

EPD, the current debate and challenges.

# New environmental indicators in EPD

*CPE Workshop. 10 December 2015, Brussels.*



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## Overview of this presentation

1. Background
2. Scope
3. Criteria
4. Policy relevance
5. Impact categories assessment
6. Possibilities



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BACKGROUND

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**FRANCE**  
**AFNOR. National annex to EN 15804. XP P01-064/CN. 2014.**

Additional toxicity.



**NETHERLANDS**  
**Environmental performance buildings. 2014 (updated 2015).**

Additional toxicity.



**BELGIUM**  
**Royal Decree. 2014.**

Additional indicators:  
Reference to both PEF and CEN



**UK**  
**BRE Green Guide to specification. 2008 (?).**


Additional indicators:  
toxicity



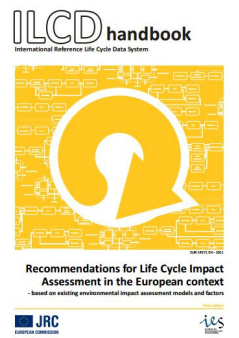
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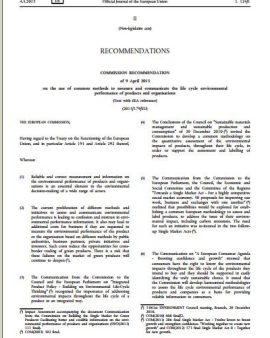


CEN TC 350



**ILCD handbook**  
International Reference Life Cycle Data System

**Recommendations for Life Cycle Impact Assessment in the European context**  
- based on existing environmental impact assessment models and factors





**PEF methodology.**  
2013.  
Now pilots until 2016.


Discussions before 2010.  
Consensus: some relevant, but not ready for standardisation.

**JRC Recommendations on LCIA methods.**  
2011.

**PEF methodology.**  
2013.  
Now pilots until 2016.

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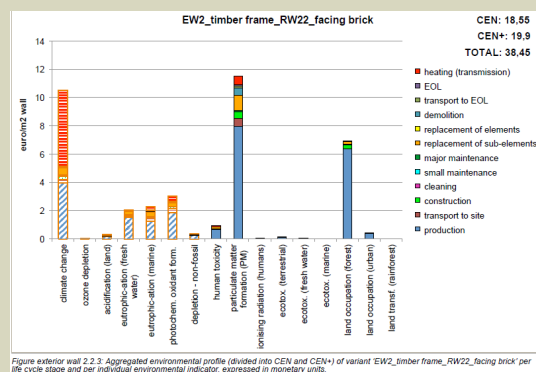
## We need more indicators

### Prevent burden shifting.

*Construction products are long lasting materials incorporated in buildings. Being blind for possible problems now – major impact on future generations.*

### Create a level playing field for all materials, industry and farming.

*E.g. the land use of biobased materials.*



OVAM/MMG - English extended summary available:  
<http://www.ovam.be/jahia/cache/offence/pid/176?actionReq=actionPubDetail&fileItem=3072>



- **Technical Report**
- The current standards (EN 15978, EN 15804) contain 7 LCIA impact categories.
- **CEN TC 350 wants to have a clear and structured view on the relevance and robustness of additional impact categories, models and indicators.**
- This TR will be used as input for further discussions
- This TR shall describe the current state and should tackle following topics:
  - Defining criteria for the inclusion of impact categories and indicators in CEN TC 350 standards. Including
  - Examining the predefined set of impact categories and indicators according to the criteria
  - Proposing possibilities of incorporating them in the standard
- The list of impact categories is a predefined set and does not imply a recommendation for inclusion in the standards.
- **Focus on LCA**
- The starting point of the TR will include the outcome of the Brussels Workshop (June 2014) and the ILCD handbook recommendations.



