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Environmental management — Water footprint — Illustrative examples on how to apply ISO 14046

Management environnemental — Empreinte eau — Exemples illustrant l'application de l'ISO 14046

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is Technical Committee ISO/TC 207, *Environmental management*, Subcommittee SC 5, *Life cycle assessment*.

Introduction

Principles, requirements and guidelines for the quantification and reporting of a water footprint are given in ISO 14046. The water footprint assessment according to ISO 14046 can be conducted as a stand-alone assessment, where only impacts related to water are assessed, or as part of a life cycle assessment. In addition, a variety of modelling choices and approaches are possible depending on the goal and scope of the assessment. The water footprint can be reported as a single value or as a profile of impact category indicator results.

This document provides illustrative examples on the application of ISO 14046 to further enhance understanding of ISO 14046 and to facilitate its widespread application.

At the time of the publication of this document, water footprint assessment methods are developing rapidly. Practitioners are encouraged to be aware of the latest developments when undertaking water footprint studies.

These examples are for illustrative purposes only and some of the data used are fictitious. The data are not intended be used outside of the context of this document.

The Bibliography might contain references to methods that are not fully compliant with ISO 14046:2014.

Environmental management — Water footprint — Illustrative examples on how to apply ISO 14046

1 Scope

This document provides illustrative examples of how to apply ISO 14046, in order to assess the water footprint of products, processes and organizations based on life cycle assessment.

The examples are presented to demonstrate particular aspects of the application of ISO 14046 and therefore do not present all of the details of an entire water footprint study report as required by ISO 14046.

NOTE The examples are presented as different ways of applying ISO 14046 and do not preclude alternative ways of calculating the water footprint, provided they are in accordance with ISO 14046.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14046:2014, *Environmental management — Water footprint — Principles, requirements and guidelines*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14046:2014 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Symbols and abbreviated terms

4.1 Symbols

α	characterization factor
C	concentration
E	emission
F	footprint
R	rainfall
V	volume

4.2 Abbreviated terms

1,4-DB	1,4-Dichlorobenzene
2,4-D	2,4-Dichlorophenoxyacetic acid
APSIM	Agricultural Production Systems sIMulator
BOD	Biological Oxygen Demand (BOD5 means “measured during 5 days”)
CF	Characterization Factor
COD	Chemical Oxygen Demand
CTU	Comparative Toxic Unit
	NOTE 1 “CTU_e” for ecosystems; “CTU_h” for humans; “CTU_c” for cancer; “CTU_{n-c}” for non-cancer.
CWU	Consumptive Water Use
CWV	Critical Water Volume
DALY	Disability Adjusted Life Years
DWU	Degradative Water Use
DWCM-AgWU	Distributed Water Circulation Model Incorporating Agricultural Water Use
ET	Evapotranspiration
FU	Functional Unit
H_2O-eq	Water “equivalent”
	NOTE 2 Typical unit to express the impact score associated with water scarcity. Sometimes the term H_2O-eq is written H_2O eq, or H_2Oe.
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
OEF	Organization Environmental Footprint
PEF	Product Environmental Footprint
PDF	Potentially Disappeared Fraction of species
PAF	Potentially Affected Fraction of species
RU	Reporting Unit
TOC	Total Organic Carbon
WSI	Water Scarcity Index

NOTE 3 Sometimes the term water stress index (also abbreviated as WSI) is used in the literature for what is termed a water scarcity index in this document.

WSF Water Scarcity Footprint

WULCA Water Use in LCA

5 Selection of the type of water footprint assessment

5.1 General

The water footprint assessment conducted according to ISO 14046 can be:

— a stand-alone assessment where only impacts related to water are assessed;

— a part of a life cycle assessment (LCA) where consideration is given to a comprehensive set of environmental impacts, which are not only impacts related to water.

Table 1 lists the illustrative examples in this document and the different topics that are highlighted in each example.

