

September 8, 2023

Ms. McKenzie Smith
Associate Director
Climate Action Reserve
600 Wilshire Blvd., Suite 202
Los Angeles, CA 90017

RE: Comments on the U.S. Low-Carbon Cement Protocol Public Comment Draft

Dear McKenzie:

Thank you for the opportunity to comment on the U.S. Low-Carbon Cement Protocol. Solidia Technologies applauds Climate Action Reserve for being a leader in addressing climate change. The development of a rigorous standard for quantifying, monitoring, reporting, and verifying the climate benefits associated with clinker reduction in concrete will meaningfully reduce the industry's carbon emissions by incentivizing industrial-scale availability of novel, low-carbon SCMs.

We encourage the registry to consider the benefits of mineralized CO₂ in the production and/or processing of SCMs. Solidia has developed materials used in concrete production that react with CO₂ and permanently mineralize the carbon. This carbonation serves a critical function in generating amorphous silica to create a highly effective pozzolanic material. These technologies enable the cement industry to reduce CO₂ emissions of clinker production and offer an alternative to carbon sequestration and geological impoundment by providing options for converting permanently bound carbon into value-generating products aligned with a circular economy approach to sustainability.

About Solidia Technologies

Solidia is a cement and concrete technology company, offering patented low-carbon solutions that make it easy to use CO₂ to create superior, sustainable building materials. Solidia provides three core technologies that will each dramatically reduce carbon emission from cement and concrete production:

A. Solidia Cement®

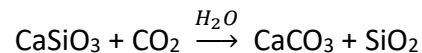
Solidia has commercialized the production of a non-hydraulic, low-lime cement that gains strength through a carbonation process. Solidia Cement is prepared using the same raw materials and industrial processing equipment as portland cement but realizes a significant reduction in both:

- a) process CO₂ (from limestone decomposition) since it uses less limestone; and
- b) thermal CO₂ (from fossil fuel consumption) because it can be produced at lower temperatures

This translates to a 30% reduction in CO₂ emissions at the kiln during production when compared to portland cement. Notably, Solidia Cement production does not require re-equipping existing cement facilities.

B. Solidia Concrete

Solidia Concrete is made by reacting Solidia Cement with CO₂ according to the basic chemical reaction:



In this reaction, the CO₂ is permanently consumed while making the concrete into a solid, durable, and valuable product. Each metric ton (MT) of Solidia Cement that is used in the precast concrete formulation will utilize and store at least 0.2 MT of CO₂. This is an addition to the 30% emissions reduction achieved in Solidia Cement production. Overall, the embodied greenhouse gas emissions reductions for precast concrete products can be greater than 50%. Precast concrete products include paver stones, concrete blocks, and box culverts.

Solidia Concrete can be produced in existing precast concrete facilities when re-equipped to handle CO₂ enclosure while the CO₂ is being utilized. Solidia Concrete is available for commercial use in precast concrete plants.

C. Solidia SCM

Solidia SCM (S-SCM) is an engineered SCM that can be used to partially replace portland cement when used in concrete. S-SCM is produced by carbonating Solidia Cement as a powder. The resulting material is a highly effective pozzolan which can be used at high replacement rates (35 – 50%) and delivers comparable performance to that of traditional SCMs including fly ash and slag. S-SCM has over 50% less greenhouse gas emissions than SCM with over 50% less greenhouse gas emissions than the portland cement that it replaces.

S-SCM can be produced at existing cement production facilities when the S-SCM processing line is equipped to directly utilize CO₂ emitted from cement production. The mineralization of CO₂ to produce S-SCM enables CO₂ capture directly from the flue gas stream of an operating cement plant and conversion into a value-added product.

To date, several hundred kilograms of S-SCM have been produced in our labs for standard concrete property testing. Third-party labs including CTLGroup and Braun Intertec have verified that S-SCM meets the performance requirement for use in concrete per ASTM C1709-18 Standard Guide for Evaluation of Alternative Supplementary Cementitious Materials (ASCM). Solidia will begin to produce 1 MT per day this fall to supply ready mix customers to conduct trial pours and field testing needed to secure market acceptance. Solidia is developing an industrial-scale process

to leverage cement plant assets and its CO₂ emissions to produce and supply a low-carbon SCM with portland cement replacement level up to 50%.

Mineralization of CO₂ in SCM Production

The integrated single reaction step in which CO₂ is scrubbed from cement kiln flue gas to carbonate S-SCM is inherent to the production process. The CO₂ bound during carbonation can be measured using thermogravimetric analysis (TGA), consistent with ASTM C1910/C1910M – 23 Standard Test Methods for Cements that Require Carbonation Curing.

For processes where CO₂ mineralization is inherent to the SCM production and measurement of the mineralization is supported by industry standard techniques, the U.S. Low-Carbon Cement Protocol should explicitly recognize the CO₂ consumed as a reduction to the project emissions for SCM/ACM manufacturing.

Thank you for this opportunity to submit comments. We look forward to continued participation and discussion.

Sincerely,

A handwritten signature in black ink, appearing to read 'Pradeep Ghosh', written over a light blue horizontal line.

Pradeep Ghosh
Senior Director, Strategy & Business Development