elk petroleum

1600 BROADWAY, SUITE 1720
DENVER, CO 80202
PHONE: 720-744-4884

May 22, 2017

Alexander Mitchell
Manager, Emerging Technology Section
California Air Resources Board
Sacramento, California

Dear Mr. Mitchell,

This letter is in response to the Carbon Capture and Sequestration (CCS) Concept Paper, Summary Paper and Public Workshop held at the Air Resources Board in Sacramento on May 8, 2017. In the Concept Paper, it was recommended that the CCS QM to be proposed for adoption by the California Air Resources Board include a Permanence Protocol that would regulate the Injection or Production Well Material and Structural Integrity. Under this category, it is proposed to specify a Well Material Integrity and Leak Mitigation Plan. In response to these proposals, Elk Petroleum has the following comments:

Well Material Integrity

The staff recommendation in the May 8th Public Workshop presentation regarding well cementing (Slide 31) was that the casing annulus in all production and injection wells must be cemented to surface. The attractiveness of CCS as a carbon mitigation method is that there are thousands of wells that already exist in depleted oil fields that can be utilized for CO2 sequestration at an economically viable cost. Since these wells were drilled and cemented to comply with Class II UIC standards, there are very few existing wells that were cemented to surface. If the requirement imposed by the Permanence Protocol is that all wells must be cemented to surface, then there will be a minimal implementation of CCS under the program.

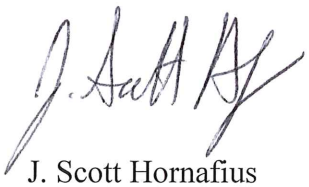
Furthermore, the requirement to cement to surface may cause more harm than good, if the goal is to prevent leakage of CO2 back to the atmosphere from the storage zone over a long time period. The problem with cementing the annulus of a well to the surface is that no behind-pipe cement job can be guaranteed to be perfect, since channelling and air pockets can occur during the cement job that will provide for a migration pathway, whether the well is cemented to surface or not. Because of this possibility, the standard practice in the oil industry is to do a mechanical integrity test on the well prior to putting it into service for CCS, in order to be sure that it is holding pressure. If the well fails the

mechanical integrity test, it is then plugged and abandoned. If the well is later found to be leaking, the well can be safely abandoned by cutting the casing above the cement top (usually located a few hundred feet above the injection or production zone).[1] During this abandonment process, cement plugs are placed in the well where the casing has been removed, and these cement plugs have high integrity because the cement is in contact with the rock formations, and the cement is uniformly place in the well without the risk of channelling or air pockets forming, as might be the case with cementing "behind pipe". However, if the casing is initially cemented to surface up the annulus, then the ability to remediate a leak would be extremely impeded, because the casing can then not be cut and pulled to prepare the well to be properly abandon. The emphasis of the Permanence Protocol should be on the proper abandonment of wells after the sequestration activity is completed, and not on how to prepare the well for injection and production prior to the short period of active sequestration, since leak prevention during the active sequestration period can be achieved under standard Class II well operating procedures. [1,2,3,4]

Leak Mitigation Plan

During the active sequestration period, any leakage from the storage zone up the well bore would be detectable by pressure monitoring of the casing and annulus, provided that the casing is not cemented to surface.[1] If there is an inadequate cement bond above the injection zone in the annulus, then pressure will build up in the annulus between the cement top and the surface, and the leak can be remediated by a cement squeeze job in the un-cemented portion of the annulus. If that intervention is unsuccessful, then the well can be plugged and abandoned by cutting and pulling casing, and placing cement plugs in the open hole. The requirement to cement the casing to surface prior to the start of the carbon sequestration activity would prevent the CCS operator from having the ability to proactively detect and remediate any potential leakage up the annulus, since continuous monitoring of the annulus casing pressure would then not be an effective tool to head off any potential leakage problems if the casing has been cemented to the surface.

The oil industry has been practicing CCS safely and reliably for the past 40 years. Monitoring of these existing projects shows that there has been no evidence of environmental damage from leakage, in spite of claims to the contrary.[2] In the Public Workshop presentation, the list of Design Principles for the CCS Program (Slide 11) states that it should be based on Sound Science and the Inclusion of Expert State and Federal Agencies. Missing from this list is the Expert Recommendations of the Oil Industry. Since the oil industry is where the experience and learnings regarding CCS has occurred, it would be advisable to include the testimony of these experts in the final recommendations for the CCS Permanence Protocol. In this context, it would greatly improve the chances of a successful deployment of CCS by the Air Resources Board if the recommendations of the industry experts cited in this letter and listed below were included in the Permanence Protocol.



J. Scott Hornafius
President
Elk Petroleum, Inc.

1. J. Scott Hornafius, *Well Mechanical Integrity*, Well Mechanical Integrity Technical Discussion, Cal/EPA Headquarter Building, Sacramento, CA, May 12, 2016.

2. Katherine Romanak, *Environmental Quality Over CO2 Injection Sites*, Well Mechanical Integrity Technical Discussion, Cal/EPA Headquarter Building, Sacramento, CA, May 12, 2016.

3. Dana G. Wreath, *Wellington KS CO2 EOR Project*, CO2 EOR Technical Discussion, Cal/EPA Headquarter Building, Sacramento, CA, August 23, 2016.

4. L. Bruce Hill, *Considerations for Developing QM for EOR Storage*, CO2 EOR Technical Discussion, Cal/EPA Headquarter Building, Sacramento, CA, August 23, 2016.