Table 1 — Types of water footprint assessment shown in the examples

Example	Product/ process or organization focus	Topic highlighted [a]	Case study used in the example	Type of footprint [a]	System boundary	Impact assessment method [a]
A	Product/ Process	Water footprint inventory	Power plant	n/a (Water footprint inventory only)	Gate-to-gate	n/a (inventory only)
B	Product/ Process	Water footprint inventory using a baseline	Rice cultivation	n/a (Water footprint inventory only)	Gate-to-gate	n/a (inventory only)
C	Product/ Process	Option comparison using scarcity	Municipal water management	Water scarcity footprint	Gate-to-gate	Boulay et al. (2016) (WU LCA)[5]
D	Product/ Process	Application of water scarcity footprint method	Rice	Water scarcity footprint	Gate-to-gate	Ridoutt and Pfister (2010) [6]
E	Product/ Process	Influence of impact assessment method chosen for scarcity	Textile	Water scarcity footprint	Cradle-to-grave	Boulay et al. (2016) (WULCA) [5]; Pfister et al. (2009)[7]; Frischknecht et al. (2008) [8]; EU (2013) (PEF/OEF)[9]; Boulay et al. (2011a)[10]; Hoekstra et al. (2012) (Water Footprint Network - WFN) [11]; Berger et al. (2014)[12]

[a] All examples explicitly or implicitly contain a water footprint inventory.

Table 1 *(continued)*

Example	Product/ process or organization focus	Topic highlighted [a]	Case study used in the example	Type of footprint [a]	System boundary	Impact assessment method [a]
F	Product/ Process	Seasonality	Reservoir operation	Water scarcity footprint	Gate-to-gate	Pfister and Bayer (2014) [13]
G	Product/ Process	Scarcity vs availability	Packaging production	Water scarcity footprint; water availability footprint	Gate-to-gate	Boulay et al. (2011a)[10]
H	Product/ Process	Influence of water sources	Wheat cultivation	Water scarcity footprint	Gate-to-gate	Yano et al. (2015)[14]
I	Product/ Process	Influence of forest management / land use change	Beer production	Water scarcity footprint	Gate-to-gate	Yano et al. (2015)[14]
J	Product/ Process	Number of indicators per type of impact	Maize	Water eutrophication footprint	Cradle-to-gate	EU (2013) (PEF/OEF)[9]; Jolliet et al. (2003) (IMPACT 2002+) [15]
K	Product/ Process	Comprehensive water footprint	Packaging product	Water footprint (comprehensive profile)	Cradle-to-gate	Bulle et al. (2016) (IMPACT World+)[16]; Rosenbaum et al. (2008) (USEtox)[17]; Guinée et al. 2001[19]; EU (2013) (PEF/OEF) [9]; Verones et al. (2011) [19]; Boulay et al. (2016) (WULCA)[5]; Boulay et al. (2011a)[9]; Hannafiah et al. (2011)[20]
L	Product/ Process	Applying weighting to obtain a single value	Cereal cultivation	Non-comprehensive weighted water footprint	Gate-to-gate	Goedkoop et al. (2009) (ReCiPe)[21]; Ridoutt and Pfister (2010) [6]; Ridoutt and Pfister (2013)[22]

[a] All examples explicitly or implicitly contain a water footprint inventory.

Table 1 *(continued)*

Example	Product/ process or organization focus	Topic highlighted [a]	Case study used in the example	Type of footprint [a]	System boundary	Impact assessment method [a]
M	Product/ Process	Water footprint as part of an LCA	Packaging product	Water footprint as part of an LCA	Cradle-to-gate	Boulay et al. (2016) (WULCA)[5] (Water degradation footprint profile already present)
N	Product/ Process	Seasonality	Textile product	Non-comprehensive water footprint	Cradle-to-gate	Hoekstra et al. (2012); (Water Footprint Network - WFN)[11]
O	Product/ Process	Applying weighting to obtain to single value	Municipal water management	Non-comprehensive weighted water footprint	Cradle-to-grave	Pfister et al. (2009)[7]; Ridoutt and Pfister (2013)[22]; Goedkoop et al., (2009) (ReCiPe)[21]; Jolliet et al. (2003) (IMPACT 2002+)[15]; Rosenbaum et al. (2008) (USEtox)[17]
P	Organization	Applying water footprint to different sites	Chemical production	Non-comprehensive water footprint	Gate-to-gate	Berger et al. (2014)[12]; Saling et al. (2002)[23]
Q	Organization	Applying water footprint to supply chain of a company	Aluminium production	Water scarcity footprint	Cradle-to-gate	Pfister et al. (2009)[7]
R	Organization	Applying water footprint to a service company	Hotel operation	Non-comprehensive water footprint	Gate-to-gate	Boulay et al. (2016) (WULCA)[5] at the monthly approach; Goedkoop et al. (2009) (ReCiPe)[21]

[a] All examples explicitly or implicitly contain a water footprint inventory.

