



October 6, 2025

Carbon Capture, Removal, Utilization, and Storage
California Air Resources Board
1001 I Street, Sacramento CA 95814

RE: Information Solicitation to Inform Implementation of Carbon Capture, Removal, Utilization, and Storage Program: Senate Bill 905

California Air Resources Board:

We appreciate the opportunity to provide feedback regarding the implementation of SB 905 (Caballero, Statutes of 2022). Ocean Visions is pleased to see the creation of the Carbon Capture, Removal, Utilization, and Storage Program for its purpose to evaluate, demonstrate, and regulate carbon dioxide removal (CDR) projects and technology, as well as carbon capture, utilization, and storage (CCUS) technologies.

Ocean Visions is a science-based ocean conservation organization focused on alleviating the unprecedented ocean warming and ocean acidification that are putting marine ecosystem health and reliant economic stability at risk. For the last five years, we have developed core programming to accelerate [research and development of marine carbon dioxide removal](#) (mCDR) pathways as necessary complements to the decarbonization required to address these ocean stressors and at scale. We develop [open knowledge products](#) and [convene and facilitate progress among key actors](#) to increase societal understanding and advance mCDR research, development, and demonstration (RD&D).

Below are responses to questions provided in the California Air Resources Board (CARB) solicitation to inform on the implementation of SB 905.

Definitions

- In addition to the terms defined in statute, are there other key terms that should be defined? Please provide any proposed definitions with applicable citations.
- Are there any definitions in the statute that may require further expansion or clarification?

Given the nascent state of the mCDR field, this is the time to ensure projects are designed to include all crucial elements. To the extent possible, and where relevant in adopting new definitions for undefined terms related to SB 905, we encourage CARB to incorporate terminology inclusive of the environmental and social sciences. Where life and social sciences are not explicitly spelled out for project implementation, they may not readily be included or identified by how significant they can be to a successful operation.

Although SB 905 does not explicitly incorporate life and social sciences into the definition for CCUS and CDR projects, SB 905 indicates that it should be implemented to include evaluations of environmental health and safety and location-specific impacts (e.g., SB 905 ‘Legislative Counsel Digest’, Section 71461(a)(7); Section 71463, Section 71464(a) and (b); Section 71465(b)). Incorporating life and social sciences terminology into relevant new definitions will help to implement the intent of SB 905 and assist in the success of the Carbon Capture, Removal, Utilization, and Storage Program.

Applicability

- Are there suggestions for further description of these categories, or ways to group categories?

We encourage CARB to consider the most likely audience for the category descriptions. The general project categories given are not necessarily ones that are commonly used in communications tools for the public, which could create confusion. For example, it is currently unclear which CDR technologies are included in the category “passive air capture from ambient air.” This describes an action of CDR but does not specifically define the methods (e.g., direct-air carbon capture or DACC) in a way that reflects common understanding.

“Nature-based solutions” may also be too vague a category for CDR. Depending on the audience, certain types of CCUS or CDR projects could be identified as nature-based or be placed into a different category. We suggest adding more specificity for these categories, describing the process or outcome, and/or providing examples of projects as a way for different audiences to understand what is included in each category. Ocean Vision’s [MCDR Field Trial Database](#) may serve as a helpful resource for finding such examples and specificity on mCDR methodologies.

Financial Responsibility

- How should the requirements account for scenarios such as ownership transfer, bankruptcy, change of ownership structure, change in insurance carrier, etc.?

- Are there other ways to address investment uncertainty through insurance, or other mechanisms?

We recommend connecting with investigators who are de-risking nature-based solutions for climate change mitigation to gain additional insight. For example, the U.C. Santa Barbara's Environmental Markets Lab (emLabs) project titled, "Coastal Wetland Restoration: A Nature Based Decarbonization Multi-Benefit Climate Mitigation Solution," could present information that is helpful in shaping CARB's needs and role in this context.

