July 9, 2021

Ms. Rajinder Sahota
California Air Resources Board
1001 I St.
Sacramento, CA 95814

Re: Blue Planet Comments on Scoping Plan Development

Dear Ms. Sahota:

Blue Planet Systems Corporation (Blue Planet) appreciates the opportunity to comment on the California Air Resources Board's (CARB) public workshop series to commence development of the 2022 Scoping Plan Update.

Blue Planet is California company developing technology and products related to economically sustainable carbon capture. Our goal is to solve the carbon capture problem by converting CO_2 into high-value building materials. We hope CARB will recognize the promising role carbon capture, utilization and storage (CCUS) in aggregates and concrete can play in helping achieve carbon neutrality and net-negative emissions in California, and take steps to advance this important strategy in the Scoping Plan and other forums.

Virtually all of the Planet's Carbon is Naturally Stored in Rocks

Almost all of earth's carbon – more than 99 percent – is stored naturally through the process of mineralization in limestone rock. In fact, trillions of tons of CO_2 have been safely and naturally stored as carbonate mineral in the lithosphere for over 100 million years. Much less than 1 percent of the earth's carbon resides in the atmosphere, biomass and hydrosphere combined.[1]

If we add CCUS in rocks into our climate neutrality framework, we can introduce a game-changing, cost-effective and virtually infinite solution for addressing climate change.

This Process can be Harnessed and Accelerated to Create a Global Climate Solution

Carbon capture and mineralization is a process that captures CO_2 by direct conversion to carbonates, permanently sequestering CO_2 in a crystalline form as carbonate rock, most

[1] Kayler, Z., Janowiak, M., Swanston, C. (2017). "The Global Carbon Cycle". *Considering Forest and Grassland Carbon in Land Management*. *General Technical Report WTO-GTR-95*. United States Department of Agriculture, Forest Service. pp. 3–9.

commonly limestone. Blue Planet's CCUS plants produce coarse and fine aggregate made from sequestered CO_2 utilizing the carbon mineralization process. Our process allows lower-cost carbon capture, including from direct air capture, by avoiding the need to purify and enrich captured CO_2 before use. This reduces the cost and energy needs associated with carbon capture.

Blue Planet limestone-coated, light weight aggregate has been incorporated in Interim Boarding Area B at San Francisco International Airport, and we are now developing a commercial production plant in Pittsburg, California, that will capture CO_2 from a natural gas power plant and store it permanently in carbonate rocks. The produced rocks will be used locally as aggregate in concrete, displacing the need for natural limestone mined from quarries and supplementing California's supply for aggregate, which is insufficient to meet future needs.[2]

This is a model that can be replicated throughout the state and the world and is especially well-suited for regions like industrial hubs in and around ports where sources of CO_2 are concentrated and that are near to large, often urban, demand centers for concrete.

Storing Carbon in Concrete and the Built Environment Provides a Value-Added Market for CCUS, Making Industrial Sector Decarbonization and Carbon Removal Cost-Effective

Our efficient technology allows for permanent storage of CO_2 in building materials at scale, and creates an opportunity for developing more green buildings and infrastructure. The use of CO_2-sequestered aggregate can be an effective way to achieve carbon neutral, or even carbon negative, concrete. Standard concrete typically comprises the largest CO_2 footprint in building projects, but using CO_2-sequestered aggregate can dramatically reduce those emissions.

Concrete is the most widely used building material on earth. Every year, we use twice as much concrete we do steel, wood, and all other building materials combined. To supply this demand, approximately 50 billion tons (50 gigatons) of rock is mined every year worldwide for use in concrete, asphalt, and road base.[3] This market is rapidly growing at a rate of about 8 percent per year, and concrete suppliers in California are increasingly importing rock from out of state – with significant climate and air quality impacts – to satisfy demand.

About 70 percent of the aggregate used in concrete is limestone ($CaCO_3$), which is 44 percent weight by mass CO_2. This means that every ton of limestone contains 0.44 $MTCO_2$, stored as carbonate, and that the global sequestration potential for captured CO_2 in concrete is 22 gigatons per year – *more than half of annual anthropogenic CO_2 emissions globally.*

[2] Clinkenbeard, J.P. and Gius, F. W. (2018) Map Sheet 52: Aggregate Sustainability in California, California Geological Survey, California Department of Conservation.

[3] Steinberger, J., Krausmann, F., & Eisenmenger, N. (2010). Global patterns of material use: a socioeconomic and geophysical analysis. *Ecology Economics*, 1148-1158.

In California, we use an average of 180 million tons of construction aggregate per year.[4] Replacing this with CO_2-sequestered aggregate could sequester up to 79 $MMTCO_2$/year, more than the combined greenhouse gas emissions from all of the refineries, power plants, and cement plants in the state.[5] This means we could quickly eliminate greenhouse gas emissions from all major industrial sectors and safely sequester them in our roads and buildings.

What's more, this can be done cost-effectively. Construction sand and gravel is a billion-dollar industry in California,[6] and a $463 billion dollar industry globally.[7] Compared to sequestering carbon underground, which adds no value to a project and includes added costs for purifying, liquefying, transporting, and monitoring CO_2, sequestering CO_2 in aggregate offers lower costs and a value-added market opportunity to sell aggregate into the construction and concrete industries.