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The impact categories and indicators to be reviewed in the TR shall be:

particulate matter

land use (related impacts)

biodiversity

human toxicity

ecotoxicity

water depletion/scarcity

ionizing radiation



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- During the writing of the TR **several experts have been consulted, such as developers of impact assessment models, LCA software developers and experts from the EC-JRC.**
- The TR is based on referenced sources and facts.
- A Technical Report (TR ≠ EN) is **an informative document that provides information on the technical content** of standardization work. It may be prepared when it is considered urgent or advisable **to provide additional information to the CEN national members**, the European Commission, the EFTA Secretariat, other governmental agencies or outside bodies.
- A Technical Report is established by a CEN Technical Body and approved through a simple majority vote by the CEN national members. **It involves no obligation at national level.**
- Drafting team: **University of Leuven and VITO.** With regular discussions and commenting rounds within CEN TC 350.



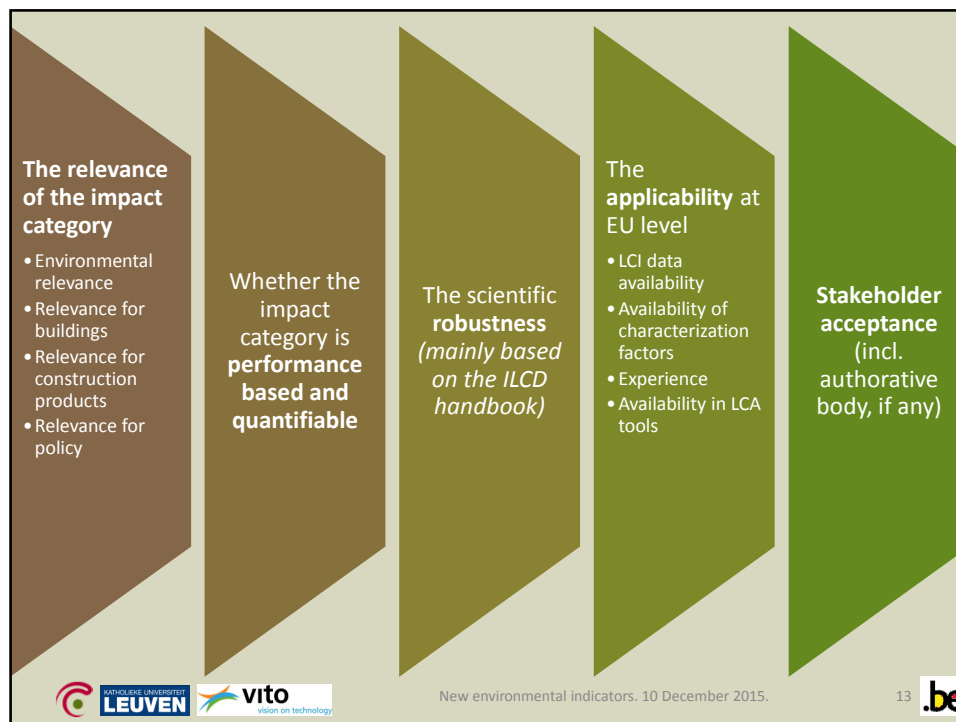
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## CRITERIA

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**I. General** The existing impact categories in EN 15804 are mainly influenced by the extraction and combustion of fossil fuels; The increase in heating efficiencies and insulation level, and the growing use of renewable energy will result in a smaller influence of the operational energy of buildings on its overall environmental profile.

**II. Assessment per impact category.** E.g. PM (much more information in the report)

many epidemiological studies indicate the relation between exposure to PM and various serious health impacts, such as mortality and morbidity.

The international Gothenburg Protocol, Clean Air Policy Package of the European Commission, ambient air quality and cleaner air for Europe Directive

European Environmental Agency monitors PM.

WHO has exposure guidelines.

Impact category	Environmental relevance	Policy relevance
Toxicity	relevant	relevant
Particulate matter (PM)	relevant	relevant
Ionizing radiation	relevant	relevant
Land use related impacts	relevant	relevant
Water scarcity	relevant	relevant



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European Environmental Agency, Outlook 2015.

