Coalition for Sustainable Cement Manufacturing & Environment
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September 17, 2021

Ms. Liane M. Randolph
Chair
California Air Resources Board
1001 "I" Street
Post Office Box 2815
Sacramento, California 95812

Subject: **CSCME's Comments on 2022 Scoping Plan Update – Scenario Concepts Technical Workshop (August 17, 2021)**

Dear Ms. Randolph:

The Coalition for Sustainable Cement Manufacturing and Environment ("CSCME"), a coalition of all five cement manufacturers in California,[1] provides these comments on the California Air Resources Board's ("CARB's") August 17, 2021 Scenario Concepts Technical Workshop as part of the Scoping Plan Update.

The California cement industry is committed to achieving carbon neutrality by 2045. Although carbon neutrality is an ambitious goal for any sector, it is particularly daunting for the cement industry, which is widely recognized as both difficult-to-decarbonize and highly exposed to the risk of leakage. These twin challenges heighten the urgency of creating a policy and regulatory environment that incentivizes long-term investments in deep decarbonization and ensures that local cement producers are not placed at a competitive disadvantage to imports.

The California cement industry is particularly difficult-to-decarbonize due to significant process emissions (i.e., the emissions that result from the chemical reaction of converting limestone into cement), which constitute more than 60% of the industry's GHG footprint. This single fact has profound implications:

- Realizing carbon neutrality in the cement industry will require the deployment of carbon capture, utilization, and sequestration (CCUS), or other yet to be developed technologies, that substantially reduce process emissions.
- The deployment of CCUS technology will require a coordinated and sustained effort to bring together the wide range of stakeholders (i.e., state and local elected officials, state and local regulators, producers, technology suppliers, environmental advocates, etc.) needed to make it a practical, safe, effective, and cost-effective solution for the cement industry.

[1] The Coalition includes CalPortland Company, Cemex, Inc., Lehigh Southwest Cement Company, Mitsubishi Cement Corporation, and National Cement Company of California Inc. There are ten cement plants located in California, eight of which are currently operating.

- CARB is perhaps the only entity that has the influence to bring together those stakeholders and the expertise needed to mobilize them toward a common goal and on a timeline consistent with the state's carbon neutrality goals (i.e., without any undue delay).

At the same time, the California cement industry is highly exposed to the risk of economic and emissions leakage due to a variety of factors, including but not limited to the fact that:

(1) Cement is a commodity that is traded globally and purchased primarily on the basis of price.

(2) Cement is an emissions-intensive industry in which relatively small increases in carbon costs (whether due to increases in carbon prices or other regulatory measures) can have a devastating effect on a producer's economic viability.

(3) The state's coastal location means that cement can be economically imported from distant locations with less stringent environmental standards.

The stakes are high. If successful, California will provide the rest of the world with a model for achieving carbon neutrality in one of the most strategically important, economically vulnerable, and difficult-to-decarbonize industries. If unsuccessful, it will provide the rest of the world with a cautionary tale and a real-world example of economic and emissions leakage.

The good news is that achieving carbon neutrality in the California cement industry is within our reach. There are a series of known market, policy, and regulatory barriers that prevent the California cement industry from achieving its carbon neutrality goals. Policymakers and regulators have an opportunity to systemically remove those barriers without placing local producers at a competitive disadvantage to imports. By doing so, they can ensure a robust and thriving California cement industry, which is the most climate-friendly source of the raw materials needed to support the state's ambitious affordable housing, residential, water supply, infrastructure, and resiliency goals.

I. ABOUT THE CALIFORNIA CEMENT INDUSTRY

Since the adoption of Assembly Bill 32 (AB32) in 2006, the California cement industry has actively worked to support the state's GHG reduction goals and the cap-and-trade program through cooperation with CARB and a wide range of stakeholders. 2021 has already been a landmark year for collaborative climate action by industry and state government. For instance, as a result of industry efforts to work with state Senator Josh Becker's office, the California legislature has passed Senate Bill 596, which codifies a realistic path to industry decarbonization at a pace that reflects the urgency of the climate challenge.

