved in developing the MSD's proposal could not agree on what MVR should be required of Class II wells to demonstrate permanent sequestration of injected CO_2.

iv. **Mandatory Greenhouse Gas Reporting Rule – Proposed Subpart RR.**[6] EPA has proposed rules for reporting GHG emissions that would require all facilities that inject CO_2 underground to report basic information. These requirements include:

(1) All CO_2 injection facilities would be required to report: the amount of CO_2 received onsite from offsite sources, the amount of CO_2 injected into the subsurface, and the source of the CO_2 (if known).

(2) Facilities injecting CO_2 for the purpose of long-term sequestration would have enhanced reporting requirements, including 1) reporting the amount of CO_2 geologically sequestered using a mass balance approach, and 2) developing and implementing an EPA approved site-specific MVR plan.

(3) EOR facilities would have the option to adopt the enhanced reporting and MVR plan requirements.

v. **Clean Air Act GHG Regulations.**[7] Unless Congress adopts a national cap-and-trade program or similar legislation, the only federal authority to regulate GHG emissions comes from the Clean Air Act. The Clean Air Act directly regulates emissions sources and does not authorize emissions credit trading for GHGs. For that reason, the

[6] Mandatory Reporting of Greenhouse Gases: Injection and Geologic Sequestration of Carbon Dioxide; Proposed Rule, 75 Fed. Reg. 18576 (April 12, 2010). Authority for this rule derives from the Consolidated Appropriations Act of 2008 (Public Law 110-161).

[7] "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule," Final Rule, 75 Fed. Reg. 31,514 (June 3, 2010).

idea of sequestration credit is most meaningful in states, like California, that have enacted legislation limiting GHG emissions.[8]

But Clean Air Act regulations could be important for facilities injecting CO_2 for purposes of either EOR or geologic sequestration (or both) if such facilities were to become regulated as emissions sources. Even a well-chosen and operated site may leak a small percentage of CO_2 into the atmosphere.

(1) EPA recently released its final "tailoring rule" establishing initial thresholds for requiring New Source Review Prevention of Significant Deterioration (PSD) Permits and Title V Operating Permits for new and existing industrial facilities.

(2) Very large GHG emissions sources will begin needing GHG emission permits in 2010. Sources emitting 50,000 tons per year or less will not require permits until at least 2016.

(3) Even a very modest leakage rate at an EOR or geologic sequestration site could eventually trigger Clean Air Act regulations. For example, an annual leakage rate of 0.1% per year at a site injecting 10 million tons of CO_2 per year would have 10,000 tons per year of CO_2 emissions.

b. **California.**[9]

i. **Permitting CCS Projects in California.** U.S. EPA Region 9 has authority to regulate all underground injection wells in California, except those categorized as Class II. The California Division of Oil, Gas, and Geothermal Resources (DOGGR) has primacy for Class II wells, which include CO_2-EOR injection wells.[10] DOGGR could seek primacy for Class VI wells when EPA's Class VI regulations are finalized. In a March 1, 2010 letter from Bridgett Luther, the Director of the Department of Conservation, to Dan Pellisier, Deputy Cabinet Secretary for Resources in the California Governor's Office, the department which oversees DOGGR, concluded that it had sufficient authority to regulate CO_2-EOR projects, but not CCS projects without EOR.

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[8] Energy and climate legislation passed by the U.S. House of Representatives in 2009 (H.R. 2454, a.k.a Waxman-Markey) would establish a national economy-wide GHG cap-and-trade program. However, recent reports suggest no similar legislation will pass in the Senate this year.

[9] For an overview of California's existing regulatory structure for CCS, see Elizabeth Burton, "Permitting – Existing Regulatory Authority and Jurisdiction in California," presented at the California Carbon Capture and Storage Review Panel Meeting, April 22, 2010.

[10] Cal. Code Reg. Tit. 14, Div 2, Chap. 4.