	5-10 year trends	20+ years outlook
<b>Protecting, conserving and enhancing natural capital</b>		
Terrestrial and freshwater biodiversity		
Land use and soil functions		
Ecological status of freshwater bodies		
Water quality and nutrient loading		
Air pollution and its ecosystem impacts		
Marine and coastal biodiversity		
Climate change impacts on ecosystems		
<b>Resource efficiency and the low-carbon economy</b>		
Material resource efficiency and material use		
Waste management		
Greenhouse gas emissions and climate change mitigation		
Energy consumption and fossil fuel use		
Transport demand and related environmental impacts		
Industrial pollution to air, soil and water		
Water use and water quantity stress		
<b>Safeguarding from environmental risks to health</b>		
Water pollution and related environmental health risks		
Air pollution and related environmental health risks		
Noise pollution (especially in urban areas)		N.A.
Urban systems and grey infrastructure		
Climate change and related environmental health risks		
Chemicals and related environmental health risks		



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## IMPACT CATEGORIES ASSESSMENT

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### The impact categories assessment

particulate matter

land use

biodiversity

human toxicity

ecotoxicity

water  
depletion/scarcity

ionizing radiation

## The impact categories assessment

### Criteria



1. Building relevance
2. Construction product relevance
3. Performance based
4. Quantifiable
5. Availability
6. Scientific robustness
7. Applicability
8. Stakeholder acceptance



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## The impact categories assessment






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## Particulate matter

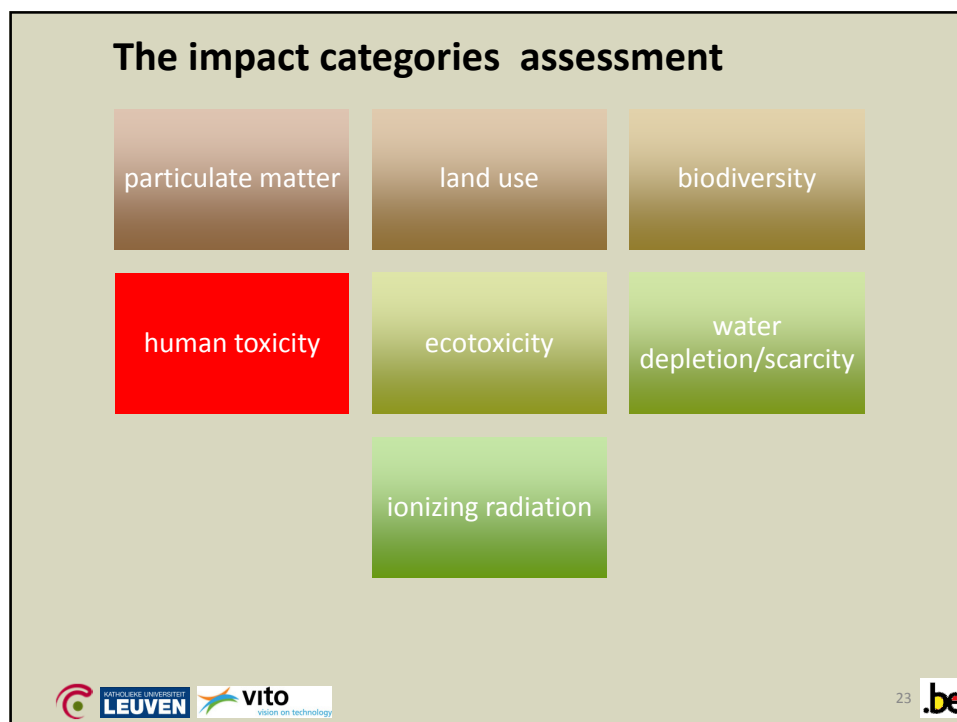
1. Building relevance	PM formed in transport processes, use of energy, demolition works, etc.
2. Relevance for construction products	Products may contribute to ambient PM due to the processes during the production stage, their transport to the construction site and end-of-life treatment
3. Performance based	Yes
4. Quantifiable	Yes



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## Particulate matter

5. Available LCIA methods (since ILCD hb)	Several LCIA methods available. New end-point method with CFs by Notter & Althaus since 2014
6. Scientific substantiation	<p>The assessment of Humbert 2009 method is updated, as it was not published at the time of ILCD, 2011</p> <p>Currently no clear guidance on how to consistently include health effects from PM<sub>2.5</sub> exposure</p>
7. Applicability	Some methods evaluate PM only on particle size. A differentiated evaluation including (e.g. the location, population density, chemical composition) would give a more realistic evaluation of HH effects. But there are recent developments: new life cycle inventory data and CFs
8. Stakeholders acceptance	UNEP/SETAC is working on a consensual PM indicator; dissemination of results expected in 2018