Concurrent with industry efforts to forge a viable path to deep decarbonization, the California cement industry has faced a challenging economic and competitive landscape. Prior to the Great Recession, the industry faced growing competition from more carbon-intensive imports that threatened to undermine the state's climate goals. Although import competition declined during the ensuing economic downturn, the cement industry was hit especially hard by a steep decline of demand. It has been an arduous recovery

for the industry; while the state and the industry have rebounded, the California cement industry once again faces growing competition from importers seeking to capitalize on regulatory cost disparities.[2,3]

Cement is an essential commodity to modern economies and holds an outsized role in translating California's economic development and infrastructure ambitions into real action. Cement is uniquely suited for the construction of buildings that provide maximum protection from fires, floods, and other growing threats from climate change. A thriving local cement industry is a crucial enabler of adaptive, climate-resilient, and environmentally responsible development. Sourcing local cement avoids not only the GHG emissions associated with importing cement from jurisdictions with less stringent environmental regulations, but also the emissions stemming from transporting it over long distances that disproportionately impact disadvantaged communities, especially those located around ports.

Under current regulatory and market conditions, cement produced outside of the state is a clear threat to both the California cement industry and those it employs, as well as the state's efforts to reduce its GHG emissions footprint. Compared to global averages, the California cement industry comprises a relatively small share of the state's emissions (currently less than 1.8% of California's annual emissions versus 7% of global emissions for world cement production).[4,5,6] The state's cement plants are subject to some of the world's most stringent emissions and criteria pollutant standards. Furthermore, since the implementation of AB 32 in 2006, the California cement industry has reduced its total emissions footprint by over 20% and decreased the combustion emissions intensity of cement production by more than 14%.[7,8]

As previously stated, cement manufacturing is a uniquely challenging process to decarbonize. The majority of industry emissions stem from the unavoidable chemical reaction that converts limestone to cement (as opposed to fuel combustion). Clinker, which is the main ingredient in cement and gives cement the ability to bind the ingredients in concrete, is produced by heating limestone to high temperatures, which results in the chemical reaction accounting for over 60% of the industry's emissions. As a result, only 40% of the industry's emissions can be mitigated through conventional GHG reduction measures like fuel switching. The dramatic emissions reductions needed to meet the state's climate goals cannot be achieved without the use of nascent breakthrough technologies such as CCUS.

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[2] U.S. Geological Survey (2021). Annual Mineral Commodity Summary.

[3] For instance, cement imported from foreign countries comprised 20% of all cement shipments in California in 2020, which is the highest import market share seen since the housing boom of the mid-2000s. See the United States Geological Survey Mineral Industry Survey December 2020 release Tables 2A and 2B (Shipments of Portland and Blended Cement – State of Destination) and International Trade Commission Dataweb portal import data for 2020 (Imports for Consumption by Customs District, First Unit of Quantity, HS Code 2523).

[4] California Air Resources Board (2021). 2000-2019 GHG Inventory (2021 Edition). Full Inventory - Economic Sector Categorization.

[5] U.S. Geological Survey (2000-2019). Annual Mineral Commodity Summary.

[6] McKinsey & Company (2020). Laying the Foundation for Zero-Carbon Cement.

[7] California Air Resources Board (2021). 2000-2019 GHG Inventory (2021 Edition). Full Inventory - Economic Sector Categorization.

[8] U.S. Geological Survey (2000-2019). Annual Mineral Commodity Summary.

