Submitted electronically

Clerk of the Board
California Air Resources Board
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Sacramento, CA 95814
https://www.arb.ca.gov/lispub/comm/bclist.php

Re: 15-day comments on Carbon Capture and Sequestration Protocol under the Low Carbon Fuel Standard

Dear Clerk of the Board,

Clean Air Task Force (CATF) and the Natural Resources Defense Council (NRDC) appreciate the continued opportunity to provide comments to California Air Resources Board (ARB) on the proposed amendments to the Low Carbon Fuel Standard (LCFS) regulation, specifically Appendix B – Attachment 1: Carbon Capture and Sequestration (CCS) Protocol (Protocol).

Introduction

We commend ARB for proposing numerous important improvements to the Protocol in the 15-Day Modifications released June 20, 2018, following the 45-day comment period on the draft Protocol. We believe that those strengthen the Protocol and afford a greater degree of oversight and environmental protection. We outline some of the most important ones below, and we support the majority of the proposed modifications. We also point out a small number of modifications that require further consideration or edits.

CATF and NRDC remain concerned that ARB has thus far declined to make significant improvements to the post-injection monitoring provisions. As currently proposed, these provisions do not afford the degree of environmental protection that is feasible, and are insufficiently informed by today's best science and practices. Failing to address the problematic aspects of the post injection monitoring provisions weakens the performance-based approach of the revised Protocol, and detracts from its effectiveness in protecting the environment and credibility. We strongly encourage ARB to revisit these aspects of the Protocol.

We Support Many of the Proposed Technical Changes

Replacement of Area of Review
In its 15-Day Modifications, ARB appears to have recognized how important it is that the Protocol reflect the three-dimensional nature of the subsurface environment and the CO_2 plume. In doing so, ARB proposes to replace "area of review" with the concepts and definitions of "storage complex" and "confining system" whenever referring to the three-dimensional storage volume and all geologic layers and structures that impede the lateral or vertical migration of the CO_2 plume. These new definitions, which we support, require operators to fully understand the geology, legacy wells and other leakage risks in the subsurface, thereby strengthening the Protocol and ensuring a higher degree of leakage prevention.

Pressure Dissipation Interval and Secondary Confining Layer
We support ARB's proposal to eliminate the requirement for a pressure dissipation interval and a secondary confining layer, and to instead focus on the demonstration of a robust confining system to ensure storage security. As we have explained in previous comments, requiring a pressure dissipation interval and a secondary confining layer does not necessarily enhance storage security, and may in fact result in the selection of a subset of sites with inherently lower security in some cases.

Given these proposed revisions, we recommend that the use of the term "confining layer" be revised in several places throughout the protocol:

2.1(a)(3) the phrase "confining layer" should be revised to read "primary confining layer."
2.3(a)(2)(A) the phrase "confining layer" should be replaced with the term "confining system."
2.3(a)(2)(B) the phrase "confining layer" should be replaced with the term "confining system."
2.3(a)(3)(B) the phrase "confining layer" should be revised to read "confining layer(s)."
2.3(a)(3)(C) the phrase "confining layer" should be revised to read "confining layer(s)."
2.3(a)(3)(E) the phrase "confining layer" should be revised to read "primary confining layer."
2.3(e)(1) the phrase "confining layer" should be revised to read "primary confining layer."
2.3(g) the phrase "confining layer" should be revised to read "primary confining layer."
2.3(k)(5) the phrase "confining layer" should be replaced with the term "confining system."
2.4.1(a)(1)(C)(3) the phrase "confining layer" should be revised to read "confining layer(s)."
3.1(c)(1)(G) the phrase "confining layer" should be revised to read "confining layer(s)."
3.1(c)(3) the phrase "confining layer" should be revised to read "confining layer(s)."
3.2(e) the phrase "confining layer" should be revised to read "confining layer(s)."