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### Human Toxicity






1. Building relevance	Toxic effects may be encountered throughout life cycle via (direct) emissions of chemicals and chemical substances released to indoor air
2. Relevance for construction products	Toxic effects may be encountered throughout life cycle via (direct) emissions of toxic substances released to indoor air (use phase), during manufacturing and end-of-life treatment
3. Performance based	Yes
4. Quantifiable	Yes

At the bottom left, there are logos for Katholieke Universiteit Leuven and vito (vision on technology). At the bottom right, there is a small number '24' and the '.be' logo.




## Human Toxicity

5. Available LCIA methods (since ILCD hb)	Since ILCD Handbook, no new methods published
6. Scientific substantiation	<p>“Current” LCIA models/methods still do not cover everything in the use phase, e.g. indoor air pollution and modelling of toxicity of metals</p> <p>Updates of USEtox include indoor air toxicity</p>
7. Applicability	<p>Concerns about the availability and quality of LCI data (both foreground and background)</p> <p>Some issues being tackled within LCA-tools, e.g. harmonisation nomenclature toxic emissions</p>
8. Stakeholders acceptance	USEtox is based on scientific consensus, but not all stakeholders (mainly the metals industry) agree that it is ready for implementation



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## The impact categories assessment

particulate matter	land use	biodiversity
human toxicity	ecotoxicity	water depletion/scarcity
ionizing radiation		



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## Ionising radiation

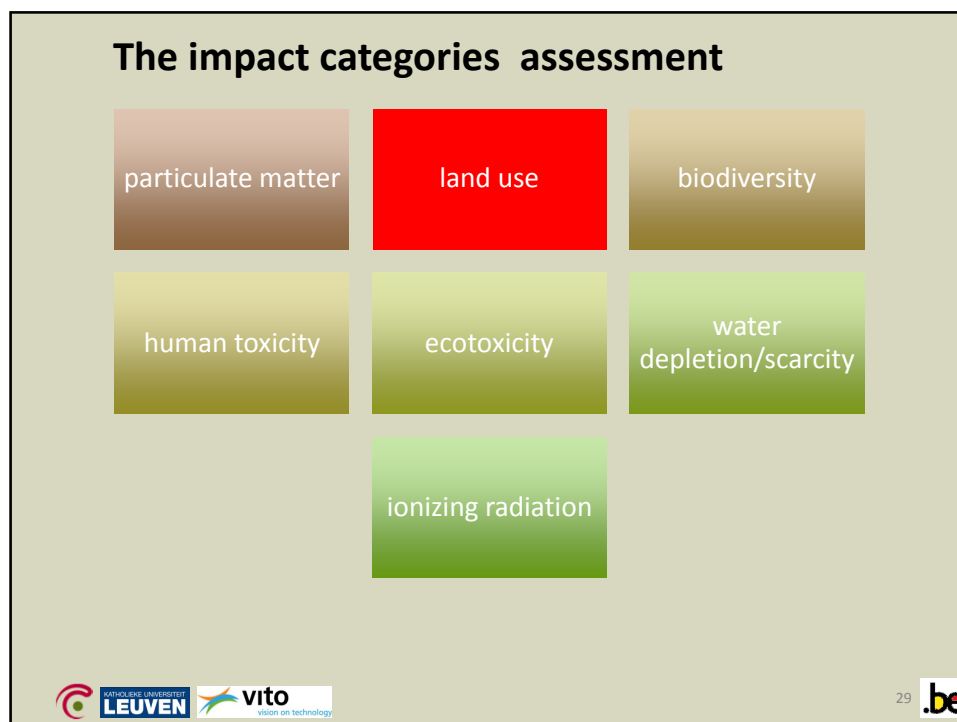
1. Building relevance	Exposure to natural sources covered by CEN/TC 351 Only nuclear energy generation can be assessed within LCA
2. Relevance for construction products	Ionising radiation through natural radon emissions from the ground, nuclear energy generation, natural radionuclides in construction materials/waste, but mainly from exposure to natural sources
3. Performance based	Yes
4. Quantifiable	Yes