NOTE 1 Guidance about application of LCA to organizations is given in ISO/TS 14072. In addition, ISO 14046:2014, Annex A, provides guidelines for water footprint assessment of organizations.

NOTE 2 The principles of comprehensiveness for an LCA study and for a water footprint assessment are different (see ISO 14040:2006, 4.1.7, and ISO 14046:2014, 4.13).

NOTE 3 The term “partial” is sometimes used as a synonym for “non-comprehensive”. However, “partial” is avoided in this document as it is also used with a different meaning, such as in ISO/TS 14067.

5.2 Choice of the type of water footprint study

The different types of water footprint are defined in ISO 14046:2014, 5.4.5 to 5.4.7. The choice of a particular type of water footprint to be assessed in a stand-alone water footprint study is determined in the goal and scope definition phase.

In addition to the goal of the study (see ISO 14046:2014, 5.2.1) the choice of type of water footprint may be influenced by consideration of an appropriate system boundary, the type(s) of water resource used and affected water resources, the associated changes in water quantity and quality and determination of relevant impact assessment categories and methodologies.

Figure 1 illustrates a procedure for choosing the type of water footprint for a stand-alone water footprint study.

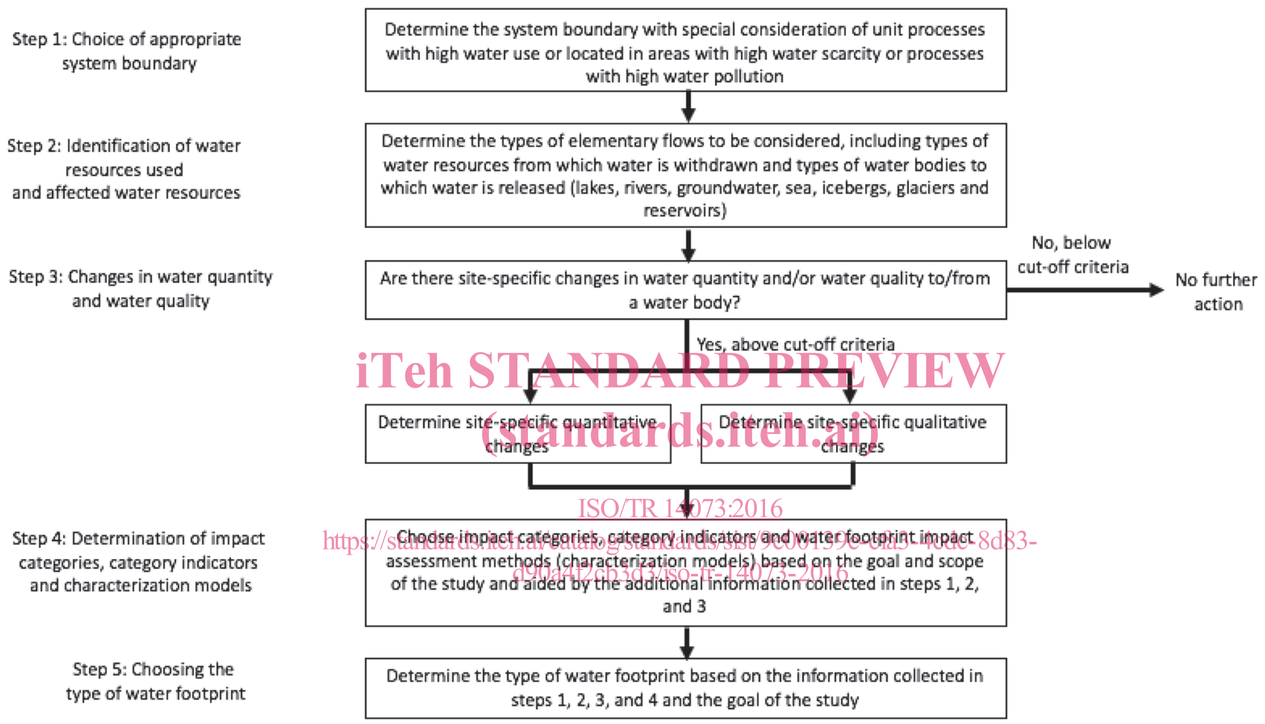

Figure 1 — Procedure for choosing the type of a water footprint assessment for a stand-alone water footprint study

The procedure for choosing an appropriate system boundary in a water footprint study as defined in ISO 14046:2014, 3.3.8, can be supported by collation of additional information such as:

— developing a map showing the geographical location of each unit process;

— identification of the unit processes that are located in areas of critical water availability (taking into account relevant seasonal and temporal variability);

— identification of the unit processes with air, water and soil emissions that can potentially affect ecologically vulnerable water bodies.

All water inputs and outputs relevant to the system (see examples in Figure 2) are considered for relevant changes in water quantity (volume) and water quality parameters and/or characteristics, including emissions to air, water and soil that affect water quality. Estimates may be based on readily available data or models.

