

CHALMERS



Specification of data conversion from EcoSpold to ISO/TS 14048, SPINE and IA98

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1 Introduction

The purpose of this report is provide a detailed specification how life cycle inventory datasets from the ecoinvent database stored in the EcoSpold data format are converted into data in ISO/TS 14048 and SPINE formats, and how impact assessment datasets are converted into IA98 format, which is compatible with ISO/TS 14048 and SPINE. The conversion of data in the opposite direction, from ISO/TS 14048, SPINE or IA98 to EcoSpold, is not included within the scope of this report. The specification of data conversion is intended to be used both as a specification of the functionality of a data conversion tool as well as a practical guide and as a reference when using translated data sets for environmental assessments.

The aim in the conversion has been to represent the information from the ecoinvent data sets in ISO/TS 14048, SPINE and IA98 in the best possible way, avoiding any loss of information, and avoiding modifications of the original information in an as high extent as possible. This has for example resulted in that the original ecoinvent nomenclatures are preserved, also in cases when a translation to a corresponding nomenclature in the target formats is possible.

The ecoinvent database is developed by the Swiss Centre for Life Cycle Inventories. The database contains more than 2700 data sets for products, services and processes used in LCA case studies. The data exchange format used to communicate the ecoinvent data is the EcoSpold format.

The report has been developed within the CPM-project “Translating the ecoinvent database into SPINE and ISO/TS 14048 format”. This project was initiated after CPM was asked to be reseller of the Swiss ecoinvent database. It was decided to translate the ecoinvent database into SPINE and ISO/TS 14048 formats, in order to make more data available within CPM and to promote the ISO/TS 14048 format.

2 Description of performed work

The specification of data conversion from EcoSpold to ISO/TS 14048, SPINE and IA98 in this report has been created by experts on environmental informatics with deep knowledge in the specifications and usage of these formats. The required knowledge on the specification and usage of the EcoSpold data format has been acquired by publicly available information material, specifications and reports, and studies of how the data format is used in the ecoinvent data sets. A dialogue with Rolf Frischknecht¹ has been essential, in those cases when no clear and unambiguous definition of fields of the EcoSpold data format could be found. The discussions with Rolf Frischknecht have also been vital when making choices in the data conversion, and choosing an option from several more or less equal alternative translations, to ensure appropriate representation of the data.

The work with conversion of *life cycle inventory datasets* included matching of each field of the EcoSpold data format to a corresponding field of the ISO/TS 14048 data documentation format. In the work, a comparison between the two formats was also made.

The data conversion from EcoSpold and SPINE has been made by using the results from a previously performed data conversion between ISO/TS 14048 and SPINE [1]. Some adaptations have been made of this conversion, to e.g. keep resolution of information where possible. No direct comparisons of the EcoSpold and SPINE data formats have however been made. A description of how an ecoinvent data set appears in SPINE is provided in [2].

The work with conversion of *impact assessment datasets* included matching of each field of the EcoSpold data format to a matching field in the IA98 data documentation format. The data conversion specification into IA98 was developed in cooperation with Raul Carlson at IMI, who is one of the developers the IA98 format.

3 Conversion of life cycle inventory datasets

This section describes how life cycle inventory (LCI) datasets from the ecoinvent database is converted into the ISO/TS 14048 and SPINE data documentation formats. LCI datasets in ecoinvent are referred to as Unit processes, Multioutput processes or cumulative LCI results (System terminated)

3.1 Overview of the EcoSpold and the ISO/TS 14048 formats

3.1.1 The EcoSpold data format

All data sets in the ecoinvent database are communicated using the EcoSpold data format. This data format is also used in other contexts for communicating environmental data, e.g. in the environmental assessment tools SimaPro and GaBi. The scope of this report is only the ecoinvent usage of the EcoSpold format. It is however likely that the specification provided in this report will be appropriate for translation of EcoSpold data that has been created in other contexts as well.

The EcoSpold data format consists of two parts; Meta information and Flow data (see figure 1 below). The general content and structure of the two parts is outlined in Table 1.

¹ Rolf Frischknecht is the manager for the ecoinvent Centre. He has deep knowledge on the ecoinvent database and the EcoSpold data format.

