



November 1, 2023

The Honorable Dr. Steven Cliff  
Executive Officer  
California Air Resources Board  
1001 I Street  
Sacramento, CA 95814

**Re: Blue Planet Comments on SB 596 Community Meeting (October 2023) and Cement Sector Net-Zero Emissions Strategy**

Dear Dr. Cliff:

Thank you for the opportunity to comment on the SB 596 Cement Sector Net-Zero Emissions Strategy (SB 596 Strategy). The production and use of cement and concrete offers a tremendous opportunity to not just transform a sector and achieve net-zero emissions, but also to develop a fully scalable and permanent carbon sink in our built environment. We encourage CARB to think holistically about the opportunity to advance the State's climate goals through the use of near-zero and carbon-negative cement and concrete – including strategies to capture and sequester CO<sub>2</sub> in aggregates and concrete through carbon capture, utilization and storage (CCUS) – and to identify steps in the SB 596 Strategy to enable and advance these opportunities. Additionally, we believe there is an opportunity, through implementation of SB 905, to create an additional CCUS protocol for mineralization, which would enable capturing and permanently sequestering captured CO<sub>2</sub> in products such as cement, aggregate and concrete.

**About Blue Planet**

Blue Planet is a California company developing technology and products related to economically sustainable carbon capture. Our goal is to solve the carbon capture problem by converting CO<sub>2</sub> into high-value building materials. Our technology can be deployed at cement facilities or other difficult-to-decarbonize industries and captures not only CO<sub>2</sub>, but also particulate matter, NO<sub>x</sub>, SO<sub>x</sub> and other pollutants hazardous to surrounding communities. It can also be coupled with direct air capture facilities and deployed as a carbon dioxide removal strategy. We are currently constructing and beginning operations of a plant in Pittsburg, California on the Sacramento Delta, and our carbon-sequestered aggregate has been utilized at San Francisco International Airport, where carbon-sequestered concrete is specified.

Blue Planet's technology produces coarse and fine limestone aggregates made from sequestered CO<sub>2</sub> utilizing the carbon mineralization process. It allows lower-cost carbon capture, including from cement facilities, by avoiding the need to purify and enrich captured CO<sub>2</sub> before use, which reduces the cost and energy needs associated with carbon capture. It is also fully scalable and can

be applied to any facility in any part of the state where concrete is utilized, regardless of its proximity or access to a geological sequestration site.

### **Achieving SB 596 objectives requires rapid development of CCUS**

We appreciate the strong support and continued progress in decarbonizing the cement industry by minimizing cement in concrete through optimized design, energy efficiency and the use of supplementary cementitious materials (SCMs). These measures, while effective, cannot achieve deep decarbonization or reduce emissions to net-zero as required by SB 596. About 60% of the carbon intensity from current cement operations comes from “process emissions,” which can only be reduced through carbon capture. Decarbonizing California’s cement sector to levels required by SB 596 requires the rapid deployment of CCUS at existing facilities, in addition to other emerging technologies and strategies.

### **Carbonate mineralization offers a significant, timely and permanent CCUS solution**

As described on Slide 21 in the October Community Meeting, geologic sequestration of captured CO<sub>2</sub> presents several challenges. These include the build out of CO<sub>2</sub> pipelines and the permitting to develop Class VI wells for sequestration. In addition to the potential impacts to the community concerns referenced at the workshop, there is an additional barrier: time-to-deploy.

Permitting of CO<sub>2</sub> pipelines and Class VI CO<sub>2</sub> injection wells has been a challenging obstacle. Carbon capture projects that seek to inject CO<sub>2</sub> into appropriate geologic formations for the sole purpose of long-term storage are subject to the Environmental Protection Agency’s Class VI rule, which is part of EPA’s Underground Injection Control (UIC) Program. On March 14, 2023, a coalition of business groups submitted a letter<sup>1</sup> to EPA Administrator Michael Reagan urging officials to expedite applications for CO<sub>2</sub> injection wells,<sup>2</sup> citing frustration to advance carbon capture projects. According to the groups, “Without immediate improvement, the current Class VI permitting timeline will continue to serve as a barrier to meeting emission reduction goals – including the ones the Biden Administration has set – while discouraging much-needed infrastructure investments across the country.”<sup>3</sup>