Criteria and Toxics Monitoring

- What project-specific air monitoring activities are CCUS/CDR developers currently conducting or intending to conduct, if any?
- What specific criteria for pollutants or toxics emissions should be prioritized for monitoring and where along the CCUS/CDR project components (i.e. capture, transport, injection/utilization) should monitoring be prioritized?

While the question asks about air monitoring, we'd like to offer insights that would ensure CARB has vital information to implement SB 905 for mCDR, as well as terrestrial CDR. Like open air, mCDR field trials will occur in open systems, coastal or open ocean. This means it is critical to ensure that monitoring, reporting, and verification (MRV) methods are at a mature-enough level to enable real-time monitoring at acute dosing events in parallel with modeling MRV. Modeling MRV in tandem with observed MRV from field trial data provides a "digital twin" of the system to provide a predictive model of the field project's impact. Such modeling also ensures operators can continue to track field project impacts with relative accuracy over the limitations of observational methods. Digital twin activities can apply to any type of monitoring and are very important for tracking potential pollutants or toxics emissions.

- How long should criteria or toxics monitoring be conducted for?

For mCDR, each project's timeline should be technology-specific to account for long-term impacts (within the 100-year cap) and catered to deployment/dosing periods (i.e., the ratio of observed versus modeled monitoring activities).

- What frequency of monitoring and reporting should CARB consider, and should this differ by project type? Do you have estimates on costs for monitoring and reporting?

Frequency of monitoring and reporting should differ by project type, as CDR technologies are variable and each project's robust MRV needs will rarely be the same. The frequency should be informed by the current technological capacity feasible for MRV through both modeling and observational lens alongside the needs of the community where the project is sited (e.g., the [LOC-NESS project](#) used both observed and modeling monitoring).

- Should CARB consider different monitoring requirements at carbon capture sites versus carbon removals utilizing natural systems?

CARB should consider different monitoring requirements at CCUS sites versus CDR that utilize natural systems because the project and technology needs will differ. For example, the [2025 Carboniferous project proposal and permit request](#) to perform research specifies MRV that is specific for placing sugarcane bagasse at the Orca Basin, a deep anoxic marine basin on the outer continental shelf south of Louisiana. The Carboniferous MRV includes, but is not limited to, monitoring carbon sequestration and storage of multiple tons of matter on the seafloor before, during, and after the biomass has been sunk, in addition to benthic seafloor biodiversity (e.g., microbes) impact assessments. Meanwhile, the [2024 Vesta field trial in Duck, North Carolina](#) conducts coastal ocean alkalinity enhancement with olivine sand. Vesta's project is using natural wave action to dissolve the olivine through a process known as mineral weathering and thereby remove atmospheric carbon dioxide. This Vesta project's MRV includes, but is not limited to, sampling the quantity of olivine in the soil, soil transport modeling under normal and abnormal (e.g., hurricane) conditions, and it requires biodiversity monitoring to halt sand placement if species of concern (e.g., whales, sturgeon) are spotted in the project's implementation zone.

Minimizing Local Water and Air Quality Impacts

- Are there other guardrails that should be considered beyond existing local, state, and federal regulations to minimize impacts? For example, many projects will have to meet the requirements of the California Environmental Quality Act (CEQA), what other requirements should be included and why? If proposing other requirements, please also provide any cost and time estimates for implementation.

We recommend reviewing and considering application of contents in the 2024 White House [Environmental Justice Science, Data, and Research Plan](#).

- Is there any information from existing studies or projects to inform a CEQA analysis for the rulemaking?

We recommend exploring Ocean Visions' [MCDR Field Trial Database](#), which contains past and ongoing mCDR projects, to inform CARB's guardrail analysis.

Because organizations like Ocean Visions, among others in the mCDR field, are crafting new resources to understand and reduce potential risks presented by mCDR projects, we encourage CARB to set a regular schedule to review and modify relevant rules for the implementation of SB 905. For example, Ocean Visions is currently driving development of the first comprehensive [Environmental Impact Assessment Framework for mCDR](#) to guide responsible development as a standardized resource for assessing risks and benefits of mCDR approaches (anticipated release: 2027).