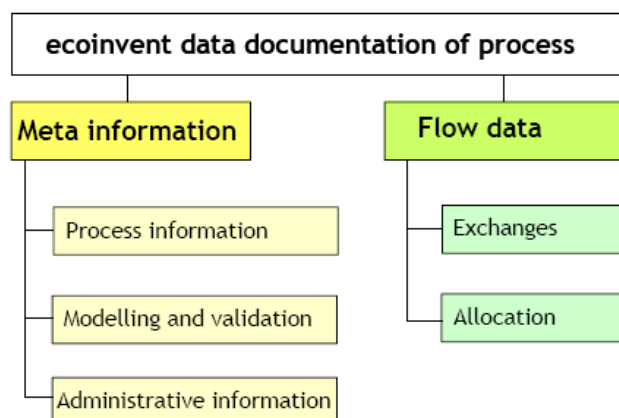


Figure 1. Overview of the structure of the EcoSpold format (from Frischknecht et al [3])

Table 1. The general structure of the EcoSpold format (from Frischknecht et al [3])

Meta information	
<i>Process</i>	
ReferenceFunction	defines the product or service output to which all emissions and re-quirements are referred
TimePeriod	defines the temporal validity of the data set
Geography	defines the geographical validity of the data set
Technology	describes the technology(ies) of the process
DatasetInformation	defines the kind of process or product system, and the version number of the data set
<i>Modelling and validation</i>	
Representativeness	defines the representativeness of the data used
Sources	lists the literature and publications used
Validations	lists the reviewers and their comments
<i>Administrative information</i>	
DataEntryBy	documents the person in charge of implementing the data set in the database
DataGenerator AndPublication	documents the originator and the published source of the data set
Persons	lists complete addresses of all persons mentioned in a data set
Flow data	
Exchanges	quantifies all flows from technical systems and nature to the process and from the process to nature and to other technical systems
Allocations	describes allocation procedures and quantifies allocation factors, required for multi-function processes

The EcoSpold format was originally created for communication of LCI data sets. The scope of the format has however been extended and it is used for all types of data sets in the ecoinvent database (see table 2 below). Consequently, the different fields in the format are interpreted differently depending on which type of data set that is documented.

There are two very central fields for the interpretation of which type of data set that is documented in the format: the fields *type* (201) and *impactAssessmentResult* (208) in *Data set Information*. These two fields together supply the key to what type of data set that is documented in the format, and consequently to how all other fields in the format should be interpreted; as LCI data, as IA results, as elementary flows, or as impact categories, see table 2 below.

The ISO/TS 14048 and SPINE data formats are only intended for LCI data. The data conversion specification for ISO/TS 14048 and SPINE is consequently only valid for EcoSpold data sets containing LCI data, which implies that the type of the data sets is either Unit process, System terminated, or Multioutput process. The conversion of EcoSpold datasets of type impact category are described in section “Conversion of impact category datasets” of this report. EcoSpold data sets of the type IA result and elementary flows are excluded from the scope of the data conversion specification in this report.

Table 2. Overview of the different data set types which are communicated with the EcoSpold format, with information on how the type of data set is identified (from EcoSpold specification)

Data set type	Values of the EcoSpold fields that identifies the type of data set		Data set type included in the scope of this data conversion specification between EcoSpold and ISO/TS 14048 and SPINE
	Type (spoldId = 201)	impactAssessmentResult (spoldId = 208)	
Unit process	1	False	Yes
System terminated (Cumulative LCI results)	2	False	Yes
IA result (Unit process or Cumulative LCI results with applied impact assessment data)	1 or 2	True	No
Elementary flow	3	<i>Not applicable</i>	No
Impact category	4	<i>Not applicable</i>	No. These datasets are converted to IA98 format. See section “Conversion of impact category datasets”
Multioutput process	5	False	Yes

3.1.2 The ISO/TS 14048 data documentation format

The technical specification ISO/TS 14048, specifies and describes a data documentation format [4]. The format is part of the ISO 14040 series of standards describing life cycle assessment and is aimed to support transparent documentation, interpretation, review and reuse of LCA data and LCA results.

A model of a technical system is in ISO/TS 14048 referred to as *Process*. The data documentation format for description of a process consists of three parts (see figure 2):

- *Process*, which contains the description of properties of the modelled process with regard to technology, time-related and geographical coverage etc. The Process part also includes inputs and outputs to the modelled process.
- *Modelling and validation*, which contains the description of prerequisites for the modelling and the validation of the process e.g. modelling choices describing which processes and flows that have been excluded.
- *Administrative information*, which contains general and administrative information related to the administration of the documentation of the process e.g. data commissioner, date completed, copyright etc.