Even though DOGGR has authority to permit a CO_2-EOR project, it does not have any specific authority related to sequestration or assuring permanence of sequestration. That means it is unclear what role a DOGGR Class II permit will play in helping a CO_2-EOR project get sequestration credit under any of California's GHG emissions reductions programs (described in more detail below).

Because sequestration naturally occurs as part of the EOR process, a Class II permit issued by DOGGR for a CO_2-EOR project might be able to include monitoring requirements that would aid in demonstrating sequestration. Under the California Environmental Quality Act (CEQA), DOGGR can impose such additional mitigation measures to assure safe operation.[11] Further, permitting CO_2 injection for EOR and sequestration is arguably consistent with DOGGR's dual mandate to increase the recovery of oil and gas resources within the state and protect the environment.[12] California permitting agencies are developing this approach for the proposed Occidental of Elk Hills, Inc. (Oxy) CO_2-EOR project associated with the proposed Hydrogen Energy California (HECA) project.[13]

It is possible then, for example, that a DOGGR Class II permit could include sufficient monitoring requirements to demonstrate permanent sequestration for purposes of the SB 1368 Emissions Performance Standard. But the Air Resources Board could have different requirements for crediting under AB 32 cap-and-trade program.

ii. **California Climate Policy and Sequestration Credit.** California climate policy is more extensive and aggressive than federal policy. There are several state level programs in which credit for geologic sequestration of CO_2 potentially could have value.

First, efforts are underway to establish a broad-based GHG cap-and-trade program in order to meet the GHG emissions targets set by AB 32. CCS might be identified as a way to avoid GHG emissions to comply with emissions caps or as a way to generate offsets for GHG emissions. Second, SB 1368 established a GHG emissions performance standard (EPS) for long-term electricity contracts to serve California consumers. The EPS allows for CCS to be used as a way to reduce the GHG intensity of electricity. Lastly, Executive Order S-01-07 established a Low Carbon Fuel Standard (LCFS) as a mechanism for the transportation sector to meet AB 32's GHG emission reduction targets. The LCFS establishes a goal of reducing the carbon intensity of California transportation fuels by at least 10 percent by 2020 to be achieved through market-based

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[11] *See* Cal. Pub. Res. Code § 21000 et seq.

[12] *See* Cal. Pub. Res. Code §3106(a) & (b).

[13] *See* Hydrogen Energy Power Plant Licensing Case, California Energy Commission Docket Number 08-AFC-08. *See also*, Hydrogen Energy California LLC Submissions to California CCS Review Panel, July 29, 2010.

mechanisms like credit trading. CO_2-EOR could potentially provide a mechanism for reducing the carbon intensity of fuels or generating compliance credits (though it is not now among the established options).

Multiple California regulatory agencies potentially could be involved in determining standards for giving sequestration credit (or not) to CO_2-EOR sites for purposes of compliance with any or all these programs.

(1) **GHG Emissions Reduction (AB 32).** California has ambitious GHG emissions reductions targets, with short term targets set in Assembly Bill 32 in 2006 and long term goals outlined by executive order in 2005: 1990 levels by 2020; and 80 percent below 1990 levels by 2050.[14]

AB 32 directed the Air Resources Board (ARB) to prepare a scoping plan to identify the best ways to reach the 2020 target, including a cap-and-trade program. The Climate Change Scoping Plan,[15] as adopted by the Board in December 2008, "expresses support for near-term advancement of [CCS] technology and monitoring of its development." Further, the plan states that "California should both support near-term advancement of the technology and ensure that an adequate framework is in place to provide credit for CCS projects when appropriate."

The Climate Change Scoping Plan proposes that a California Cap-and-Trade Program would regulate all electricity generation, including imports, as well as industrial sources and processes that emit 25,000 metric tons of CO_2 equivalent ($MTCO_2e$) per year or more in the first compliance period (2012–2014). Starting in the second compliance period (2015–2017) transportation fuels, all commercial and residential fuel combustion of natural gas and propane, and industrial fuel combustion at facilities with emissions below 25,000 $MTCO_2e$ would be included. As stated in the cap-and-trade program Preliminary Draft Regulation,[16] however, ARB is considering including all sectors in the program starting in 2012. CCS is not directly addressed in the Preliminary Draft Regulation.