Permit and Project Portal

- What key issues should CARB address when developing the unified permit application?

CARB could consider the value of using cost-cost or risk-risk analysis within the permit process. Such analysis considers the costs or risks of inaction versus the costs or risks of permitting the project.

- Considering the data and information portal will be voluntary to use, what features of the permit portal would increase the likelihood the portal is used by both project developers and permitting agencies?

Ocean Visions favors open access portals so that information is open and public.

- Are there examples of existing similar systems (e.g. CEQAnet) that CARB should look to when developing the permit portal?
- Are there examples of existing public CCUS project databases that we should look to and/or emulate for public reporting on project deployment?

For platforms to consider emulating, please see the Ocean Visions [MCDR Field Trial Database](#). The database shows a list and map of past and ongoing mCDR projects. CARB may also find value in the [mCDR Ecosystem Database](#) which profiles different actors across multiple sectors in the mCDR field and how they are connected.

Integration with Existing State Programs and Potential New Policy Support

- What role could projects developed under SB 905 play in these programs and are there other programs or policies in which carbon capture removal, storage, and utilization could play a role for compliance?

We recommend viewing the [U.S. National Marine Carbon Dioxide Removal Research Strategy](#) as a reference in regard to policy and interagency coordination.

Similarly, the [Ocean Visions Ocean-based Carbon Dioxide Removal Road Maps](#) may be helpful for scoping critical research CDR gaps that still need to be filled. Such insights could help implement research and permitting, especially for analyzing the benefits of different project applications to California's net-zero goals and knowledge-building activities.

- Are there other things the state could be doing to scale up deployment of projects under SB 905?

California could consider increasing capacity-building efforts or environmental and social impacts outside of the context of permitting and as standalone project categories due to the cross-cutting benefits such explorations would provide to CDR or CCUS knowledge and permitting. For example, Nawaz and Belotti (2025) and Nawaz et al. (2025) are examples of perspectives and real-time studies on community perspectives with regards to mCDR projects and their impacts, the latter of which was conducted in the same area as mCDR research currently conducted by the Pacific Northwest National Laboratory. This is an example of how social science research in tandem with life and/or physical science research can inform each other on the needs of the community and subsequent levels of feasibility for different mCDR technologies.

Protocols

- Are there certain carbon capture, removal, utilization, and storage project type methodologies that should be prioritized based on existing science, existing methodologies, or implementation experience?

Looking at the ocean space, abiotic mCDR methods are the most thoroughly researched pathway in regard to MRV and scaling for field trials in California. For example, the Port of Los Angeles hosts three mCDR projects (two by [Captura](#) and one by [Equatic](#); see the [Ocean Visions mCDR field trial database](#) for more information). Specifically, the abiotic method of ocean alkalinity enhancement (OAE) is perceived as [technologically feasible](#) based on the state of knowledge into the physical and chemical processes by which it can occur, the robust MRV infrastructure already available and implemented, and OAE's ability to deliver co-benefits to local ecosystems (e.g., ocean acidification remediation).

The state of the science for OAE should not discount the potential value for researching and developing other mCDR pathways however, as there are distinct advantages, costs, risks, and social acceptance levels associated with different pathways.

- Should CARB consider adopting project type specific protocols or defining more widely applicable standards, or a combination of both? If CARB were to define key standards applicable to all methodologies as opposed to individual methodologies based on specific technology or storage, what could those look like (i.e. recommendations on existing standards), and would that approach help to scale and innovate in this space faster than development of individual protocols?

Regarding CDR protocols, we recommend reaching out to [Isometric](#) as a potential thought partner.

Public Project Database

- Are there examples of existing public CCUS project databases that we should look to and/or emulate for public reporting on project deployment?

We recommend our resources, the [MCDR field trial database](#) and [mCDR Ecosystem Database](#) as examples of publicly available databases.

We look forward to following CARB in the implementation of SB 905 and are available should you have additional questions.

A handwritten signature in black ink, appearing to read 'Ruth DL'.

Ruth Driscoll-Lovejoy
mCDR Program Director, Ocean Visions