Environmental Product Declaration for concrete

Author : Roberto Bogliolo
BUZZI UNICEM SpA
Environment, Health and Safety

INTRODUCTION

Concrete LCA study and EPD document, developed in accordance with some general rules, as “International requirement” and the PCR, are some useful instruments to analise the product environmental impacts in its cicle of life, from “cradle to grave”. Buzzi Unicem took part, as partner, to an international “Life project”, called “INTEND” in order to prepare the international guideline, the rules for concrete and cement and to divulgate the results in Europe.

THE INTEGRATED PRODUCT POLICY

In the European Commission's sustainable development strategy, the minimisation of environmental impacts of product - considered in all the phases of the life-cycle - is one of the key points of the actual environmental policy.
But, with so many different products and actors there can not be one simple policy measure for everything. Instead there is a whole variety of tools - both voluntary and mandatory - that can be used to achieve the scope. These include measures such as economic instruments, substance bans, voluntary agreements, environmental labelling and product design guidelines. In this context, it was important to define a comprehensive approach that could coordinate all products' environmental performance measures. The EC introduces then an Integrated Product Policy (IPP) approach to the scope of strengthening and refocusing product-related environmental policies.
The importance of IPP approach was testified by the adoption of a Green Paper on Integrated Product Policy that builds on extensive consultations of interested parties and presents ideas for strengthening product-focused environmental policies and assisting the growth of a market for greener products.
The overall strategy of IPP is to promote a gradual increase in the environmental quality of goods and services in a life-cycle perspective; this means to use market forces to the largest possible extent. In particular, the three market drivers identified are:

1. Getting the princes right that helps to internalise external costs, for example, due to environmental impacts. This can be obtained for example by using a differentiate taxation or an extension of the producer responsibility concept to new areas.
2. Strengthening green production by encouraging eco-design and environmental friendly production processes.
3. Stimulating demand for greener products to develop and/or increase a green products' market. However, to be able to choose between different products, consumers need information which is easily accessible, understandable, relevant and credible. In this context, the development and use of environmental labelling can be suitable to reach the scope.

The Integrated Product Policy (IPP) strategy is based on a series of voluntary tools based on environmental impact evaluation of products along the life cycle (Life Cycle Assessment LCA). Environmental labels and declarations, as defined in ISO 14020, are one of these voluntary tools.
The recent Commission Communication on Integrated Product Policy outlined the overall EC strategy for reducing the environmental impact caused by products. The Commission will take a number of actions to stimulate continuous improvement in the environmental performance of products throughout their whole life-cycle. The Communication sets out what the Commission will do to implement IPP. It will adopt a two-pronged approach:

- Improving the tools that already exist to make them more product-focused. These tools, known as the IPP toolbox, can be used on many different products. They include environmental management systems (such as the EU Eco-Management and Audit Scheme EMAS), environmental labelling and the provision of life-cycle information. IPP will also improve co-ordination between the different instruments to better exploit their synergies.
- Taking action to improve the environmental performance of products that have the greatest potential for environmental improvement

Environmental claims

Environmental claims are communication tools that provide information about a product or service in terms of its overall environmental character, a specific environmental aspect or any number of aspects. Therefore, purchasers can use this information in choosing the products or services they desire based on environmental, as well as other, considerations.
Environmental Claims are one of the most efficient and useful tools for IPP, in fact:

- they can be used to diffuse product information on environmental performances
- they enable consumers to become more conscious in their choices towards environmental sustainable consumption
- they are tools that can be used in legislation-making
- they provide a wide involvement of interested parties
- they are effective as founded on a life cycle approach.

Environmental Claims can be considered as voluntary market oriented tools and can act both on the demand side and supply side, involving a significant number of private and public stakeholders. On the **supply side**, they represent for company an incentive to continuous improvement of processes and enable a differentiation of product on market. On the **demand side**, they enable consumers to become more conscious in their choices towards environmental sustainable consumption.
Environmental Claims types are different for uses and purposes and each one is focused on a particular aspect of a wide labelling system. Target groups and stakeholders present different characteristics according to claims type.
The International Standards Organisation (ISO) has developed standards for three types of environmental product claims, termed ISO Type I, II and III. These can be described as follows:

- **Type I** or Environmental Labelling (ref. standard ISO 14024), based on criteria set by a third party and multi-issue, being based on the product's life cycle impacts. The awarding body may be either a governmental organisation or a private non-commercial entity. Examples include the EC Eco-label, Nordic Swan and German Blue Angel;
- **Type II** or self-declared environmental claims (ref. standard ISO 14021), based on self-declarations by manufacturers or retailers. There are numerous examples of such claims e.g. the percentage of recycled material;
- **Type III** or Environmental Declaration (ref. draft standard ISO/CD 14025) consists of quantified product information based on life cycle impacts. These impacts are presented in a form that facilitates comparison between products e.g. a set of parameters. However, there is no comparing or weighting against other products inherent within the claim

Fig. 1 – EPD logo

The environmental product declaration

Environmental declaration of products (EPD), as defined in ISO TR 14025, gives the possibility to communicate objective, comparable and credible information relating to the environmental performance of products. EPD is developed using LCA. Information contained in the declaration gives no criteria for assessment, preferability or minimum levels to be met but EPD standardise the LCA management, allowing a comparison among results of different LCA studies.