Pressure Front
We also support ARB's proposal to replace the concept of "pressure front" with areas of "elevated pressure," which far more accurately reflects the more stochastic behavior of pressure in the subsurface.

3.3. Injection Well Operating Requirements
We support the proposed addition to subsection (b) that injection pressure not unacceptably increase the risk of significant induced seismicity.

Other
Other areas of substantive improvement that we support include:

- Linking the monitoring, measurement and verification (MMV) to the risk assessment;
- Requiring the operator to submit interpretation of data;
- Ensuring MMV is sensitive to the geologic environment;
- Evaluation of MMV;
- Periodic review of MMV methods; and
- Requiring operators to document their methods.

Recommended Changes
Highlighted below are several areas that have been modified since the draft Protocol that require further modification to improve subsurface CO_2 security and be more firmly rooted in today's best scientific methodologies.

Definition of Elevated Pressure
The definition of "storage complex," (proposed §2(a)(48)) should be modified as follows, to take into account the universal definition of risk as Probability x Consequence, and the fact that risk can be infinitesimally small although technically not zero.

> "Elevated pressure" means the fluid response to CO_2 injection is such that the pressure rise creates an unacceptable risk of CO_2 or brine leakage.

Definitions of Pore Space and Porosity
As currently written, these two terms have the same meaning, i.e. the volume of void space in rocks or soil. In practice, the term "pore space" is used in the draft Protocol to refer to the voids themselves, not their total volume. As such, we recommend the following revisions:

> 2(a)(88) "Pore space" means the ~~volume between crystals or grain~~ voids in a rock or soil that can be filled by a fluid, such as water, air, or CO_2.

2(a)(89) “Porosity” means the ~~relative~~ volume percentage of pore space.

1.1.1. Third Party Review

Subsections (e) and (f) require the third-party reviewers of the Sequestration Site Certification and CCS Project Certification to be professional geologists or engineers, respectively, licensed under California law “or equivalent.” We request that ARB clarify whether the phrase “or equivalent” is intended to allow geologists and engineers licensed in other states to meet this requirement, which is something we would support. Additionally, it is critical that third-party reviewers have specific subject matter expertise, which licensing as a professional geologist or engineer does not guarantee. An expert of choice may not be licensed in the state where the project is located, and the state need not be California. We recommend that ARB include additional qualifications beyond professional licensing to ensure that third-party reviewers have the requisite experience to provide appropriate review.

2.3 Geologic and Hydrologic Evaluation Requirements

We support the intent behind the proposed change to subsection (b)(6) but the term “significant” is vague and undefined. We propose instead that operators be required to identify and describe all geologic structures that are “material to leakage” or, alternatively, “material to permanence.”

2.4. Storage Complex Delineation and Corrective Action

We support the proposed revision in subsection (b)(1)(C) that corrective action be performed on all wells that may be pathways for CO_2 leakage, including both wells that penetrate the storage complex and wells within the surface projection of the storage complex. As ARB rightly recognizes, shallow wells that do not intersect the storage complex can still become leakage pathways if CO_2 migrates outside the storage complex.

2.4.3. Corrective Action Requirements

We recommend that subsection (b)(1) be revised to require operators to “Use best available methods and technologies to” identify all artificial penetrations. This would provide a recognition that it may not be technologically feasible to identify “all” artificial penetrations, while still maintaining a high standard that all available efforts be made to do so.

We also propose that subsections (b)(1) and (b)(2) be combined to reduce redundancy, as follows:

> (1) Identify all artificial penetrations, including all wells that either penetrate the storage complex or are within the AOR, and provide a tabulation of each well's type, construction, date drilled, location, depth, record of plugging and/or completion~~,~~; casing

diagrams for those wells pursuant to subsection C.2.4.3.1; and any additional information the Executive Officer may require;
~~(2) Identify all wells that either penetrate the storage complex or are within the AOR, and provide casing diagrams for those wells pursuant to subsection C.2.4.3.1; and~~

We strongly support the proposed addition in subsection (c) that operators be required to provide a description of the completeness of any well record databases relied on to identify wells. The quality of such databases may vary significantly, meaning that they may or may not be reliable as a tool for locating existing wells that may be CO_2 leakage pathways.

