



ENVIRONMENTAL PRODUCT DECLARATIONS (EPDs) OF CEMENT-BASED PRODUCTS: STATE OF PRACTICE AND PATH FORWARD—TechNote

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Question

What are cement-based product Environmental Product Declarations (EPDs) and how are they used to support sustainability-related efforts?

Answer

An Environmental Product Declaration (EPD) is an independently verified report used to communicate the potential environmental impacts (for example, emissions to air, resource use, and energy) associated with a specified product, in simple language. The goal of EPDs for cement-based products is to provide a quantitative measure for assessing and comparing the potential environmental impacts of producing like products.

Concrete, owing to its versatility, widespread availability, and economic advantages, stands as the world's most-used building material (Krausmann et al. 2017). The sheer magnitude of the cement and concrete industry underscores the substantial levels of the associated material consumption and greenhouse gas (GHG) emissions (Zhong et al. 2021; Rousseau et al. 2022). Recognizing the imperative for producing more sustainable cement-based products, an acknowledgment of the need for standardized protocols to assess their environmental impacts is growing.

Over the past decade, industry efforts on the quantification of the potential environmental impacts have resulted in industries turning to EPDs. The U.S. concrete industry has been actively developing concrete EPDs since 2012 (Carbon Leadership Forum 2012). Concrete EPDs have been used in green building standards and rating systems, such as LEED v4, to disclose the material's environmental footprint, inform material selection, and support green procurement practices on both material and structural levels. More recently, ACI CODE-323, "Low-Carbon Concrete—Code Requirements and Commentary," mentioned EPDs as a source of information for documenting the GHG emissions associated with concrete mixtures. The future use of EPDs is expected to increase significantly, particularly for the procurement of sustainable cement-based products.

In the United States, several government policies have been created to promote public procurement of materials that are manufactured in a cleaner, more efficient, environmentally friendly manner. In California, the Buy Clean California Act (BCCA) of 2017 set the precedent for the use of EPDs in the public procurement of building materials, where acceptance is contingent upon their global warming potential (GWP) being lower than a predetermined threshold value (California Legislative Information 2017). Buy Clean acts have since been enacted in Washington, Minnesota, Oregon, and Colorado (BlueGreen Alliance Foundation 2022). Starting in late 2021, multiple federal initiatives, including Executive Order 14057: Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, contained requirements for the use of EPDs, driving demand for materials with a lower carbon footprint (EPA 2023).

The first EPD for concrete was issued by a ready mixed producer in San Jose, CA, in 2013 (Himes 2023). Industry-average EPDs have been produced in North America by the National Ready Mixed Concrete Association (NRMCA 2019), Concrete Canada (CRMCA 2017), and the Canadian Precast/Prestressed Concrete Institute, National Precast Concrete Association, and Precast/Prestressed Concrete Institute (CPCI/NPCA/PCI 2016). Data are collected from participating association members to create an industry-average EPD, and results are reported based on a given "class" of concrete, such as for a given strength class of concrete produced with a broadly specified binder composition. For example, a category in the NRMCA industry-average EPD for ready mixed concrete is "3001-4000 psi (20.69-27.58 MPa) and 30-39% fly ash" (product name 4000-30-FA). Alternatively, product-specific EPDs are made using data from a specific facility or group of facilities and are based upon the materials in a specific mixture design. Product-specific EPDs more accurately represent the environmental impacts of concrete incorporated into a particular project.

This TechNote provides an overview of the ongoing industry efforts in EPD development, how EPDs are created, types of EPDs, and the limitations of the approach.