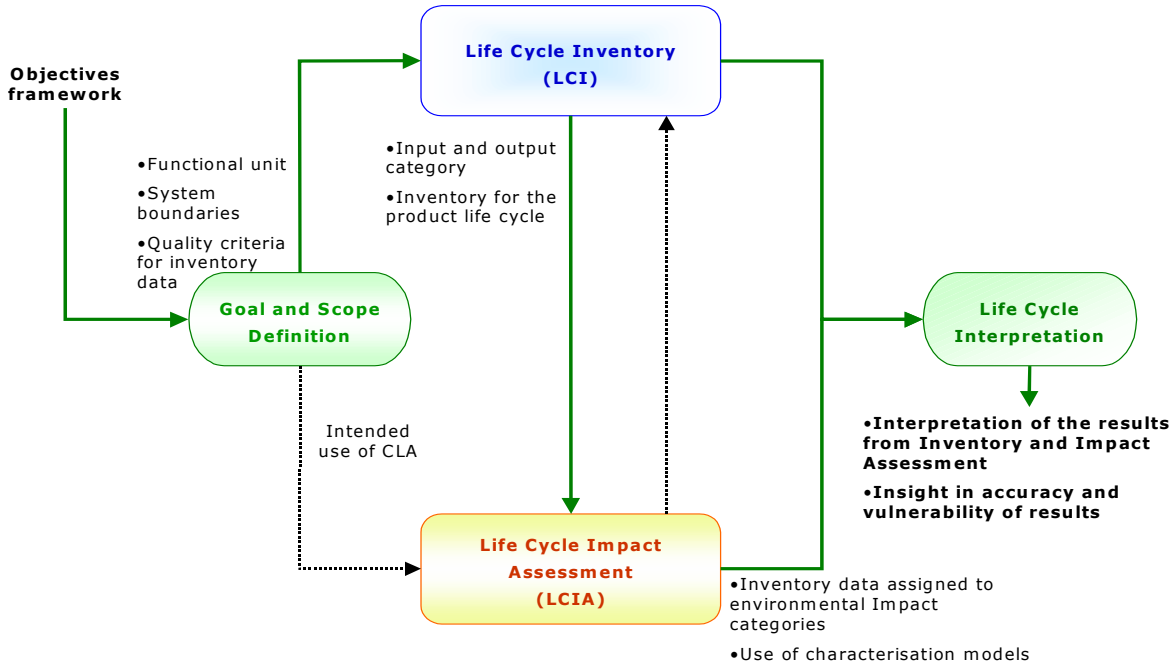

Fig. 2 – LCA scheme

Objectives of environmental declarations are:

- To communicate detailed and verifiable information on environmental aspects
- To encourage the supply of and the demand for environmental preferable products
- To stimulate ongoing potential environmental improvement

Producers can take advantages of implementing an EPD, because it can provide opportunities for giving a quantitative and verified description of the environmental performance of product / services in a comprehensive life cycle perspective.
Consumers can use EPD as a source of information in procurement and purchase of product and services.
The EPD is applicable to all products, regardless of their use or position in the production sequence, classified in well-defined groups. Classification in groups makes it possible to make comparisons among functionally equivalent products.
The Environmental Product Declaration faces all environmental impacts of products along the lifecycle, considered at all spatial scale: global, regional and local:

- Consumption of natural resources
- Consumption of primary energy
- Climate change
- Destruction of the ozone layer
- Acidification Eutrophication
- Formation of photochemical oxidants
- Production of waste.

The EPD can be checked and validated by an independent accredited body that guarantees the credibility and veracity of the information contained in the LCA study and in the declaration.

The effectiveness of innovative tools and approaches for environmental communication (like the EPD) is based on the assumption that environmental "quality" can produce competitive advantages.
To fully understand the potential and actual effectiveness of the EPD, we need to assess its impact on competitiveness The only way to do this, is to identify the "elements" of competitiveness and to evaluate if and how the "environmental quality" can influence it.