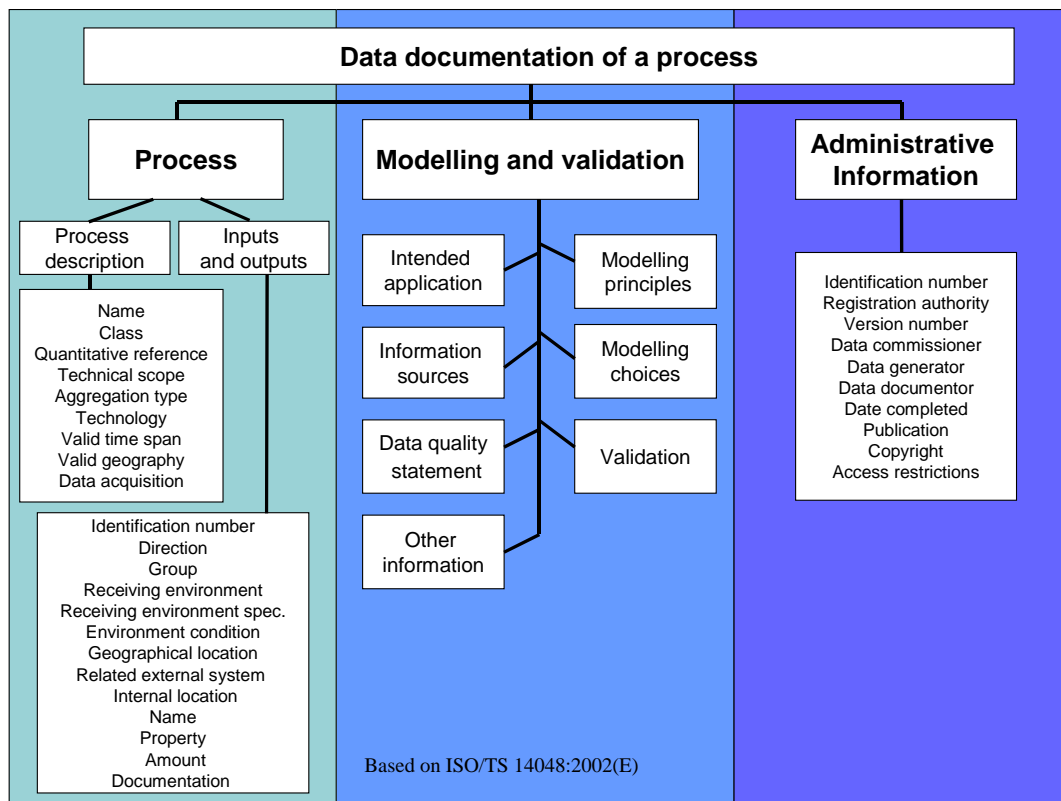


Figure 2: Illustration of structure of the major part in the ISO/TS 14048 data documentation format (from Flemström, Pålsson [5])

More information on how to interpret and practically work with the ISO/TS 14048 data documentation format can be found in [5] and [6].

3.2 Comparison of the EcoSpold and ISO/TS 14048 data formats

3.2.1 Differences on conceptual level

The EcoSpold and the ISO/TS 14048 are both formats used for communication of LCI-data. EcoSpold was created as a *data exchange format* for LCI-data, but it is also used for communication of other types of data sets, such as elementary flows or impact assessment data. ISO/TS 14048 is a *data documentation format* which is intended to facilitate many different aspects of LCA data work. The format supports transparent reporting, interpretation and review of data collection, data calculation, data quality and data reporting, as well as facilitates data exchange.

The EcoSpold data format is focused on the analytical parts, which means that structures and nomenclatures facilitating calculations on the communicated data sets are central in the data format. In ISO/TS 14048, the description of the system is much more central. For this reason, there are more fields representing the description and modelling of the system in ISO/TS 14048 compared to in EcoSpold.

The EcoSpold format makes use of ISO/TS 14048 terminology in terms of the concepts: Process, Modelling and validation and Administrative information (see figure 1). However the meaning of these concepts in the EcoSpold format is slightly different. For example the process information part of EcoSpold is a mixture of product and process information, as well

as modelling and validation information, whereas the process information part of ISO/TS 14048 is only intended as a description of the process.

Differences in documentation

The larger part of the documentation of data sets in theecoinvent database is stored in reports outside of the database, and is hence not communicated using the EcoSpold communication format. In ISO/TS 14048 all documentation on data sets is intended to be included in the format, i.e. data and all relevant documentation to assess the quality and applicability of the data can be included in the documentation of a dataset in the ISO/TS 14048 format.