We note, however, that this change is still not reflected in Figure 5. As written, the flowchart states that if records indicate the presence of abandoned wells and if those records indicate the wells are properly plugged, then the well evaluation process is complete. A critical step is missing, which is requiring the operator to determine whether those well records are actually sufficient to locate all existing wells and determine whether they're adequately plugged. We request that an additional box be added to the flow chart that reflects the proposed additional language in subsection (c).

Out-of-Storage Complex Migration and Leakage
We support the notion of considering the migration of the CO_2 plume out of the storage complex as "subsurface leakage"(proposed §2(a)(25)). Subsurface leakage indicates that actual operational parameters deviated from the predicted ones, and action should be taken in order to understand the discrepancy and avoid further subsurface leakage in the future.

We believe §2.4.4 should be titled "Storage Complex Reevaluation" – not "Plume Reevaluation." The plume is a physical occurrence, not a regulatory construct.

Regarding the proposed actions under §2.4.4(d), we believe that it would be appropriate to revoke the Project Certification in some cases, but not all. For example, if the CO_2 has migrated into a neighboring lease where land and subsurface access is impossible, or if it has intercepted a leakage pathway that is difficult or impossible to control or monitor, then such revocation would be desirable. But there may be cases when the plume simply breaches the defined Storage Complex without any consequences and without any increased atmospheric leakage risk. In such cases, redefining the Storage Complex may be sufficient. We recommend that the Executive Officer reserve the right to revoke the Project Certification in cases where it is warranted, which would include negligence, fraud and materially increased risk of atmospheric leakage. Such authority would act as a deterrent to defining the Storage Complex too narrowly and drive precautionary behavior.

On a similar note, we do not agree that credits should be invalidated for subsurface leakage unless it can be shown that actual atmospheric leakage has occurred or is likely to occur as a result of subsurface leakage. In some cases, subsequent atmospheric leakage may be inevitable if the subsurface leakage has resulted in the CO_2 intercepting a pathway that would provide a path to the surface. In other cases, though, the CO_2 may remain permanently trapped in the subsurface, even if it has breached the originally defined Storage Complex. We believe the potential revocation of the Project Certification to be sufficient disincentive for projects to define the Storage Complex too narrowly, and that accounting under the LCFS should be concerned with actual atmospheric emissions – not inconsequential migrations in the subsurface. As such, the proposed revisions to the term $CO_{2leakage}$ in equations (5) and (6) under §2.2(e) should be struck. In addition, we would like to draw ARB's attention to the case of a reservoir that is compartmentalized. Such "blocks" are known to occur in practice and may or may not be hydrologically isolated. We presume that all blocks would be part of the same Storage Complex. If they are indeed isolated in the subsurface, breaching the Storage Complex in one block would not mean that the security of storage in the others is compromised. We recommend a scaling approach based on injected quantities for the purposes of accounting for leakage and credit invalidation in such cases.

Plume Stabilization

We request that ARB clarify the definition of "plume stabilization," at proposed §2(86). The definition remains unclear as to whether or not plume stabilization is synonymous with a static system that is in equilibrium with the surrounding rock in the storage formation or whether it allows for a demonstrable statistical trend towards subsurface pressure equilibrium and permanence of the injected CO_2, a concept we advocated for in our 45-day comments. We are particularly concerned that demonstrating complete equilibrium with the subsurface within a 100-year period may not be feasible, or indeed useful, in many geologic settings. Moreover, "small" is undefined and relative, and "certainty" is more precisely defined in relation to the risk of leakage. We recommend the following definition for plume stabilization:

> 2(86) "Plume stabilization" means that the rates of plume migration and pressure changes have decreased such that monitoring and predictive methods demonstrate that there is minimal risk of leakage over a 100-year period with a very high degree of certainty.