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## Ionising radiation




5. Available LCIA methods (since ILCD hb)	Since ILCD Handbook, still only model of Frischknecht et al. 2000 available for HH
6. Scientific substantiation	No additional information than ILCD Handbook
7. Applicability	Model of Frischknecht used by most commercial LCIA methods like Eco-Indicator 99, ReCiPe, IMPACT 2002 Might be a good impact indicator to include impacts from nuclear energy in EN 15804 and EN 15978 to avoid potential burden shifting
8. Stakeholders acceptance	No LCA authoritative body (except ILCD recommendations)



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### Land use related impact

1. Building relevance	In-situ land use - Land transformed and occupied on the construction site to build the building = physical footprint of the building
2. Relevance for construction products	Embodied land use - Land transformed and/or occupied for the production/transportation/EoL treatment of the construction materials and products which are used in the building
3. Performance based	Yes
4. Quantifiable	Yes

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## Land use

5. Available LCIA methods (since ILCD hb)	Eight available LCIA methods/models concerning land use
6. Scientific substantiation	Since ILCD Handbook several new developments: Brandao and Milà i Canals (2013), Nuñez et al. (2013), LANCA (2010) (based on Baitz 2002), LC-IMPACT LU (2013)
7. Applicability	<p>In all LCIA methods, generic characterization factors are used as a simplification in order to allow the calculation of land use impacts for the background system.</p> <p>In most LCA studies, generic characterization factors are also used for the foreground system.</p>
8. Stakeholders acceptance	No LCA authoritative body (except ILCD recommendations)



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## The impact categories assessment




particulate matter	land use	biodiversity
human toxicity	ecotoxicity	water depletion/scarcity
ionizing radiation		



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## Biodiversity

1. Building relevance	Land transformed and occupied on the construction site to build the building = physical footprint of the building
2. Relevance for construction products	Land transformed and/or occupied for the production/transportation/EoL treatment of the construction materials and products which are used in the building
3. Performance based	Yes
4. Quantifiable	Yes



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## Biodiversity

5. Available LCIA methods (since ILCD hb)	Some available LCIA methods/models present, however not always directly available in software
6. Scientific substantiation	<p>ReCiPe midpoint (not really LCIA)</p> <p>Baitz, 2007 (has no characterization factors, description of the issues, method is very complete, but not practicable within a LCA context)</p> <p>Milà i Canals (but no LCI data available in generic databases)</p>
7. Applicability	ILCD Handbook does not recommend any LCIA model/method. ReCiPe (based on Köllner, 2001) was identified as the best available method (ILCD) to describe biodiversity losses due to land use. ReCiPe, Eco-Indicator99 and Swiss Ecoscary have been widely applied.
8. Stakeholders acceptance	No LCA authoritative body (except ILCD recommendations)



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## Land use related impact



- Land use interventions have a potential impact on biodiversity, soil quality, ecosystem functions and land as resource. To cover these all, several impact assessment models and related indicators are necessary as there is currently no single indicator available covering these all.
- The EC-JRC is developing such a single indicator; this expected to be published in September 2016.

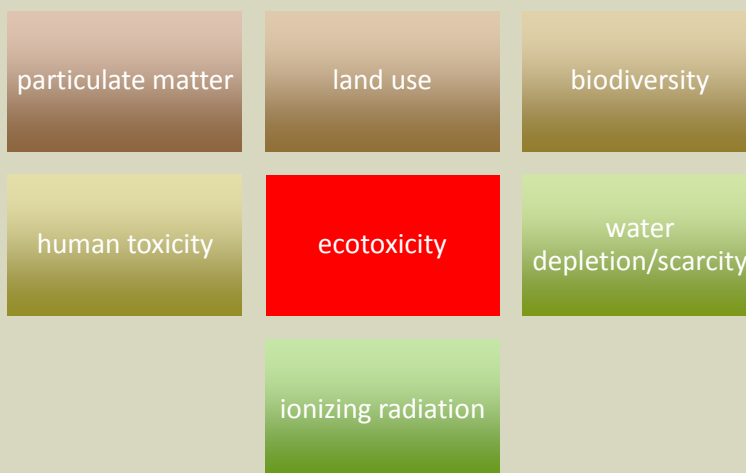


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## The impact categories assessment