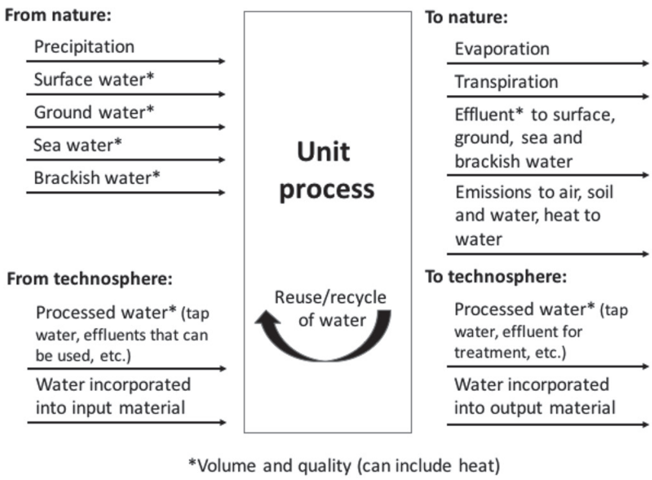

Figure 2 — Examples of water inputs (left) and outputs (right) for a unit process under study

In addition to the goal of the water footprint study, the information collected in order to define the system boundary, the type(s) of water resource used and affected water resources, and the associated (quantitative and/or qualitative) changes in water, can assist in determining the appropriate impact categories, category indicators and the characterization models to be considered for the water footprint study – and therefore choice of a type of water footprint. Based on the information collected, it is possible to:

— estimate the degree of likely significance (i.e. potential contribution to the water footprint) of each unit process for the study, and therefore which unit processes should become the focus for more detailed data collection;

— specify the data requirements (e.g. primary data, secondary data, estimated data) based on the likely significance of each unit process for the water footprint;

— define the initial cut-off criteria for the study (which are revisited throughout the study following ISO 14046:2014, 4.5).

Based on this information and general information related to the goal of the study (see ISO 14046:2014, 5.2.1) the type of water footprint that will be a result of the water footprint study can be chosen.

6 Presentation of the examples

6.1 Example A – Water footprint inventory of two power plants

6.1.1 Goal and scope

This example illustrates the compilation of water flows and emissions affecting water of a unit process.

A utility wanting to evaluate which of two planned options has the lowest direct water footprint starts by creating the direct water footprint inventory of both options, from a gate-to-gate perspective. This direct water footprint inventory can then be used in combination with water footprint impact assessment methods, considering water scarcity footprint and/or water degradation footprint, to evaluate the direct water footprint of both options.

NOTE The term “direct” is used as “what happens on the site” (see ISO 14046:2014, 3.5.14) (gate-to-gate, excluding any inputs such as infrastructure production, maintenance and outputs such as electricity). The term “indirect” is used for background processes (see ISO 14046:2014, 3.5.15).