Fortunately, the chemical properties of cement also provide a substantial opportunity for carbon removal. Cement is unusual in that it is both a source and a sink of GHG emissions. Hydrated cement in concrete reabsorbs CO_2 from ambient air over time, resulting in the safe capture and sequestration of a substantial portion of the GHG emissions associated with production – a process known as "carbonation".[9] For instance, according to a recent assessment from the United Nations Intergovernmental Panel on Climate Change, "the uptake of CO2 in cement infrastructure (carbonation) offsets about one half of the carbonate emissions from current cement production."[10] In other words, achieving net carbon neutrality in the California cement industry does not necessarily equate to eliminating all emissions, and in fact, the industry could eventually serve as a net carbon sink, provided that carbon accounting practices are updated appropriately. California has an opportunity to further capitalize on the carbonation effect by placing a greater emphasis on end-of-life handling best practices and reuse of demolished concrete to maximize naturally occurring CO_2 uptake potential.[11]

II. THE CALIFORNIA CEMENT INDUSTRY SUPPORTS THE STATE'S GOAL OF ACHIEVING CARBON NEUTRALITY BY 2045

The California cement industry supports the goal of achieving global carbon neutrality. We also support California's efforts to achieve state-wide carbon neutrality by 2045 and will continue to play a constructive role in the process. Recognizing the urgency of climate action, the industry has identified barriers to the implementation of carbon reduction measures and has created a roadmap outlining the specific levers available to remove these barriers and enable cement manufacturers in the state to achieve net zero carbon emissions. The roadmap serves as a reference for policymakers and stakeholders to understand both the opportunities and limitations to realizing a carbon neutral cement industry by 2045, as well as an invitation to all stakeholders to engage in constructive conversations about how best to achieve that goal.

Specifically, the California cement industry's path to carbon neutrality relies on three primary pathways with nine discrete decarbonization levers:

- **Pathway 1: Reducing Process Emissions**
    - **Portland Limestone Cement (PLC):** Expanded PLC production represents a promising near-term emissions reduction lever with immediate impact. Barriers to unlocking this lever include final acceptance by Caltrans and physical infrastructure constraints at cement and ready-mix concrete facilities.
    - **CCUS:** Globally, cement industry deployment of CCUS technology is still in the early stages with only a handful of projects in the pipeline. CCUS yields GHG abatement benefits on a scale otherwise not achievable by other measures. However, more research and development is

[9] Azari-Jafari, H. (2021). Lifecycle Carbon Uptake of the United States Pavement Network. Massachusetts Institute of Technology Concrete Sustainability Hub.

[10] United Nations Intergovernmental Panel on Climate change (2021). AR6 Climate Change 2021: The Physical Science Basis. Pg. 1172.

[11] Talati, S., Merchant, N., Neidl, C. (2020). Paving the Way for Low Carbon Concrete. Carbon 180.

needed and major barriers to deployment remain, primarily in the form of high capital costs and significant project risk, as well as gaps in current incentives and a time-intensive permitting process.

- **Alternative Raw Materials (ARM):** Achieving a 70% clinker ratio in California by 2045 through the addition of ARMs would produce significant GHG emissions reductions but will require significantly boosting the supply of these materials. ARMs are widely accepted and used but face a tightening supply landscape. The industry is actively investing in efforts to fill supply gaps using novel ARMs, particularly natural pozzolans and calcined clays.

- **Alternative Cements & Clinkers:** The long-term performance of alternative cements and clinkers is currently unproven with a still uncertain range of emissions savings. There are significant technological barriers to feasibly unlocking this lever. Deployment at scale is constrained by limited production capacity and applications, and outstanding uncertainties regarding long-term performance require more testing.

- **Pathway 2: Reducing Combustion Emissions Through Fuel Switching**

  - **Biomass-Derived Fuels:** Biomass is underrepresented in the industry's fuel mix. Reaching a maximum substitution rate for biomass would moderately reduce the industry's emissions and, in the case of non-agricultural biomass, provide forest management and wildfire protection benefits. Barriers to unlocking this lever include a lack of regulatory clarity around what is possible, lengthy permitting timelines, public acceptance challenges, and constrained supply due to insufficient collection and distribution networks.