Documentation of a model of a technical system that consists of a combination of models of technical systems

The ISO/TS 14048 allows transparent documentation of models of technical systems that consists of a combination of models of technical systems. In such documentation the included models are documented individually, together with a documentation of the composite system. The documentation of the included models is referenced in the documentation of the composite system. EcoSpold does not support such documentation of composite systems and included processes. A qualitative text description of the included processes which are combined to form the current process can be provided in the field *Meta information – Process information – includedProcesses*.

3.2.2 Differences in definition of fields

The conceptual differences discussed above result in differences in the definition of fields in the different formats. Even though a field may have the same name in EcoSpold and ISO/TS 14048, there are several examples of the case when the definitions of the fields are different. When creating a specification for a data conversion from EcoSpold to ISO/TS 14048 the definitions as well as typical content of the fields in the both formats need to be studied carefully.

3.2.3 Differences in resolution

EcoSpold and ISO/TS 14048 are using a different number of fields to represent the same type of data or information. A concept which is represented with many fields in a format has a high resolution in that format, and a concept which is represented with few fields has consequently a low resolution in that format. It is generally not any problem to translate data from a format with a high resolution to a format with a lower resolution. The opposite scenario is though problematic if the inner structure of the more general fields in the format with low resolution is not known.

As mentioned above, the EcoSpold data format has a high resolution in the analytical parts of the data set and a lower resolution in the descriptive parts, compared to ISO/TS 14048. In the translation from EcoSpold to ISO/TS 14048 there are some difficulties with the descriptive information. An example of this is the EcoSpold field *generalComment* in *Process information*, which according to the definition of the field corresponds to four different fields (Intended application, Information sources, Data selection principles, Modeling choices) in the Modeling and validation part of ISO/TS 14048. In the actual data sets in theecoinvent database, this field may also include information about allocations that have been performed and further information about the process that is described.

EcoSpold has furthermore a high resolution for information on references to persons and data sources. Data on a person is stored in seven fields (*name, address, telephone, telefax, email,*

companyCode, *countryCode*) in EcoSpold and internal identification numbers are used to refer to persons from three different fields (*Modelling and validation – Validation – proofReadingValidator*, *Administrative information – Data entry by – person*, and *Administrative information – Data generator and publication – person*). ISO/TS 14048 does not support this kind of internal register of persons, and instead store information on persons in the field it is used.

3.2.4 Differences in handling of amounts

The EcoSpold format supports communication of amounts of four different uncertainty types. The uncertainty types are specified by a nomenclature. Lognormal distribution is default, and normal, triangular or uniform distribution may be chosen if appropriate. The format contains a set of fields for storage of the parameters for these uncertainty types (*meanValue*, *uncertaintyType*, *standardDeviation95*, *minValue*, *maxValue*, *mostLikelyValue*), which are used for the different types of amounts as described in table 3 below.

Table 3. Overview of the different uncertainty types in EcoSpold

Uncertainty type	EcoSpold fields used for the current uncertainty type				
	meanValue	standard Deviation95	minValue	maxValue	mostLikely Value
lognormal	X	X			
normal	X	X			
triangular	X		X	X	(X) ²
uniform			X	X	

In the ISO/TS 14048 any types of uncertainty types and amounts may be specified and communicated. In ISO/TS 14048 the values are documented by the following data fields:

ISO/TS 14048 Process – Inputs and outputs - Amount

- *Name*: the name of the distribution function
- *Parameter*
 - *Name*: the name of the parameter
 - *Value*: the value of the parameter

3.2.5 Differences in constraints in field content or nomenclatures in the formats

In addition to differences described above, there are also differences in constraints in field content in the formats. This may concern the maximum allowed number of characters of the text in a field, or specification of type of data. An example of a field in EcoSpold where the maximum allowed length of the text is longer compared to the corresponding field in ISO/TS 14048 is the EcoSpold field *Meta information – Process information – Technology – text*. This field should according to the definition and typical content of theecoinvent data sets best be corresponded by the field *Short technology description* of ISO/TS 14048, but the field *Technical content and functionality* was instead used as the EcoSpold data field does not fit in this ISO/TS 14048 data field. An example of differences in specification of data type is the EcoSpold field *version* and the corresponding field *Version number* in ISO/TS 14048. The EcoSpold field is allowed to contain a decimal number while the ISO/TS 14048 field according to the specification shall contain an integer.

