

MODEL EUROPEAN ENVIRONMENTAL PRODUCT DECLARATIONS FOR CONCRETE ADMIXTURES

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Abstract

Concrete should rightly be regarded as an engineered construction material that has a major role to play in providing the sustainable built environment demanded for future generations.

Admixtures are an essential constituent in helping modern concrete achieve and optimise its unique combination of properties.

Environmental Product Declarations (EPD) are a key element in the evaluation of the sustainability of construction and in future will be important in providing reliable data for building information modelling (BIM).

EFCA- the European Federation of Concrete Admixtures Associations, representing 11 national admixture associations - first published Generic EPDs for six categories of admixtures in 2006.

- water reducing/plasticising and high range water reducing/superplasticising
- Hardening accelerating
- Set accelerating
- Set retarding
- Air entraining
- Water resisting

In 2012, EN 15804 “Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products” was published. Since then EFCA and its members have worked to provide Model European EPD for the same categories of admixtures to ensure that the information is updated to be compliant with the rules in EN 15804. This paper provides the background and details of these newly updated admixture EPD.

Keywords: Concrete admixtures, environmental product declarations, concrete sustainability, EFCA(European Federation of Concrete Admixtures Associations.)

1. INTRODUCTION

Concrete should rightly be regarded as an engineered construction material that has a major role to play in providing the sustainable built environment demanded for future generations.

Its unique combination of strength and durability, thermal mass and flexibility of design enable it to make a valuable contribution at each stage of the life cycle of a project. Locally and responsibly sourced, it is fully reusable or recyclable and uses recycled and by-product materials - an ideal material for the resource efficient, circular economy that is the aim of Europe today. Admixtures are an essential constituent in helping modern concrete achieve and optimise this combination of properties by:

- Improving strength and resistance to damage from harsh environments
- Ensuring consistency during delivery and placing over a wide range of workability even for very high flow concrete
- Improving quality of finish and reducing service life repair
- Reducing embodied energy and carbon
- Improving site practice
- Delivering cost benefits to the concrete producer and user

Environmental Product Declarations (EPD) are a key element in the evaluation of the sustainability of construction and in future will be important in providing reliable data for building information modelling (BIM).

EFCA has been in existence since 1984 and represents 11 European national associations of concrete admixture producers. Among its aims and objectives are:

- To act as the voice of the European concrete admixtures industry when approaching authorities, institutions, organisations or any other competent body on an international level.
- To provide the common message of the industry to make known its position and views to the European Commission, European Parliament, CEN and other Groups dealing with issues such as European Legislation, European Harmonisation of Standards and certification.
- To present the views and interests of manufacturers, contractors and consultants in Technical, Health, Safety and Environmental matters.
- To work for the improvement of the technical standards of the industry, for example through technical knowledge, innovation and environmental protection.
- To advance and encourage the use of admixtures by means of lectures, publications and other activities including presentations at conferences.
- To work closely with other European organizations in the field of concrete, constituents and supply, in order to promote the use of concrete as the premier construction material of choice.

In keeping with these aims in 2006, working with the National Association member companies across Europe, EFCA took a lead by publishing generic EPD for six admixture types. Since then CEN Technical Committee TC 350 has been working on a suite of standards aimed at harmonising the way that sustainability of construction projects is measured. EN 15804 “Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products” [1] was published in 2012. This

effectively rendered the original EFCA EPDs out of date through not being in full compliance with the EN 15804 rules.

During 2014, EFCA and its members have worked to rectify this and in 2015 will publish six new Model EPDs in compliance with EN 15804 and externally verified by the respected German Institute for the Building and Environment (IBU), a programme holder within the ECOPlatform (www.bau-umwelt.com).

2. THE EFCA 2015 MODEL EPDS

Model EPDs have been published for six categories of admixtures that are covered by EN 934 [2]:

- Water reducing/plasticising and high range water reducing/superplasticising
- Hardening accelerating
- Set accelerating (for concrete and shotcrete)
- Set retarding
- Air entraining
- Water resisting

During 2014, materials and production data from across the European plants which are part of the EFCA federation were reviewed and life cycle analysis, which is the basis of an EPD, carried out by environmental consultants Thinkstep (www.thinkstep.com). Using the IBU product category rules in compliance with EN 15804 these were converted into a structured EPDs that meet the requirements for declaration and verification stipulated in EN ISO 14025 “Environmental labels and declarations - Type III environmental declarations - Principles and procedures.” [3]

The term “Model” EPD is used to show that the results of the Life Cycle Assessment provided in each declaration have been selected from the product within each category that showed the highest environmental impact (i.e. a worst-case scenario). This method was chosen so that anyone wanting to use the EPD data for an analysis of concrete and mortar products could use the model data in the knowledge that they are adopting a conservative, safe value that represents this admixture type across the EFCA members.

In order to determine whether the Model EPD is applicable to a particular supplier’s admixtures, a confidential guidance document has been produced which allows the supplier to assess, through a point scoring system, whether its admixture formulation is covered. Having done this the supplier can then declare to customers, that it meets the requirements for the EFCA EPD to be applicable to its products.

It is important to note that, because the life cycle analysis data that underlies the EPD was provided only by EFCA member associations and their companies, the Model EPD cannot be applicable to any company not within the EFCA federation structure.

2.1 Description of the EPD

The basis of the EPD is life cycle analysis, in which all of the inputs to and outputs from the product are assessed for their environmental impact with regard to a number of agreed parameters. EN 15804 recognises several stages in the life of the construction product such as concrete which are:

- The product stage
- Construction process stage
- Use Stage
- End of life stage

These are further divided into modules which are shown in Table 1.