In addition to the Scoping Plan, ARB developed a mandatory GHG reporting inventory, which appears at sections 95100-95133 of title 17 of CA Code. Sites where CO_2 is injected, whether for EOR or for sequestration, do not appear to be

[14] Assembly Bill 32, the Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006):

[15] California Air Resources Board, December 2008, Climate Change Scoping Plan: A Framework for Change, http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm.

[16] California Air Resources Board, November 24, 2009, Overview: Preliminary Draft Regulation for a California Cap-and-Trade Program, http://www.arb.ca.gov/cc/capandtrade/meetings/121409/pdr.pdf.

covered by the reporting rule. Similarly, ARB does not have a quantification methodology for emissions and emissions reductions associated with CCS.

(2) **GHG Emissions Performance Standard (SB 1368).**[17] Senate Bill 1368 established a GHG Emissions Performance Standard (EPS) for electricity of 1,100 lbs CO_2 per megawatt-hour (MWh) of electricity delivered. (This is equivalent to the emissions from a combined-cycle natural gas power plant). The mandate applies to long-term financial commitments (more than 5 years) to purchase electricity from baseload facilities to serve California consumers. Under SB 1368, geologically sequestered CO_2 does not count as an emission from a power plant for purposes of determining EPS compliance. Sequestration is considered successful if**:**

(a) It includes capture, transportation, and injection of CO_2 emissions;

(b) Complies with applicable laws and regulations; and

(c) Has an economically and technically feasible plan that will result in permanent sequestration.[18]

The California Energy Commission (CEC) has authority to enforce the EPS for municipal utilities and has established regulations for screening long-term facilities for compliance with the EPS.[19] The regulations do not define permanence for sequestration nor do they address whether CO_2 derived from a power plant and sequestered at an EOR site would meet the criteria for successful sequestration. The California Public Utilities Commission (CPUC) has jurisdiction under SB 1368 to enforce the EPS on investor-owned utilities.

As discussed above, a DOGGR permit for a CO_2-EOR project related to a power plant subject to the EPS might be able to include sufficient standards to meet the CEC or CPUC's screen for determining compliance.

(3) **Low Carbon Fuel Standard (Executive Order S-01-07)**. Executive Order S-01-07 established California's Low Carbon Fuel Standard (LCFS), which sets an initial goal of reducing the carbon intensity of the state's passenger vehicle fuels by at least 10 percent by 2020.

Fuel providers are required to ensure that the mix of fuel they sell in California, on average, meets the standard on a lifecycle basis. That means the LCFS covers

[17] Senate Bill 1368 (Perata, Chapter 598, Statutes of 2006)

[18] Cal. Code Regs., Chap. 11, Art. 1, § 2904(c)

[19] Cal. Code Regs., Chap. 11. Greenhouse Gases Emission Performance Standard, Article 1, § 2900 et. seq.

not only tailpipe emissions, but also emissions associated with production and distribution of transportation fuels. CCS potentially could be used to help fuel providers comply with the standard either as a method to directly to reduce the carbon intensity of certain fuels or generate tradable compliance credits.

ARB's LCFS regulations only directly address CCS in a limited way. They allow for consideration of use of CCS technology in determining the carbon intensity value of crude oil and the associated compliance obligations of the fuel provider.[20]

3. Approaches to Regulating CO_2-EOR with Sequestration. In order for CO_2-EOR to receive credit for sequestration for any of the above-described programs, appropriate standards must be developed that will measure the quantity of CO_2 sequestered and demonstrate that sequestration is permanent. The analysis presented here focuses on regulatory frameworks for crediting CO_2-EOR with sequestration. Please see the Technical Advisory Committees other papers on permitting and MVR for a fuller discussion of the range of issues that must be considered within these regulatory frameworks.

The advantages and disadvantages of two potential regulatory frameworks are discussed below. The first approach would only credit CO_2-EOR with sequestration only when it meets the same standards as sequestration projects in saline formations. The second approach would establish customized standards for CO_2-EOR that would better accommodate on-going oil production, but still provide sufficient verification of sequestration.