² In case of triangular uncertainty distribution, the meanValue shall be calculated from the mostLikelyValue. The field mostLikelyValue shall not be used in the ecoinvent quality network.

Several fields of the two formats are also associated with nomenclatures, which are specifying the allowed content of the fields. These nomenclatures can either be exclusive or inclusive. Exclusive means that the nomenclature can not be extended with any new values, while inclusive implies that this is possible. The translation of data to a field which is associated with an exclusive nomenclature is only possible if the field of the source format is associated with a nomenclature where each value either already exists or can be translated to a value which exists in the nomenclature of the target field. An example of a field in ISO/TS 14048 which is associated with an exclusive nomenclature is *ISO/TS 14048 Process – Inputs and outputs – Receiving environment*.

3.2.6 Differences in usage of the formats

The typical usage of the data formats is also important to consider when making a data conversion specification. Theecoinvent network has developed guidelines for modeling and documenting processes, see [3] for more information on this issue. According to the guidelines, names of exchanges to or from technosphere are names of processes, waste management or transports. This is a different way of handling inputs and outputs and processes compared to ISO/TS 14048 and SPINE. In the ISO/TS 14048 and SPINE names of inputs from technosphere are described by the name of intermediate product, which can be delivered by different processes. Waste is typically described as an output of the process named by the type of the waste, which can be managed by different waste management processes. Similarly, transports are also modeled and documented as separate processes.

This data conversion specification does not make any modifications of the ecoinvent data sets regarding waste management or transport processes. It is however recommended that a tool for data conversion from EcoSpold to ISO/TS 14048 provides the users with the possibilities to translate in line with to the convention for handling inputs and outputs and processes in ISO/TS 14048 respectively SPINE, to facilitate interpretation and use of ecoinvent data sets for the users.

3.3 Overview of the data conversion specification from EcoSpold to ISO/TS 14048

3.3.1 Different cases of data conversion

As described in chapter 3.4 there are differences between the EcoSpold and the ISO/TS 14048 data formats which need to be bridged when specifying a data conversion between the formats. These differences include high level conceptual differences, differences in the definition of fields, differences in number of fields to represent the same information, differences in handling of amounts, and differences in constraints on field content in terms of different data types, exclusive nomenclatures, etc. To provide an overview of how this range of issues has been solved in the creation of this data conversion specification, a classification of different data conversion cases is provided below.

3.3.1.1 One field in EcoSpold to one field in ISO/TS 14048 (1:1)

In many cases the data conversion is very straight-forward. A field in EcoSpold has an exactly or closely matching field in ISO/TS 14048. This kind of matching, i.e. when the information of a field in EcoSpold is translated to a single field in ISO/TS 14048 which not contains any information from other EcoSpold fields, is in this report referred to as *1:1*.

An example of a closely matching is the name of a process in EcoSpold which is translated to a name of a process in ISO/TS 14048. The picture is however not as simple as it seems. There

are conceptual differences between the definition of process used in ISO/TS 14048 and in EcoSpold, the name of a process has hence a slightly different meaning in EcoSpold compared to ISO/TS 14048.

3.3.1.2 Several fields in EcoSpold to the same field in ISO/TS 14048 (n:1)

In some cases several fields in EcoSpold are translated to one field in ISO/TS 14048. This kind of matching is in this report referred to as *n:1* (any number of fields is matched with a single field). To make it transparent where the information originally was stored in the EcoSpold format, internal headings with the original EcoSpold field name have been added in these ISO/TS 14048 fields. The internal headers are both facilitating the interpretation of the data, as well as making it possible to keep the high resolution when translating the information to a format with higher resolution (e.g. on further translation to SPINE or a reverse translation of the data back to EcoSpold).

An example where EcoSpold has a higher resolution compared to ISO/TS 14048, and internal headers hence have been added, is information on persons as discussed in 3.4.3. A specification of the fields in ISO/TS 14048 that are assigned internal headers on conversion of data from EcoSpold is provided in Appendix A, where also the internal ordering of the headers is specified.

3.3.1.3 One field in EcoSpold corresponds to several fields in ISO/TS 14048 (1:n)

In some cases a field in EcoSpold contains information which is stored in several different fields in ISO/TS 14048. This kind of matching is in this report referred to as *1:n*. The information in the EcoSpold field can generally only be transferred to one of these fields in ISO/TS 14048, as no assumptions generally can be made on any specific structure within these fields. The decision on which field to choose has been based on an assessment of typical data in existing ecoinvent data sets, and discussions with Rolf Frischknecht at the ecoinvent Centre who is expert on the EcoSpold format and the ecoinvent data.