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## Ecotoxicity

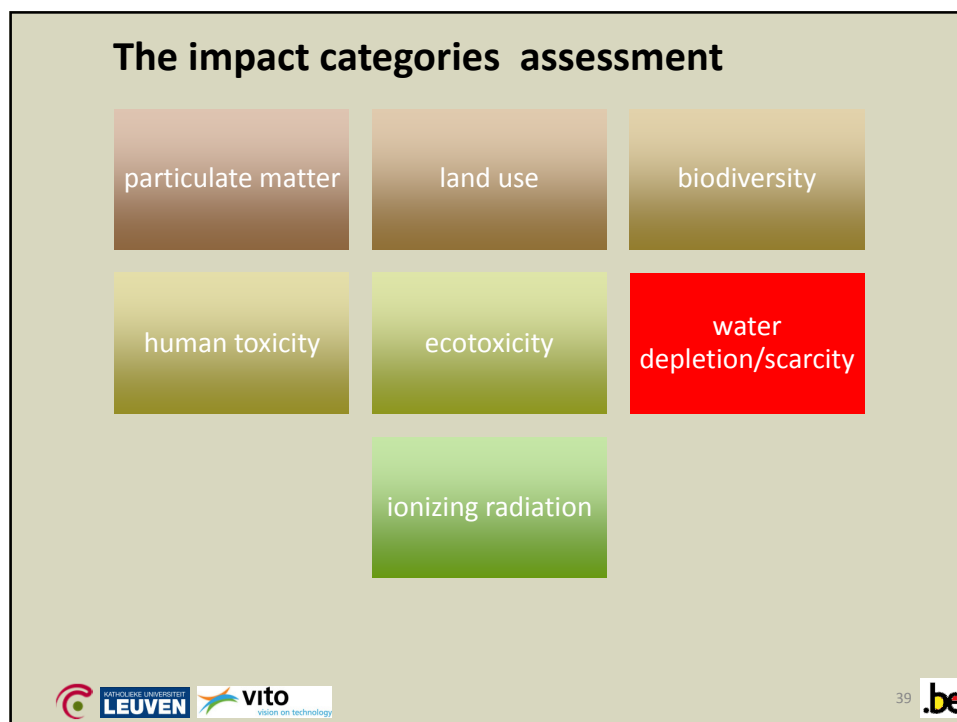
1. Building relevance	Some examples of potential toxicity related to buildings are the leaching of components. Ecosystems may be exposed to outdoor toxic emissions through contaminated water or soil.
2. Relevance for construction products	Toxic effects may be encountered throughout life cycle via (direct) emissions of toxic substances released to indoor air (use phase), during manufacturing and end-of-life treatment
3. Performance based	Yes
4. Quantifiable	Yes



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## Ecotoxicity




5. Available LCIA methods (since ILCD hb)	Ten LCIA methods available. Since ILCD handbook, no new methods available
6. Scientific substantiation	Current LCIA models/methods still do not cover every part of the use phase of a building. Toxicity impacts related to indoor and outdoor emission within a building's use phase are often excluded in characterization models due to the difficulty of determining effects at the building level.
7. Applicability	<p>ILCD Handbook recommends UseTox for characterizing impacts related to freshwater ecotoxicity at midpoint. On terrestrial and marine ecotoxicity none of methods reviewed are recommended by ILCD.</p> <p>Improve the LCIA models to provide a more meaningful result in ecotoxicity assessment by critically adopting and adapting advanced knowledge and models from risk assessment.</p>
8. Stakeholders acceptance	USEtox is based on scientific consensus; but, not all stakeholders (mainly the metals industry) agree that it is ready for implementation



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### Water depletion/scarcity

1. Building relevance	Buildings contribute to water consumption, mainly during the use phase: shower, cooking, washing, etc.
2. Relevance for construction products	Water is an essential component for the production of almost all construction materials and products
3. Performance based	Yes
4. Quantifiable	Yes