INTEND Project

Buzzi Unicem and Unicalcestruzzi took part to the **INTEND** project concerns the "Definition of an Environmental Product Declaration system that can be applied at international level and its implementation in two pilot countries (Sweden and Italy)".
The **INTEND** project is funded by the European Commission's LIFE Environment 2003 program. The project has started in January 2003 and has ended in September 2005.
INTEND's objectives was:

- To define an Environmental Product Declaration (EPD) system, according to ISO TR 14025. The EPD international scheme framework be defined by identification of coordination and harmonisation rules among national schemes.
- To test the defined system in two pilot countries (Sweden and Italy) and to diffuse the main system characteristics e at European and international level, also to candidate countries.
- To give the opportunity and the tools to Member States and candidate countries to cooperate in the implementation of an international system composed by national sub-systems.
- To diffuse the knowledge of type III Environmental Claims and to educate technicians on them.
- To increase people's knowledge and sensitiveness on products (goods and services) environmental aspects

Project description

First part of the project was based on the evaluation of an EPD system applicability in Italy, through some pilot projects. According to pilot projects' results a new EPD international scheme was structured focusing on:

a. the definition of system coordination and recognition mode,
b. drafting international coordination rules
c. PSR harmonisation rules and stakeholders' involvement
d. Identification of an international reporting format
e. Identification of common promotional activities to diffuse the knowledge of the EPD international system.

The new EPD international system tested in Italy through some pilot projects, conducted on different product groups.
Pilot projects implemented during the first and the second phase of the project covered a large part of product groups (goods and services) for different industrial sectors:

Services: Electrical energy production, Waste treatment, Waste water treatment;
Products: Paper, Chemestry, Pharmaceutical and Building and construction.
In particular for building and construction: Ceramic Tiles, **CEMENT**, **CONCRETE** and Expanded Clay.

Project results

The demonstration project will give results in both countries, the first (Sweden) with an already existent scheme which will be checked and adapted to the new features, and the second (Italy) where an EPD system does not exist at the moment but there is a great interest in this argument.
The definition of an EPD international system, with its rules and regulations will give the opportunity to different regions and countries to acquire all the information necessary for an EPD system implementation.
Such a demonstration project will be useful for the European Commission in order to define general rules for an EPD system application in Europe and for a wide diffusion of the environmental label and declaration tools, in general.
In particular, for the European Commission this project will give information regarding main features that an EPD system must have and main issues that has to face with, in order to promote the diffusion of EPD schemes in Europe.

At international level, a working group has been established in the ISO organisation (ISO/TC 207/SC 3) to define a Technical Report (ISO TR 14025) on Type III Environmental Product Declaration (EPD). At the moment, they are discussing about creating a standard for type III, as already done for type I and II Environmental labels and declarations. Recently (December 2003) they have prepared a first draft ISO/CD (Committee Draft) 14025.
The European environmental policy is strongly focusing on voluntary tools to be applied by private companies and public administrations for a stronger commitment in environmental protection. In particular, the new Integrated Product Policy (IPP) strategy, introduced by the European Commission, is based on a series of voluntary tools based on environmental impact evaluation of products along the life cycle (Life Cycle Assessment LCA). Environmental labels and declarations, as defined in ISO 14020, are one of these voluntary tools.
In some countries, in Europe and abroad, there is a strong interest on EPD by companies, public institutions, ONGs and accreditation or certification bodies. There are some experiences regarding an EPD system implementation. Most of the systems concern a single product group, as, for example, in France where there is a scheme for the construction products, or in Canada for paper products. Until now, in Europe only Sweden has developed a complete EPD system for validation and certification of EPDs according to ISO TR 14025.
The strong and wide interest for Environmental Product Declaration in Italy induced some pilot initiatives (e.g. ANPA pilot projects 2000-2001) and the addressing of some Italian companies to the Swedish System. Any experience on EPD underlines the necessity of an International system.
The **INTEND** project gives the opportunity to test and promote an international system, putting together some of the best experiences in EU.
The type III Environmental Declaration is a tool complementary to type I claims, like EU Ecolabel. The possibility of choosing among a complete set of claims would be a great opportunity for companies and support a wide Integrated Product Policy implementation

BUZZI UNICEM activities

At this moment, on the environdec web-site (www.environdec.com), 143 PCR for different products are published, as Building products, Cement, Ceramic tiles, clay constructions products, Concrete, Expanded Clay, Flooring materials.
In accordance with the “Requirements for an international EPD Scheme”, Buzzi Unicem prepared the specific rules so-called Product Category Rules (PCR), in order to guarantee the comparability of results of declarations.
PCR 2004:1 for cement
PCR 2005:7 for concrete
These PCR are approved, after a period of open consultation, by the Swedish Environmental Management Council, and are valid for 3 years.