The application of the concept of plume stabilization is important as well. We recommend a small modification in the language of proposed §5.2(b)(3), in order to allow for a demonstration that includes both monitoring and modeling, as follows:

> 5.2(b)(3)(B) Monitoring and observation wells may remain open, and in active monitoring mode, until CARB <u>approves a</u> ~~determines that~~ plume stabilization <u>determination</u> ~~has occurred.~~

Baseline Testing and Soil Gas Assessment

We strongly support ARB's changes in proposed §2.5 that take a more performance- and site-based approach to selecting baseline monitoring techniques, in particular soil gas and atmospheric flux monitoring (revised to a *potential* tool in the 15-day Modifications), while at the same time allowing for methods accompanied by an assessment of sensitivity to detect CO_2 in the natural environment. However, we remain concerned by the persistence of soil methods in several parts of the proposal. As we have commented previously to ARB, soil gas methods such as those required during the post-injection period in proposed §5.2(b)(G)(1), and as a *recommended* method in proposed §2.5(c)(5)(B), are known to suffer from inherent limitations and may not be effective in detecting CO_2 in the shallow subsurface.

We recognize that the rule will require an operator to demonstrate, during the injection period MMV, that leakage signals from soil flux methods will be effective (proposed §4.3.2.2(c)). However, a demonstration of sensitivity is not a requirement of post injection monitoring and may prove unrealistic for the injection period MMV as well, given that many years may be required to establish representative soil gas concentrations. Moreover, establishment of a baseline might not be possible given that climate change may result in changes in soil gases which further confound the use of a baseline approach.

Therefore, we strongly discourage the reliance on any baseline soil and air method in the rule. If soil methods are to be employed, they should be *process-based* methods that are implemented to determine sources of leakage once it has been identified, and do not require a baseline, as recommended by the University of Texas at Austin Gulf Coast Carbon Center.

Testing and Monitoring

There appear to be significant overlaps in the requirements of §§4.1(a)(9) and 4.1(a)(12). We recommend that ARB consolidate these two subsections or else clarify how the requirements differ.

Monitoring of Wellbores

We believe that the requirement for monitoring of all wellbores at proposed §4.3.2.2(e) is unnecessary. During the operational phases of injection, the operator would notice a drop in injection pressure at the injection wellhead in the event of CO_2 and related brines reaching the surface. Operators are already required to continually monitor mechanical integrity (§4.2(c)) and determine whether a release may have occurred if mechanical integrity may be compromised (§4.2.2). If an operator suspects a loss of mechanical integrity, it should be immediately required to cease injection, and go to the field to inspect all wellbores potentially affected, whether they be production wells or legacy wells. Therefore, we recommend that this requirement be revised as follows such that surface inspection and CO_2 flux monitoring be required in the event of a loss of mechanical integrity or other indicator of well failure:

> 4.3.2.2(e) Monitoring of all wellbores: When loss of mechanical integrity is detected the CCS Operator must investigate ~~monitor~~ all potentially affected wells within the storage complex. ~~Monitoring should include direct observation of the wells, if possible, and surface air monitoring around the wellbore.~~ Where leakage is suspected, monitoring

should be considered ~~focus on identifying CO2 flux~~ in the vicinity of ~~the~~ potentially compromised wellbore ~~that may indicate a catastrophic leak~~.

4.3.2.2(f) Ecosystem stress monitoring

Research has been conducted in areas with natural CO_2 seeps or in controlled release experiments to test the efficacy of vegetation stress monitoring to detect CO_2 leakage. While the use of remote sensing techniques to detect plant stress has shown some promise in identifying CO_2 leak sites, there is also a high incidence of both false positives and false negatives, given that there are many factors affecting plant health. Applying these techniques successfully requires significant, site-specific experience and is most appropriately used to supplement other monitoring techniques.