### **Permanence of mineralized CO<sub>2</sub>**

While several technical, legal, and economic questions remain related to geologic sequestration, carbonate mineralization offers a fully scalable, permanent carbon storage solution ready for deployment today. As described in our July 9, 2021, comments related to the Scoping Plan kickoff workshops and validated in peer-reviewed research, the mineralization process

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<sup>1</sup>[https://ww2.arb.ca.gov/system/files/webform/public\\_comments/4211/2023.6.27%20Letter%20to%20CARB%20re%20Advance%20Procurement%20%281%29.pdf](https://ww2.arb.ca.gov/system/files/webform/public_comments/4211/2023.6.27%20Letter%20to%20CARB%20re%20Advance%20Procurement%20%281%29.pdf)

<sup>2</sup> <https://www.naturalgasintel.com/state-groups-say-ccs-projects-languish-awaiting-fed-permits-for-injection-wells/>

<sup>3</sup>[https://www.pachamber.org/media/9615/pa\\_chamber\\_joins\\_coalition\\_in\\_urging\\_epa\\_to\\_speed\\_up\\_permitting\\_for\\_carbon\\_capture\\_projects/](https://www.pachamber.org/media/9615/pa_chamber_joins_coalition_in_urging_epa_to_speed_up_permitting_for_carbon_capture_projects/)

permanently stores carbon in rock and can then be used in concrete and stored in our built environment.

Indeed, the cement-making process illustrates the permanence of CO<sub>2</sub> sequestered in limestone, as described in Slide 10 at the Community Meeting. Limestone (CaCO<sub>3</sub>) must be exposed to extremely high heat (~1,500° C) to separate calcium oxide (CaO), thereby releasing CO<sub>2</sub> via the reaction: CaCO<sub>3</sub>(solid) + heat → CaO(solid) + CO<sub>2</sub>(gas). Blue Planet’s synthetic limestone would require a similar degree of heat to trigger any reaction to re- release captured CO<sub>2</sub>.

We appreciate the State recognizing the opportunity around carbon mineralization and storage in concrete, including:

- In the Final 2022 Scoping Plan Update, CARB discusses the role of carbon capture and carbonate mineralization in the context of decarbonizing cement and other sector transitions, stating “direct air capture and carbon mineralization have high potential capacity for removing carbon...”<sup>3</sup>
- The CEC identifies carbonate mineralization, including carbon storage in aggregates as one of the most promising strategies for decarbonizing the cement sector:<sup>4</sup>

Capturing carbon from industrial processes and then utilizing it in a product is considered one of the essential components for mitigating CO<sub>2</sub> emissions since it can achieve net negative emissions, especially for sectors that are unable to achieve zero emissions. For example, carbon capture and utilization appear to be a pathway to achieve significant decarbonization of the cement industry where 60 percent of the carbon dioxide is from process emissions... For instance, carbon capture and utilization in the cement industry has recently emerged with sustainable techniques to use carbon emissions in concrete production. Some emerging utilization techniques, such as mineral carbonation, includes adding carbon into cement to enhance the concrete’s compressive strength. With almost 4 billion tons of construction aggregate produced in North America, mineral carbonation could be the most efficient route to CO<sub>2</sub> utilization.

In the SB 596 Strategy, we encourage CARB to evaluate and highlight the need to adopt measures not just to decarbonize cement operations directly, but also to highlight the ability of carbon sequestering concrete materials to lower the carbon footprint of concrete overall. The two strategies go together. In the SB 596 Strategy, CARB should consider both “supply side” strategies to decarbonize cement operations, as well as “demand side” strategies to affect related concrete markets and further support for efforts to decarbonize the cement sector.

**Enable carbonate mineralization as a decarbonization strategy for the cement sector by incorporating it into the SB 596 Strategy, CCS Protocol, SB 905 implementation, LCFS, and Cap-and-Trade Program**

We encourage CARB to employ a coordinated approach among programs to enable CCUS to scale quickly in California. Specifically, we encourage CARB to formally recognize

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<sup>3</sup> CARB (2022) 2022 Scoping Plan for Achieving Carbon Neutrality, California Air Resources Board, November 16, pg. 221. <https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp.pdf>

<sup>4</sup> See pg. 10 at: [https://esd.dof.ca.gov/Documents/bcp/2223/FY2223\\_ORG3360\\_BCP5441.pdf](https://esd.dof.ca.gov/Documents/bcp/2223/FY2223_ORG3360_BCP5441.pdf)

mineralization, including its promising application in the cement and concrete sectors, as a key solution for decarbonizing cement and concrete in the SB 596 Strategy. Further, we hope the SB 596 Strategy will identify specific steps and recommendations to advance this promising strategy as a solution for decarbonizing cement and other sectors. These steps should include:

- Formally incorporating carbonate mineralization into the CCS Protocol through implementation of SB 905.
- Adopting amendments in the Low Carbon Fuel Standard (LCFS) that allow new CCUS protocols to be used in that program as they are developed and adopted through the SB 905 process.
- Incorporating the CCS Protocol into the Cap-and-Trade Program when the program is amended and allow new CCUS protocols to be used in that program as they are developed and adopted through the SB 905 process.
- Developing additional incentives to support CCUS, including carbon stored in concrete, through the Cap-and-Trade program, public procurement, product specifications, or other approaches. We discuss procurement options below and look forward to commenting separately on potential changes to the Cap-and-Trade program in our response to the recent workshop on that item.

We look forward to working with CARB staff regarding any technical or accounting questions that would support these efforts.

### **Public procurement policies critical to advancing low-carbon and negative-carbon cement and concrete strategies**

In addition to supporting policies, including new CCUS protocols and financial incentives to enable deep decarbonization of cement operations, the State must create demand for low carbon cement products. The best way to do this is through public procurement policies. Caltrans and other state agencies are among the largest cement and concrete users in the world, accounting for 40 percent of all concrete use in California and can set the market for low carbon cement and concrete products based on their procurement decisions and product specifications.

Pursuant to SB 596, CARB must evaluate measures to support market demand and financial incentives to encourage the production and use of cement with low greenhouse gas intensity. We believe that additional policy support from the state, especially through public procurement activities, can enable additional and transformational carbon reductions from the cement and concrete sectors. These policies include at least the following, each of which we hope CARB will fully evaluate and include in the SB 596 Strategy:

- Advance market commitments (AMCs) to accelerate the commercialization and scaling of technologies capable of producing ultra-low carbon or even negative-carbon negative cement and concrete.
- Incorporating cement and concrete into the State's Buy Clean framework, which could be done without legislation under Executive Order N-19-19, and similar to recent actions at the federal level under President Biden.

- Other related procurement efforts, such as New Jersey’s Low Embodied Carbon Concrete Leadership Act (LECCLA S287), which offers tax incentives to concrete producers who provide reduced carbon products.
- Low Carbon Product Standards.
- Product specifications or bid preferences based on the use of low carbon cement/concrete and concrete with sequestered carbon.
- Requirements in the CALGreen building code requiring use of low-carbon cement and concrete, including stretch codes requiring the use of carbon-sequestered concrete and concrete with net-negative greenhouse gas intensity.

In addition to supporting SB 596 implementation, many of these policy approaches, especially specifying the use of carbon sequestered concrete, would have the added benefit of supporting the State’s carbon removal goals and broader objectives of the Climate Change Scoping Plan for achieving carbon neutrality.

### **Advance market commitments a critical element of a successful SB 596 framework**

Advance market commitments (AMCs) are a particularly important component for a public procurement program to support decarbonizing cement and concrete. The use of AMCs can accelerate the commercialization and scaling of technologies to produce ultra-low carbon and carbon negative cement and concrete. We support comments by the Decarbonized Cement and Concrete Coalition (DC<sub>2</sub>) related to AMCs, and encourage CARB to highlight their important role in the SB 596 Strategy.

New cement and concrete solutions, including those offered by Blue Planet and several others, hold enormous promise for both zeroing out CO<sub>2</sub> in cement and concrete production and for permanently sequestering CO<sub>2</sub>. These solutions have the potential to achieve dramatic carbon reductions and eventually achieve the promise of carbon-negative construction. Critically, bringing these solutions to market requires extensive new private sector funding.

A key prerequisite for commercial-scale financing is committed offtake, that is customers agreeing in advance to buy the future production of low-carbon cement or concrete plants. Given the outsized role of public agencies in the market for cement and concrete in California, AMCs by the public sector represent a clear demand signal and are regarded as bankable orders, which can unlock private sector investment in deep decarbonization strategies reach commercial scale.

Thank you for your consideration of these comments, and we look forward to working with you to implement SB 596, as well as related strategies such as the LCFS, Cap-and-Trade, and SB 905 in the coming months.

Sincerely,

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Blue Planet Systems Corporation