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## Water depletion/scarcity



- |                                           |                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5. Available LCIA methods (since ILCD hb) | There are only two LCIA methods for water scarcity evaluated within the Recommendations on LCIA of ILCD Handbook (Swiss Ecoscarcity – water, MEEuP). Several methods have been further developed, in the meanwhile                                                                                                                   |
| 6. Scientific substantiation              | There are only two LCIA methods for water scarcity evaluated within the Recommendations on LCIA of ILCD Handbook (Swiss Ecoscarcity – water, MEEuP). Several methods have been further developed, in the meanwhile                                                                                                                   |
| 7. Applicability                          | <p>Foreground data: Swiss Ecoscarcity, Pfister 2009 and AWaRE method: as only volumes of consumed water and region (mostly country-level) are required, the inventory of foreground data can be easily done.</p> <p>Background data: Swiss Ecoscarcity and Pfister 2009: generic data are widely available in several databases.</p> |
| 8. Stakeholders acceptance                | In May 2015 the WULCA working group has communicated their recommendation regarding a stress indicator on water scarcity. A preliminary version of the recommended method AWaRe has been made available on their website in June 2015.                                                                                               |



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## POSSIBILITIES

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**Possible Options**

**Mandatory**

- the impact category is added to Table 3 of EN 15804 and EN15978,
- without further interpretation.

**Optional**

- the manufacturer has the freedom to decide whether or not to declare the impact category
- without further interpretation.

**Mandatory additional information:**

- mandatory to calculate and declare the impact category, Declared in the additional information section
- allows for accompanying text

**Optional additional information**

- the manufacturer has the freedom to decide whether or not the impact category is declared.
- Declared in the additional information section
- allows for accompanying text

**Not ready**

- it is considered that the impact category is not yet ready for uptake in standardization.



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This informative Annex considers possible options for including the impact categories in the standards based on the results of this review

A - Impact category		B - Summary of the evaluation of additional impact categories in this TR										C - Possible options for uptake									
		relevance				Best available methodology at the time of the TR assessment	performance based quantifiable	scientific robustness	applicability				stakeholder acceptance	In EN 15804				In EN 15978			
		environment	buildings	products	policy				data availability	experience	availability in tools	mandatory		optional	mandatory additional information	optional additional information	not ready	mandatory	optional	mandatory additional information	optional additional information
Human toxicity	cancer					Usetox v1.0 (1)		(2)			(3)					(6)				(6)	
	non cancer							(2)			(3)					(6)				(6)	
Ecotoxicity	marine							(1)	(3)	(4)											
	freshwater							(2)			(3)					(6)				(6)	
	terrestrial							(1)													
Particulate matter (respiratory inorganics)						Riskpoll/Humbert (2009)			(8)						(9)	(9)					
Ionizing radiation	human health					Erishknecht et al (2000)															
	ecosystem health					Garnier-Laplace et al (2008/2009)			(10)								(11)				(11)

A - Impact category		B - Summary of the evaluation of additional impact categories in this TR										C - Possible options for uptake										
		relevance				Best available methodology at the time of the TR assessment	performance based quantifiable	scientific robustness	applicability			stakeholder acceptance	In EN 15804				In EN 15978					
		environment	buildings	products	policy				data availability	experience	availability in tools		mandatory	optional	mandatory additional information	optional additional information	not ready	mandatory	optional	mandatory additional information	optional additional information	not ready
Land use related impact	General / single indicator					JCR method under development			(15)													
						LC-Impact LU			(16)													
	Biodiversity (end point)					ReCiPe			(7)	(16)												
						Ecolindicator 99												(21)	(23)			
	Soil quality	(12)	(12)			Milà i Canals et al. 2007 (26)			(17)	(16)		(20)						(21)	(23)			
	Ecosystem functions	(13)	(13)			Lanca			(25)	(16)		(19)						(24)	(18)			
	Resource depletion	(14)	(14)			Not assessed in the TR																
water scarcity						AlWaRe method (2015)					(22)	(23)										