ARB's proposal that monitoring be conducted yearly is not sufficiently justified and fails to account for seasonal and other variations in plant cover and health; the appropriate monitoring frequency must be site-specific. Additionally, some sites may not be appropriate for such monitoring techniques, as the presence of vegetation is clearly a key prerequisite. We recommend that instead of mandating the use of vegetation surveys, ARB require operators to assess the efficacy of such surveys on a site-specific basis, as part of a holistic assessment of appropriate surface and near-surface monitoring techniques.

4.3.2.4. Verification

Consistent with our comment on §§1.1.1 (e) and (f), we request that ARB clarify whether the phrase "or equivalent" in §(b)(2) is intended to allow geologists and engineers licensed in other states to meet this requirement, which we support.

Post injection Site Care and Monitoring

We continue to have serious concerns with the proposed post-injection site care and monitoring regime. With the proposed 15-day Modifications, ARB's approach to post-injection monitoring can be summarized as follows:

- Intensive monitoring is to take place as soon as injection stops and until plume stabilization has been successfully demonstrated.
- Plume stabilization may not be demonstrated earlier than 15 years after injection stops.
- After plume stabilization has been successfully demonstrated, leak detection checks are to take place until 100 years after injection have elapsed, consisting of the following at a 5-year frequency:
    - Soil-gas and surface-air monitoring at and near former wellheads or well pads;
    - Visual inspection of the land surface near former wellheads or well pads; and
    - Inspection of potential pathways highlighted in the risk assessment for the preferential migration of CO_2 or brine to the surface, followed by more intensive monitoring if such inspections give reason for concern.

ARB rightly recognizes plume stabilization as the more important and resource-intensive task, and appropriately requires a significant effort to prove that such stabilization has occurred. However, there are several problems with the approach after that point.

First, as we have extensively documented in previous comments, soil-gas and surface-air monitoring techniques have been shown to be inaccurate, unreliable, and prone to influences from several external factors that are irrelevant to the security of storage. We continue to recommend that, if the objective is to detect CO_2 fluxes at the surface, a more general class of methods should be required, such as surface- and near-surface detection methods. Mandating problem-prone monitoring methods weakens oversight. We therefore again encourage ARB to rely on the use of at-depth monitoring methods that have been shown to detect CO_2 leakage, or the potential for leakage, sooner and much more reliably, and to place greater credence on the results of these methods.

Second, and along similar lines, visual inspections of the land surface near former wellheads or well pads may only be effective in detecting large leaks under limited circumstances where there is ample and sensitive vegetation that is unaffected by other factors such as seasonal or other temporal variations, stress due to drought or weather, etc. Although easy enough to perform, this requirement creates the impression of diligence, but provides only the most rudimentary protection.

Third, although the proposed addition of inspection of potential pathways highlighted in the risk assessment for the preferential migration of CO_2 or brine to the surface, followed by more intensive monitoring if such inspections give reason for concern is a sound concept, it must be appropriately timed and prescribed. The type of "inspection" is also not specified. We believe that such a requirement is appropriate and desirable until such time as it is proven with a very high degree of confidence that no such migration is possible. Prescribing it on a perpetual basis is unnecessary given the extensive monitoring, risk identification and mitigation measures that comprise the Protocol.

Taken together, these points fall short of achieving the highest level of environmental benefit or scientific integrity. In fact, ARB staff's response to Board Member Judy Mitchell's query at the April 27th, 2018 Board meeting query on the soundness of the 100-year monitoring provision gives us further cause for concern. The response[1] states precedent in the Forestry Offset Protocol and consistency with that as the primary reason for the existence of the same provision in the CCS Protocol, and proposes a decrease in the frequency of monitoring as a way to address concerns about the requirement's soundness and workability. CATF and NRDC have submitted detailed comments[2] previously, extensively demonstrating that forestry and CCS

[1] Industrial Strategies Assistant Division Chief Sahota, Meeting, State of California Air Resources Board, Transcript, at 250-51 (Apr. 27, 2018) *available at:* https://www.arb.ca.gov/board/mt/2018/mt042718.pdf?_ga=2.108898882.1568586200.1530205962-927216373.1510684661.