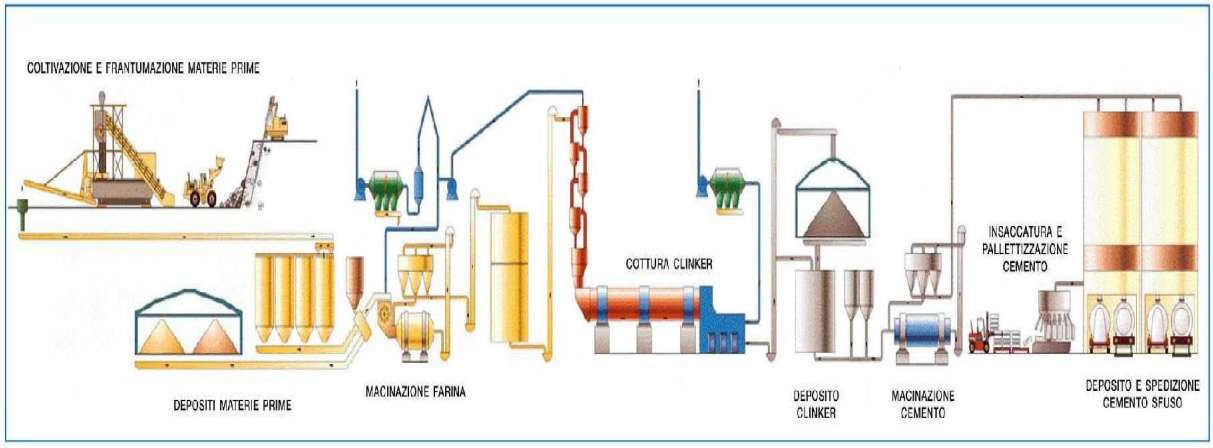

Fig. 3 – Cement process scheme

Using these documents, Buzzi Unicem, prepared the LCA studies, about Cement and Concrete, in order to publish the results in the EPDs. On environdec web-site, 98 different EPD are published, among these:
EPD Buzzi Unicem – Cement (Vernasca plant)
EPD Unicalcestruzzi – Concrete (Santena plant)

EPD results (Concrete)

LCA study results are illustrated, with tables and graphics, in the EPD document, in order to diffuse the information on the environmental performances, as required for type III labels.
The next table is referred to the environmental impacts, for 1 m^3 of concrete, produced in the plant of Santena.

Impact categories		Average Concrete
ENERGY RESOURCES - GER	MJ	2053,929
ENERGY RESOURCES - RENEW.	MJ	100,234
WATER USE	l	629,455
GREENHOUSE - GWP100	kg CO_2 eq	237,026
OZONE LAYER DEPLETION - ODP	kg CFC_{11} eq	2,00E-06
ACIDIFICATION - AP	kg SO_2 eq	4,450
PHOTOCHEMICAL OXIDANT	kg C_2H_4 eq	0,09
EUTROPHICATION POTENTIAL	kg PO_4^{3-} eq	0,09
Solid waste (solo dirette+indirette)	kg waste	41,583
Solid waste - HAZARDOUS	kg waste	0,271

Tab. 1 – EPD results

It's possible to compare these results with the most important results present in bibliography (Boustead Model 5.0)

		Buzzi Unicem values	Bibliography values	Diff. %
ENERGY RESOURCES	MJ / m^3	2.053,929	2.466,920	- 16,7
RAW MATERIALS	kg / m^3	2.281,45	2.313,68	- 1,4
GREENHOUSE GWP100	kg CO_2 eq / m^3	237,026	403,920	- 41,31

Tab. 2 – EPD results II

As it can be seen the results show a very good performance and an important reduction of impact compared to the bibliography values.
The most important reason are:

1. The performance are referred to a new plant, with low environmental impacts (use of secondary raw material and recycling system);
2. Cement, used for concrete production, is produced in the cement plant of Vernasca (PC), one of the most modern cementery in Italy (with secondary raw material and waste fuels). Also for this product, Buzzi Unicem has developed an EPD
3. Results of the two EPDs, contrary to the bibliography data, have been certified from an independent verifier.

The verification that data and declaration are in conformance with the requirements are carried out by an accredited independent verifier. The verification of the EPD by an independent third part is the only way to have believable information contained in the EPD and in the LCA study.

Conclusion – End of Life

The concrete EPD is a classic "from cradle to gate" approach. In the LCA study the "End of life" of the concrete is not described quantitatively, but only with a description of some possible scenes.
In order to value the complete "life cycle", having a classic "cradle to grave" approach, it's possible to use this verified end certified data, during the phase of planning, considering some other important aspects as the durability of the concrete, to determine the useful lifetime of the structure, the possibility of recycling and the carbonation of the material.
This use of the LCA study and the data of EPD is a modern way to plan with more and more attention to real environmental impacts.

REFERENCES

1. "Requirement for an international EPD scheme" - INTEND Project, 2005.
2. Cement PCR:2004:1, concrete PCR:2005 – http://www.envirodec.com.
3. Cement EPD, Concrete EPD (Buzzi Unicem).
4. "Analisi del ciclo di vita, LCA" – Gian Luca Baldo, Massimo Marino e Stefano Rossi, edizioni ambiente, may 2005.