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1.	Usetox v1.0 was assessed in the technical report. An update of this method (Usetox v2.0) was released in august 2015 improving multiple issues. This updated version was however not assessed in the TR. In case toxicity is uptaken as optional additional information, it should be discussed to lay down the method being Usetox v1.0 or whether to start using the updated and improved version Usetox v2.0.
2.	A relative high uncertainty was reported.
3.	The availability of LCI data was reported to be of concern.
4.	Experience is available, but for some product groups and for some issues the experience shows issues of concern.
5.	The poor stakeholder acceptance is mainly due to the methodological imperfections due to the inherent properties of some substances
6.	Toxicity assessment of construction products using current methodologies should not be communicated without interpretation due to inherent uncertainties.
7.	Not recommended by JRC
8.	The issues identified are regarding foreground data collection. This is due to the absence of a harmonized measurement standard.
9.	If PM is reported, it should be accompanied by a clear information on how the data was obtained/measured/estimated, this until a harmonized method is available.
10.	The characterization factors of Garnier-Laplace were identified as not peer-reviewed.
11.	Both at building and at product level ionizing radiation has not been identified as relevant in current LCA studies. However, ionizing radiation might be a good indicator to identify nuclear energy use during the life cycle of the building and construction products. The indicator for radioactive waste in EN 15804 and EN 15978 provides a similar function, but remains at the inventory level. Radioactive waste hence does not take the severity nor the impact into account which makes it difficult to aggregate. <i>"Although the exposure to ionizing radiation due to energy consumption in buildings and for the manufacture of buildings products is only a small fraction of the total dose received annually by a person, it may be appropriate to include ionizing radiation as an indicator in both the EN 15804 and the EN 15978 to understand the burdens that arise."</i> It is also important to mention the importance of the soil and of some materials as potential sources of ionizing radiation.
12.	No studies were found demonstrating the relevance of soil quality and ecosystem functions in the context of buildings and construction works. Therefore, it is not clear whether the impact on soil quality is sufficiently significant for it to be included as an impact category. However, it is recognized that many construction products are derived from activities (mining, quarry, agriculture and forestry) which do impact on soil quality.
13.	In relation to land use no explicit statistical or other data have been found for this impact indicator. However, it is recognized that buildings and construction products are derived from activities, such as mining, quarry, agriculture and forestry, which have an impact on Ecosystem functions.
14.	In relation to land use no explicit statistical or other data have been found. In the context of land use this impact category has not been considered further in the TR.
15.	The EC-JRC is currently working on a revision/additional refinement of the land use impact assessment. The final result of the revision is expected to be ready in September 2016.
16.	Generic characterization factors are used for both the background and foreground system while specific characterization factors should be used for the foreground system. Specific regional data are not yet available for any LCIA method and indicator
17.	Recommended by the ILCD handbook as "level III, i.e. "recommended but to be applied with caution".
18.	Rejected mainly because too recent and not sufficient insights.
19.	For the time being only available in Gabi.
20.	An updated version by Brandao exists since 2013 but has not yet been integrated in available software tools.
21.	Due to the JRC developments it is important to stimulate the collection and experience of collecting inventory data for this indicator.
22.	Although the recently recommended method by WULCA is not yet available in current widely used LCA tools, it is assumed that this will very soon be available as the flows are easy to implement and the method is recommended by the authoritative body WULCA. As the characterization factors are available it is possible to use a csv file to add them to SimaPro for example.
23.	Due to the consensus model. However it has not been implemented yet. (cfr experience).
24.	explanatory information might be needed to accompany the result of this impact category.
25.	Not sufficiently assessed to draw a conclusion.
26.	The recommended method in case of uptake would be the 2013 update of the Milà i Canals et al LCIA method.



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Policy key question:  
What is the level of accuracy we want?

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## Summary

- The draft TR provides the necessary **structured** way to discuss on environmental impact categories in the context of standardization, including a set of criteria.
- Another added value: the **focus on standardization**
- A lot of work and effort has been invested to make sure the TR is a collection of **factual** information which is expressed in a **neutral** way.
- It provides a wide overview of the situation today: available methodologies, their **strengths and also their weaknesses**
- No recommendations
- The **starting point for future discussions** and conscious decision making
- Established through literature review, expert consultation and multiple commenting rounds.
- Oral **consensus was reached** within the experts of the CEN Joint Working Group;
- Next step: 1st semester of 2016: voting procedure for an official acceptance.





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