[2] Coalition Comments on Draft CCS Accounting and Permanence Protocol and on Draft Regulatory

projects are substantially different. While both types of projects can be held to a consistent level of permanence, the requirements imposed on them to demonstrate permanence must be specific to the nature of the projects, and hence fundamentally different.

In addition to the different nature of forestry and CCS projects themselves, ARB's regulatory approaches to the two classes of projects is starkly different. Under the Forestry Offset Protocol, leakage risk mitigation is absent, and ongoing monitoring and accounting of carbon stocks is both appropriate and desirable. In sharp contrast, the CCS Protocol is the largest collection of preventative, risk identification and mitigation provisions for CCS conceived by any jurisdiction to date. We commend ARB for pursuing the laudable goals of protecting public health and the environment. However, ARB needs to remain open to the possibility that this multi-layered approach to shrinking risk down to the bare minimum will actually succeed – something that the current post-injection monitoring requirements portray is not the case.

In addition, the proposal to decrease (or, to increase) the frequency of the monitoring prescribed over the 100-year period without a provision to consider site-specific parameters, is unsound and risks prolonging the time during which a potential leak remains undetected. For example, if human activity at the surface interferes with a well component and causes a leak, this could go undetected for a longer period if the frequency of checks is decreased. A default number is of little use in the complex universe of a CCS project. What is important is to assess whether there is residual risk of leakage throughout the 100-year period, what monitoring methods are best suited to establishing such risk, and the degree of confidence. Using the example above, if well components are vulnerable to human activity at the surface and no definitive means exist to prevent interaction, then ongoing monitoring would be warranted. If, however, by physical, electronic (note that we are contemplating technology many decades from today when these provisions would theoretically kick in) or other means such interaction is guaranteed to be avoided, then no further monitoring would be necessary. We do not contend that the number "100" should simply be replaced by another, or smaller, number. Nor do we contest the definition of permanence in the context of the LCFS, which requires CO2 to remain underground for 100 years – we believe that this performance level will be easily achieved or even greatly exceeded for the vast majority of injected CO2. Instead, we propose that the Executive Officer have authority to require post-injection monitoring to continue for up to 100 years if necessary, while also having the authority to approve site closure earlier if no remaining doubts exist on the security of storage.

Our alternative does not require an affirmative belief today that no leakage is ever possible after a certain point, or in every case. It merely requires leaving open the possibility that technology and understanding many decades from now will have advanced to the point that will enable us to make such statements with a very high degree of certainty. For example, earthquakes have been cited as a possible reason for CO2 leakage. In 2004, a 6.8-Richter scale earthquake took place 20km from a CO2 injection site in Nagaoka, Japan. The injected CO2 has

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Amendments to the Low Carbon Fuel Standard as these pertain to CCS technology, *(*Dec. 4, 2017) *available at:* https://www.arb.ca.gov/fuels/lcfs/workshops/12042017_coalition.pdf.

been monitored by scientists before, during and after the earthquake and no leaks have been detected to date.[3] Today, this forms the basis for a hypothesis that earthquakes may not be an a priori concern to the integrity of sequestration sites. However, this hypothesis will need to be tested on a case-by case basis taking into consideration geologic and tectonic setting as well as well construction.