We do not consider two more extreme approaches – 1) where CO_2-EOR would receive sequestration credit without providing any verification beyond the business-as-usual requirements for EOR, or 2) where CO_2-EOR would never be eligible for sequestration credit. The first would arguably undermine California's climate policies by allowing sequestration credit without verification. The latter would arbitrarily exclude a potentially important CCS technology.

a. **Credit CO_2-EOR with sequestration only if it meets the same permitting and MVR requirements as sequestration in saline formations (such as, e.g. Class VI standards).** One possible regulatory approach would be to require a CO_2-EOR site seeking credit for sequestration to meet all the regulatory requirements of saline formation sequestration. A CO_2 -EOR site would only be able to receive sequestration credit by meeting all permitting, human health, environmental safety protection, and MVR requirements applicable to saline formation sequestration sites (such as Class VI permitting requirements). A CO_2 -EOR site not seeking sequestration credit would be exempt from regulations aimed at geologic sequestration.

[20] Cal. Code Reg. Tit. 17, § 95486 (b)(2)(A) (Determination of Carbon Intensity Values).

In California, this approach could translate to requiring any CO_2-EOR project seeking sequestration credit (e.g. under AB 32, SB 1368, or the LCFS) to obtain a Class VI permit and meet any additional state-imposed requirements for saline formation sequestration site.

i. **Examples.** In order to protect business as usual for the EOR industry, many CCS policies (and model policies) categorically exempt all EOR operations from new CCS regulations. Such exemptions could be interpreted to mean that a CO_2-EOR site would need to meet all standards imposed on saline formation sequestration sites in order to receive sequestration credit. For example:

(1) **Model Legislation Proposals.** The Interstate Oil and Gas Compact Commission (IOGCC) published model state legislation for regulating geologic sequestration of CO_2 that has been followed closely by several states. Under IOGCC's proposal, CO_2-EOR projects would be exempt from the regulations for saline formations unless the site operator wanted to engage in production and sequestration simultaneously, in which case the saline formation sequestration regulations would apply.[21]

The CCSReg project developed model federal legislation in 2010 that would require an EOR facility to meet all the permit requirements required of any other geologic sequestration facility in order to be credited under any federal GHG emissions reduction program.[22]

(2) **States.** Some early moving states followed the IOGCC model legislation approach. For example, Montana and Wyoming[23] categorically exempt EOR sites from most aspects of their new policies governing geologic sequestration, but provide guidance on how an EOR site could be converted to a geologic sequestration site. [24]

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[21] IOGCC Task Force on Carbon Capture and Geologic Storage, "Carbon Dioxide in Geologic Structures: A Legal and Regulatory Guide for States and Provinces, September 25, 2007.

[22] CCSReg Project, "Model Legislation: The Carbon Capture and Sequestration Regulatory Act of 2010," May 19, 2010, available at http://www.ccsreg.org/pdf/CCS_Draft_Leg_05192010.pdf.

[23] *See* Montana SB 498 (2009) and Wyoming HB 90 (2009).

[24] Although most states have exempted EOR from their new geologic sequestration policies, some states lay the groundwork for EOR sites to receive sequestration credit. In ND, the Industrial Commission may adopt procedures and criteria to determine the amount of injected CO_2 stored in an EOR project, to facilitate carbon credits or allowances for EOR projects. §38-22-33. West Virginia's CCS legislation clarifies that CO_2 injected for EOR is not subject to provisions of the bill and that the new law does not impede or

(3) **EPA Class VI Proposal**. Under its current proposal, EPA would regulate injection wells in oil and gas reservoirs under Class II rules so long as any oil and gas production is occurring. The implication is that no sequestration would be recognized until oil and gas production ceases and the Class II well could qualify as Class VI.[25]

ii. **Advantages.**

(1) **Environmental integrity.** Requiring CO_2-EOR compliance with the same permitting and MVR requirements as saline formation sequestration would ensure that sequestration credits have equivalent environmental value. The climate change mitigation purpose of geologic sequestration in a saline formation is the same as it would be in an oil reservoir. Different MVR standards are difficult to justify unless there is assurance that the standards are can be equally effective.