  - **Engineered Municipal Solid Waste:** Although waste-derived fuels are used in cement industries around the world, they account for only a small portion of the industry's fuel mix in California, which is limited by existing statute. Achieving maximum waste-derived fuel substitution would drive a substantial reduction in emissions while also diverting waste from landfills or incineration. Barriers to unlocking this lever include issues around defining recycling and wastes (which create access and supply challenges), lengthy permitting processes that are disconnected from the benefits and real-world processes that plants must navigate to fuel switch, public acceptance challenges, and perverse incentives that make landfilling more cost effective than using these materials as a substitute fuel**.**

  - **Natural Gas:** If key economic barriers are addressed, the industry would likely be able to displace coal and pet coke with natural gas consumption and swiftly reduce its GHG footprint by a significant margin.[12] Barriers to unlocking this lever include the fact that natural gas is not frequently cost-competitive with coal and pet coke in California and that statewide storage and supply constraints limit supply to industrial users.

[12] For example, each unit of coal that is replaced by natural gas would result in a roughly 45% reduction in CO_2 emissions. See U.S. Energy Information Administration (Jun 2021), "How Much Carbon Dioxide is Produced When Different Fuels are Burned".

- **Pathway 3: Increasing Distributed Electricity Generation**

    - **Waste Heat Recovery (WHR):** WHR has not been widely deployed in the California cement industry given outstanding regulatory and cost barriers. If key barriers were addressed, WHR could displace a substantial share (up to roughly a quarter) of a plant's electricity-related emissions with zero-emissions energy. Barriers to unlocking this lever include significant investment disincentives driven by departing load charges and other regulatory gaps, a cumbersome permitting process, and a limited payback potential on installed systems.

    - **On-Site Renewables:** On-site renewables currently contribute limited electricity generation at California cement plants but have the potential to displace a greater share of the industry's electricity purchases with clean energy. Barriers to unlocking this lever include overlapping investment hurdles, including financial penalties from departing load charges, limited rate- and program-based incentives for distributed electricity investment at cement plants, and cost factors that constrain returns**.**

The industry is unable to meet the ambitious goal of carbon neutrality by 2045 on its own. We will need help from policymakers, regulators, architects, engineers, builders, developers, and other key stakeholders that influence how cement products are made, used, and recycled in the state. We will also need focused action and engagement to overcome the policy, regulatory, and economic barriers that limit the industry's ability to quickly shrink its carbon footprint, whether it be through improving energy efficiency, utilizing less carbon-intensive fuels, developing breakthrough technologies, or creating viable markets for low-carbon cement and concrete products.

Accordingly, there is no one single solution that will make carbon neutrality a reality. The California cement industry requires a flexible portfolio of strategies that includes a commitment to pursue an "all-of-the-above" approach that unlocks a range of decarbonization levers such that each plant can chart a course that aligns with its unique needs and circumstances, close coordination among stakeholders throughout the cement-concrete-construction value chain, and constructive engagement among stakeholders throughout the public policy ecosystem.

III. THE CALIFORNIA CEMENT INDUSTRY NEEDS SUPPORT FROM A WIDE RANGE OF STAKEHOLDERS, BUT ESPECIALLY CARB, TO REACH CARBON NEUTRALITY BY 2045

As explained previously, the cement industry faces the unique challenge of an immutable process emissions "wall" that cannot be addressed through conventional GHG abatement measures like fuel switching and electrification. Carbon neutrality by 2045 is simply unattainable without a concerted effort by stakeholders to enable widespread industry deployment of CCUS technology and to unlock other decarbonization levers in the interim. The cement industry is not adequately equipped to forge this path alone and getting to net zero carbon emissions hinges on two primary conditions that will require meaningful action from CARB.