We do consider it perfectly plausible though that such studies will have been performed many decades from today. We are not contending that modeling or predictions should be used in lieu of real evidence or observations. On the contrary, we believe in using concrete evidence. As another example, Porse et al.[4] assess the risk of a well blowout to be on the order of 10^{-3}, with the relevant sample space being Railroad Commission districts in Texas. Others assess the risk to be two orders of magnitude lower (10^{-5}) based on offshore wells in the UK, highlighting that location and regulation can play an important part in mitigating risks.[5] These studies represent statistical evidence, based on experience and observation – not modeling or conjecture. Categorically believing that the existence of such evidence will be impossible is unfounded. It is also paradoxical that ARB believes that 15 years may sufficient to make the more involved and complex demonstration of plume stabilization, but apparently does not consider it possible that residual leakage risk can also be shown to be minimal or non-existent at some point during the 100-year period.

We also point out that these post-injection monitoring requirements are almost certain not to be applied in practice in the later years, for the very simple reason that many decades from now both the CCS Protocol and the LCFS program will likely have been succeeded and superseded by other requirements and programs. With that in mind, we strongly urge ARB to consider the side effects that such requirements may have at the present time in California and other jurisdictions. Our organizations believe that CCS can meaningfully complement other greenhouse gas reduction strategies and have long argued that it be required for certain types of facilities through performance standards and other regulations. However, we are concerned that if the Protocol is finalized in its current form, the provisions we highlight as problematic may impose additional actual and/or citable hurdles to requiring broader and more expedited installation of CCS in California and nationally, at no environmental benefit.

Our proposed approach avoids these pitfalls while affording a greater degree of environmental protection. It allows for post-injection monitoring to extend to the full 100 years if needed, using tools that are specific to the situation and known to be effective, with monitoring to be performed at a frequency best suited to the situation as opposed to a “one-size-fits-all number”. Specifically, we recommend the following changes:

2(a)(91) “Post-injection site care and monitoring period” means the time between the date of injection completion and ~~100 years after injection completion~~ until the Executive Officer has authorized site closure.

2(a)(101) “Site closure” means the point or date~~, after at least 100 years and~~ as determined by the Executive Officer following the requirements under subsection C.5.2, at which point the CCS Project Operator is released from post-injection site care responsibilities.

5.2(b)(2) After injection is complete, the CCS Project Operator must continue to conduct monitoring as specified in this section and Post-Injection Site Care and Site Closure Plan for up to ~~a minimum of~~ 100 years~~.~~ and until such time as the Executive Officer approves a demonstration by the CCS Project Operator that project monitoring and modeling data, and other evidence, show with a very high degree of confidence in achieving permanence following the cessation of injection.

5.2(b)(3)(G) The CCS Project Operator must implement a leak detection strategy~~ at~~:

1. ~~, and i~~In the near surface strategically located near plugged and abandoned project wells; and

2. At ~~A~~areas of concern informed by the risk assessment (following subsection C.2.2) as potential pathways for the preferential migration of CO_2 or brine to surface,

~~, every five years~~ during the post-injection site care and monitoring period at a frequency based on monitoring and verification data collected during injection and using methods approved by the Executive Officer. ~~Monitoring must include:~~

~~1. Soil-gas and surface-air monitoring at, and within 10 ft of, the former wellhead or well pad;~~

~~2. Visual inspection of the land surface within a 100 ft radius of the former wellhead or well pad; and~~

~~3. must be inspected~~.

If the ~~inspection~~ checks suggest~~s~~ a potential leak may have occurred, the area must be tested pursuant to subsection C.4.3.2.

Minor Editorial Changes

- Delete definition §2(2) “Area of Review”. The use of this term may lead to confusion and we recommend that everywhere it is used it be replaced with the phrase “the surface projection of the storage complex.”
- 2.1. Covered Greenhouse Gas Emissions for the LCFS: in the first sentence change “LCSF” to “LCFS”
- 2.2(f): In the first sentence the phrase “must be evaluated” is repeated twice.

We encourage ARB staff to contact us for any clarification, and we continue to remain available to work with staff through the final stages of the Protocol.

We appreciate the opportunity ARB has provided for our review and recommendations on the 15-day Modifications.

Respectfully,

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