(2) **Clarity of regulatory purpose.** CCS and EOR have fundamentally different purposes (climate protection versus oil production). Regulations attempting to serve both purposes might shortchange one or the other.

(3) **Protection of EOR industry.** EOR business-as-usual is most securely protected by a blanket exemption for EOR from sequestration regulations.[26] Under this approach, no additional regulatory requirements would be imposed on CO_2-EOR sites unless they make a choice to become sequestration sites and follow those rules.

iii. **Disadvantages.**

(1) **Poorly fitting standards**. The extensive knowledge and characterization of oil reservoirs from years of production might justify different kinds of site characterization and MVR requirements for sequestration in oil and gas reservoirs compared to lesser known saline

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impair EOR operations, including the right to sell emission reduction credits associated with EOR. §22-11A-8.

[25] *See* A. Scott Anderson, Environmental Defense Fund, Carbon Sequestration in Oil and Gas Fields (in Conjunction with EOR and Otherwise), at 2, White Paper for MIT EOR and Carbon Sequestration Symposium, July 23, 2010.

[26] *See* IOGCC Task Force on Carbon Capture and Geologic Storage, "Carbon Dioxide in Geologic Structures: A Legal and Regulatory Guide for States and Provinces, September 25, 2007.

formations. Different requirements for CO_2-EOR do not have to be lesser requirements.

(2) **Delay in deployment of CCS.** CO_2-EOR sites are attractive for early projects because of greater availability of site characterization information and the opportunity to offset costs with oil production and sales. Regulations that are not well-designed to accommodate ongoing oil production might be a disincentive for these early projects.

(3) **Unrecognized sequestration.** If CO_2-EOR sites become regulated as emissions sources (e.g. under the Clean Air Act), fairness would suggest that their sequestration achievements should be acknowledged without requiring the site to meet otherwise inapplicable CCS permit requirements. Otherwise, CO_2-EOR might become uneconomic.

b. Customize MVR and permitting standards for CO_2-EOR that accommodate oil production, but provide sufficient verification to justify sequestration credit. An alternative regulatory approach is to assume that EOR and sequestration can and should occur simultaneously at the same site. This approach would require developing regulations that would accommodate active oil production while providing for sufficient MVR and other permitting standards to justify sequestration credits. This type of approach would allow CO_2-EOR to receive credit for CO_2 sequestration while remaining within the EOR regulatory framework (i.e., remaining a Class II injection well). However, for sequestration credit to be given, sufficient MVR and permitting standards will be required, even if they are different than those imposed on saline formation sequestration sites.

In California, this approach might take the form of DOGGR permitting CO_2-EOR injection wells under its Class II authority. Then any CO_2-EOR site wishing to receive sequestration credit would have to opt into additional MVR and other standards that satisfy other regulatory agencies charged with giving sequestration credit for purposes of AB 32, the SB 1368 EPS, of the LCFS. These other agencies might coordinate with DOGGR to have these enhanced standards be included in the Class II permit.

i. **Examples.** As discussed above, most early CCS policy and policy proposals do not create a method for crediting CO_2-EOR sites with sequestration unless they follow rules established for saline formation sequestration. But there are some examples of policies and proposals that take this approach of customizing regulations for CO_2-EOR:

(1) **Mandatory Greenhouse Gas Reporting Rule, Proposed Subpart RR**. As described above, EPA's proposed GHG reporting rule

for CO_2 injection would have CO_2-EOR sites opt into the enhanced requirements for saline formation sites if they wish to receive credit for sequestration. Choosing to comply with the enhanced MVR requirements would not require changing the sites regulatory status under the UIC (i.e. changing from regulation under Class II to Class VI).