First, cement is a fungible commodity sold in a cost-competitive marketplace that, especially in California, is easily accessible to imports and particularly vulnerable to displacement due to the disparate regulatory

costs faced by the California cement industry compared to global competitors. In other words, the industry faces extreme leakage risk and is highly limited in its ability to pass through increased costs to consumers. Although this poses a significant roadblock to industry investment, a coordinated effort to remove the barriers to economically feasible decarbonization and preserve the competitive advantage of the local cement industry will aid industry efforts to achieve annual emissions reductions while simultaneously developing a robust CCUS capability.

To guarantee that California's emissions reductions are due to decarbonization and not displacement of cement production to other jurisdictions with less stringent environmental regulations, policymakers should implement market-based policies that level the playing field for the California cement industry. Specifically, California should apply an incremental carbon border adjustment matched with allowance allocations, which would align the carbon costs of all cement-based products consumed in the state, regardless of where it is produced. An incremental carbon border adjustment would help ensure that California's climate change objectives are not undermined by leakage and that the industry remains competitive with imports, while passing through regulatory costs to sustain a financially viable local cement industry. As one example, the European Union will likely implement a Carbon Border Adjustment Mechanism into their Emissions Trading Scheme in the near-term. This policy change would mandate importers of non-EU products to purchase emissions allowances equal in value to the carbon price that would have been paid if the goods were produced in the EU. Applying a similar policy to the California economy would meaningfully expand the cement industry's ability to invest in crucial GHG abatement measures.[13]

Second, applicable regulatory and market stakeholders must create the conditions necessary for CCUS deployment. Currently, the deployment of breakthrough technologies like CCUS is hindered by overlapping and time intensive permitting requirements. CARB's convening authority will be an essential avenue to get all stakeholders to the table to ensure that the California cement industry does not face costly and lengthy delays when breaking ground on CCUS projects that would act as a disincentive to future investment and deployment.

The limited number of operational CCUS projects around the world have proven that public investment support is an essential ingredient to enable capital intensive investments in GHG mitigation. By this measure, existing state and federal incentives are insufficient to induce development of the robust carbon transport and storage network required to begin making strides towards widespread CCUS deployment. For instance, under the existing cap-and-trade program, California cement manufacturers are not able to receive credits or avoid allowance obligations if they successfully capture and safely store CO_2. To provide a clear incentive and price signal, California should apply the Low Carbon Fuel Standard CCUS Protocol to the California cement industry, which would recognize the reduction in CO_2 emitted into the atmosphere due to the use of CCUS technology.

[13] In terms of climate policy in California, implementing a carbon border adjustment was proposed as an additional action to minimize emissions leakage in the 2017 Scoping Plan (p.73). Additionally, Senate Bill 596, Section 38561.5 (b) (4) directs the state board to develop a comprehensive strategy for cement industry carbon neutrality, to include provisions to minimize and mitigate potential leakage via a "border carbon adjustment mechanism."

Beyond recognizing the economic value of CO_2 that is successfully captured and safely stored, California should provide public financial support in the near term to incentivize CCUS deployment in the cement industry by achieving a manageable payback period and limiting the risk associated with long-lived, capital-intensive investments. Specifically, California should devote a portion of California Climate Investment funds to accelerate CCUS deployment in the industry and catalyze the development of public infrastructure to transport and store captured carbon.

IV. CONCLUSION

In providing support to the California cement industry as discussed above, CARB can foster a regulatory environment that preserves the competitive balance and climate benefits of locally produced cement, while also enabling the industry to chart a feasible course to carbon neutrality by 2045. The urgency of the climate challenge is clear. With the support of CARB's convening authority and by reducing the uncertainty of industry investment, the California cement industry can meet the challenge of deep decarbonization head on and take the actions necessary to reduce net emissions to zero, while continuing to provide the climate-friendly raw materials needed to realize the state's infrastructure and resilient development ambitions.

Sincerely yours,

Erika Guerra
Chair, Executive Committee
Coalition for Sustainable Cement Manufacturing & Environment

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