California Needs to Appropriately Account for Carbon Dioxide Stored in Concrete to Unleash this Powerful Climate Solution

Key to enabling this promising opportunity is including it in accounting for the State's climate programs and public procurement. CARB should include CO_2 mineralization and sequestration in rock as an eligible CO_2 storage solution in its CCUS protocol under the Low Carbon Fuel Standard (LCFS), and extend those protocols to the Cap-and-Trade Program.

CARB should also highlight in the Scoping Plan the role that public procurement can play in supporting CCUS from the industrial, cement and power sectors, and encourage Caltrans, the Department of General Services (DGS), the High Speed Rail Authority, and other state and local public procurement agencies to account for embodied carbon in concrete and other building materials – including CO_2 sequestered in aggregate – and prioritize procurement for materials that have the lowest embodied emissions *and* that utilize CO_2-sequestered aggregate.

Leverage Public Procurement to Enable CCUS

Given the opportunity for a value-added climate solution, and assuming CO_2 sequestered in aggregate is fully accounted for in the State's programs, California can leverage public procurement to enable wide-ranging CCUS solutions. Combined with the 45Q tax credit ($35/$MTCO_2$ for utilized CO_2), the value of Cap-and-Trade allowances assuming CCUS in aggregate is included (conservatively, $20-30/$MTCO_2$ through 2030), and a prioritization in public procurement for concrete using aggregate with sequestered CO_2 (likely indistinguishable for taxpayers, but critically important for enabling greenhouse gas reductions) – California can

[4] Clinkenbeard, J.P. and Gius, F. W. (2018) Map Sheet 52: Aggregate Sustainability in California, California Geological Survey, California Department of Conservation.
[5] https://ww3.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_sum_2000-18.pdf
[6] https://www.cacities.org/Resources-Documents/Education-and-Events-Section/Public-Works-Officers-Institute/2019-Session-Materials/Sand,-Gravel,-Stone-What-Your-Agency-Needs-to-Kno
[7] https://www.grandviewresearch.com/industry-analysis/aggregates-market

establish a sustainable framework to support rapid and sustainable deployment of CCUS, without additional subsidy.

Response to Workshop Question: *What approaches to CN exist that are technologically feasible, cost-effective, and have minimal impacts to households and jobs? How quickly can sectors transition?*

We appreciate the several workshops hosted by CARB, the breadth of issues covered by the Scoping Plan, and the specific questions teed up in the workshops. We want to address one specifically, highlighted above. Supporting CCUS in aggregate is technologically feasible, cost-effective, and will only have positive impacts on households and jobs. Sequestering carbon in rock provides a value-added solution that will help a wide array of industries quickly decarbonize, cost-effectively, without displacing current jobs or employees. We hope CARB fully explores this important opportunity in the Carbon Neutrality Scoping Plan.

Recommendations

As CARB develops its updated Scoping Plan, Blue Planet respectfully requests the following recommendations be considered:

- Update the landscapes carbon storage inventory to reflect the amount of carbon stored in rocks and minerals in California.
- Fully evaluate the potential for mineralization and CCUS in rock to serve as a storage medium for captured CO_2 from industrial operations, power plants, bioenergy projects, and direct air capture.
- Set targets for sequestering carbon in California's built environment in line with the evaluation above and the State's carbon neutrality goals, including at least 50 $MMTCO_2$/year by 2030.
- Develop accounting protocols for embodied carbon in building materials that includes CO_2 sequestered in aggregate.
- Leverage public procurement at Caltrans, DGS, High Speed Rail and other public agencies to support CCUS in the built environment.
    - Per Executive Order N-19-19,[8] encourage the California State Transportation Agency and DGS to use public procurement and investments in roads and buildings to minimize emissions and maximize carbon sequestration in the built environment.
    - Pursuant to its MOU on environmental sustainability with federal agencies,[9] encourage the California High Speed Rail Authority to procure concrete with sequestered CO_2 in aggregate.
- Incorporate CO_2 sequestered in rock and mineralization as eligible CCUS mediums in the LCFS.

[8] https://www.gov.ca.gov/wp-content/uploads/2019/09/9.20.19-Climate-EO-N-19-19.pdf
[9] https://hsr.ca.gov/wp-content/uploads/docs/about/partnerships/mou/HST_Sustainability_MOU_Signed.pdf

- Adapt LCFS CCUS protocols, including CCUS in aggregate, to be eligible under the Cap-and-Trade Program.
- Develop measures to decarbonize the cement sector and achieve negative-carbon concrete, on timelines that outpace achievement of carbon neutrality and net-negative emissions statewide.
- Identify key industrial decarbonization hubs in California, especially around ports, and measures to accelerate decarbonization in those regions.
- Develop measures and goals to rapidly decarbonize the industrial sector and natural gas power plants, including through the use of CCUS and CO_2 storage in aggregate.
- In addition to sequestering carbon in aggregate, support recycling concrete and aggregate to increase local supplies of rock and reduce emissions associated with mining and transporting virgin aggregate.

We are grateful for your attention and consideration of our comments. We look forward to engaging in the ongoing Scoping Plan process and with CARB and other agencies in various forums. Please do not hesitate to reach out if you have any questions about Blue Planet, our technology, or the recommendations offered in this letter.

Thank you,

Brent R. Constantz, Ph.D.
Chief Executive Officer
Blue Planet Systems Corporation