(2) **MSD Recommendation**. As described above, the Carbon Sequestration Council's MSD group's widely regarded recommendations would alter EPA's proposed geologic sequestration rules to accommodate simultaneous oil production and sequestration under Class II permits.

(3) **Texas.** In Texas, policy governing geologic sequestration of CO_2 is evolving to encourage pairing with EOR. For example, Texas HB 469 (2009) provides various tax incentives designed to encourage use of anthropogenic CO_2 for EOR. The incentives are available to CO_2-EOR that conduct monitoring and verification to reasonably demonstrate that 99% of the injected CO_2 will be sequestered for 1,000 years.

In addition to incentives, Texas is developing regulations that will accommodate simultaneous sequestration and oil production.[27] In SB 1387 (2009), the Texas legislature directed the Railroad Commission to develop rules governing geologic sequestration of CO_2. The legislation directs that UIC Class II wells are to be exempt from these rules. Further, converting a well from EOR use to geologic sequestration is not to be considered a change in the purpose of the well.

But the rules proposed by the Railroad Commission are designed similarly to the Carbon Sequestration Council's MSD recommendation. The new regulations would not apply to a Class II CO_2 injection well permitted "for the primary purpose of enhanced recovery operations from which there is a reasonable expectation of more than insignificant future production volumes of oil, gas, or geothermal energy and operating pressures no higher than reasonably necessary to produce such volumes or rates." The proposed rules would, however, allow an operator to propose to permit a project as an EOR project and a geologic storage facility simultaneously.[28] That means EOR projects that also apply for geologic storage permit would be subject some additional siting

[27] See Texas Carbon Capture & Storage Association materials, e.g. Darrick Eugene, "The Texas Edge: SB 1387 – Framework for Geologic Storage," presented to the UT Law, Carbon, and Climate Change Conference, February 18, 2010.

[28] Texas Railroad Commission, proposed new Chapter 5, *§5.201. Applicability and Compliance.*

and MVR requirements to which other Class II wells would not otherwise be subject.

ii. **Advantages**

(1) **Deploying CCS sooner**. Rules designed to accommodate oil production are probably the best way to harness the infrastructure and know-how of the established industry EOR industry. Encouraging CO_2-EOR as sequestration with customized rules might be the best way to begin using CCS soon enough to put California on a path to achieving its 2050 GHG emissions reductions goals.

(2) **Recognizing the EOR knowledge base.** EOR site operators have extensive knowledge about their reservoirs, which means customized MVR requirements could be effective without being lesser than standards for saline formation sites.

(3) **Ensuring economic viability of EOR under GHG caps**. If EOR sites become regulated as GHG emissions sources under the Clean Air Act, then a method for crediting them with CO_2 they successfully sequester will be critical for the on-going economic viability of CO_2-EOR.

(4) **Encouraging CO_2-EOR in California**. There is no anthropogenic CO_2 being used for EOR in California today. Sequestration credits might be a necessary incentive to encourage CO_2-EOR sites in the state, which make good candidates for early CCS projects. The viability of CCS is important in the near-term for new power plants required to meet the SB 1368 EPS.

iii. **Disadvantages**

(1) **Complexity and uncertainty in GHG accounting.** GHG accounting is more challenging if sequestration credit is given to an operation that produces fossil fuel. Policy choices must be made about how to allocate sequestration credit among different parties and regulatory programs. For example, it could be double-counting to apply sequestration credit from CO_2-EOR to a fuel provider's LCFS obligation and to a power plant to meet its SB 1368 obligations.

(2) **Regulatory inconsistency.** Customizing regulations for sequestration at CO_2-EOR sites could mean establishing requirements that are different than requirements for sequestration in saline formations. Different standards could be equally effective if designed well, but there is a risk that one set of requirements would turn out to be

less stringent than the other. California's climate programs will be less effective if sequestration credits have inconsistent environmental value.

(3) **Stakeholder discord.** Even if stakeholders agree that there should be a way for CO_2-EOR to receive sequestration credit while remaining within the EOR regulatory framework (i.e. Class II), there is no consensus on what MVR or other standards would be appropriate for verification.