Additionally Module D (after the product life cycle) is designed to consider any other benefits or impacts that can occur outside of the normal life cycle modules, for example for concrete this could (and should) include the benefits of carbonation of concrete in reducing atmospheric carbon dioxide, particularly after crushing and storage for recycling after demolition.

EN 15804 allows EPD to be produced which include as a minimum modules A1-A3 (product stage only) with options to include the remaining modules. For admixtures, which are constituent materials of the final concrete products, the most appropriate are Modules A1-A3 since it is difficult to assess the admixture itself directly at the later stages as it has been fully incorporated into the concrete. This is commonly described as a ‘Cradle to factory Gate’ EPD.

Table 1: Summary of the life cycle stages defined in EN 15804

| Life Cycle Stage | Module Description | Module Ref. |
|---|---|-------------|
| Product stage | Raw material supply | A1 |
| | Transport | A2 |
| | Manufacturing | A3 |
| Construction process Stage | Transport from the gate to the site | A4 |
| | Assembly | A5 |
| Use stage | Use | B1 |
| | Maintenance | B2 |
| | Repair | B3 |
| | Replacement | B4 |
| | Refurbishment | B5 |
| | Operational energy use | B6 |
| | Operational water use | B7 |
| End of life stage | De-construction demolition | C1 |
| | Transport | C2 |
| | Waste processing | C3 |
| | Disposal | C4 |
| Benefits and loads beyond the system boundaries | Reuse, Recovery and Recycling-potential | D |

For each of these EN 15804 modules a series of parameters has been established which allows calculation of the environmental impacts of using the product. Table 2 shows the range of parameters and their units. The values for each of the parameters shown in the EPD relate to 1kg of admixture and can be used as inputs to the calculation of LCA and EPD for concrete and mortar products based on the actual amounts used in the mix design.

To produce the LCA and EPD the consultant, Thinkstep has analysed data relating to raw materials and production supplied by the manufacturers using Product Category Rules (PCR)[4] established to be in compliance with EN 15804 by IBU. This analysis and a confidential background report has been submitted to IBU who will independently verify that the EPD are in compliance with the PCR and structured in accordance with EN ISO 14025. This important verification process provides the user of the EPD with confidence that the declaration is a credible representation of the environmental implication of using the admixtures as described in the relevant European Standards.

The values shown in Table 2 are preliminary, pre-verification values for 1 kg of plasticiser and superplasticiser. These are included as an indication only and should not be assumed to be the final values. The full verified Model EPD are anticipated to be obtainable for download from July 2015 either from the EFCA website at www.efca.info or the IBU website www.bau-umwelt.com.

Table 2: Preliminary results pre-verification for 1kg of plasticisers and superplasticisers

| Parameter | Unit | Values |
|--|---|----------|
| Results of LCA – Environmental Impact: 1 kg plasticisers and superplasticisers | | |
| Global warming potential | [kg CO ₂ -Eq.] | 1.88E+0 |
| Depletion potential of the stratospheric ozone layer | [kg CFC11-Eq.] | 2.30E-10 |
| Acidification potential of land and water | [kg SO ₂ -Eq.] | 2.92E-3 |
| Eutrophication potential | [kg (PO ₄) ³⁻ - Eq.] | 1.03E-3 |
| Formation potential of tropospheric ozone photochemical oxidants | [kg Ethen Eq.] | 3.12E-4 |
| Abiotic depletion potential for non fossil resources | [kg Sb Eq.] | 1.10E-6 |
| Abiotic depletion potential for fossil resources | [MJ] | 2.91E+1 |
| Results of LCA – Resource Use: 1 kg plasticisers and superplasticisers | | |
| Renewable primary energy as energy carrier | [MJ] | 1.51E+0 |
| Renewable primary energy resources as material utilization | [MJ] | 0.00 |
| Total use of renewable primary energy resources | [MJ] | 1.51E+0 |
| Non renewable primary energy as energy carrier | [MJ] | 2.66E+1 |
| Non renewable primary energy as material utilization | [MJ] | 4.82E+0 |
| Total use of non renewable primary energy resources | [MJ] | 3.14E+1 |
| Use of secondary material | [kg] | 0.00 |
| Use of renewable secondary fuels | [MJ] | 0.00 |
| Use of non renewable secondary fuels | [MJ] | 0.00 |
| Use of net fresh water | [m ³] | 6.04E-3 |
| Results of LCA – Output flows and waste categories: 1 kg plasticisers and superplasticisers | | |
| Hazardous waste disposed | [kg] | 5.17E-6 |
| Non hazardous waste disposed | [kg] | 2.56E-2 |
| Radioactive waste disposed | [kg] | 9.00E-4 |
| Components for re-use | [kg] | 0.00 |
| Materials for recycling | [kg] | 0.00 |
| Materials for energy recovery | [kg] | 0.00 |
| Exported electrical energy | [MJ] | 0.00 |
| Exported thermal energy | [MJ] | 0.00 |

3. SUMMARY

The members of EFCA feel it is vital to support the concrete industry by providing Model EPD to supply credible, verified information that can be used by concrete manufacturers in the production of their own product EPD. This will be essential in future to allow concrete to demonstrate its vital contribution to sustainable construction.

To meet this commitment EFCA will publish verified European Model EPD during the second half of 2015.

REFERENCES

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- [3] EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures.
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