An example of this case is the EcoSpold field *generalComment* in *Process information*, which can contain different information as mentioned in 3.4.3. Based on an assessment of the most typical content of the field in ecoinvent, it was found that the field *ISO/TS 14048 Process – Process description – Technology – Technical content and functionality* best corresponded to the EcoSpold field.

The EcoSpold fields *inputGroup* and *outputGroup* are providing data to both *Direction* and *Group* in *Inputs and outputs* in ISO/TS 14048. Each exchange in an EcoSpold data set has either a value of the field *inputGroup* or *outputGroup*. If *inputGroup* is defined, the field *Direction* has the value “Input” and the field *Group* is assigned the value of the EcoSpold *inputGroup* field. If instead *outputGroup* is defined, the field *Direction* has the value “Output” and the field *Group* is assigned the value of the EcoSpold *outputGroup* field. The values of the nomenclatures for the *inputGroup* respectively *outputGroup* could be translated to the corresponding values used in the target format, to facilitate interpretation of the data to the users. A recommended translation when converting EcoSpold data to either ISO/TS 14048 or SPINE is provided in table 4 below.

Table 4. Overview of the values in the inputGroup and outputGroup nomenclatures together with a recommended translation when converting data to either ISO/TS 14048 or SPINE.

EcoSpold field	Possible EcoSpold values		Recommended translation
	Coded value	Decoded clear text value	
inputGroup	1	Materials/Fuels	Not used in theecoinvent quality network
	2	Electricity/Heat	Not used in theecoinvent quality network
	3	Services	Not used in theecoinvent quality network
	4	FromNature	Natural resource
	5	FromTechnosphere	Refined resource
outputGroup	0	ReferenceProduct	Co-product
	1	Include avoided product system	Not used in theecoinvent quality network
	2	Allocated by product	Product
	3	WasteToTreatment	Residue
	4	ToNature	Emission

3.3.2 Constraints affecting the data conversion

3.3.2.1 Constraints in field content in the formats

Another aspect to consider in these decisions is, as mentioned above, data types of the fields in the formats. An example is EcoSpold field *Process information – Data set information – Timestamp*, which includes both date and the exact time of when the data set last was changed. The corresponding field in ISO/TS 14048 (*ISO/TS 14048 Process – Process description – Valid time stamp – End date*) only allows a date and no specification of time. The time information was for that reason excluded from the data conversion.

Another example is the EcoSpold field *version*, which as mentioned in 3.4.4 allows storage of a decimal number, while the corresponding field *Version number* in ISO/TS 14048 has the data type integer. This obstacle has not been solved in this data conversion specification, as there is no appropriate alternative matching field available in ISO/TS 14048. To make it possible to convert data from EcoSpold to ISO/TS 14048 without loss of relevant information, the data type for the field *Version number* was for that reason changed to decimal number in the Chalmers implementation of ISO/TS 14048.

3.3.3 Handling of EcoSpold nomenclatures

3.3.3.1 Resolve nomenclature coding into text for fields with coding

Some of the fields of the EcoSpold format contain a nomenclature expressed as a code/number. Examples of such fields are: energyValues, type in Data set Information, copyright etc. To facilitate interpretation of the translated data sets these codes have in the data conversion been replaced by the corresponding text, e.g. for energyValues the value “2” has been replaced by the corresponding text value which is “Gross values”.

3.3.3.2 Translation of nomenclatures

The original ecoinvent nomenclatures have been preserved in the data conversion from EcoSpold to ISO/TS 14048 and SPINE to an as high extend as possible. The only exception is when ISO/TS 14048 has an exclusive nomenclature. In such cases a translation between

the nomenclatures used in ecoinvent and in ISO/TS 14048 has been made. The ISO/TS 14048 field *ISO/TS 14048 Process – Inputs and outputs – Receiving environment* is as discussed in 3.3.5 associated with an exclusive nomenclature with the allowed values "Air", "Water", "Ground", or "Technosphere". This affects the translation of data from EcoSpold to ISO/TS 14048 as described below:

For flows to or from technosphere (inputGroup = 5 or outputGroup = 0 or 2):

- *Receiving environment* = "Technosphere"
- *Receiving environment specification* = "Technosphere"
- Values from the EcoSpold fields *category* and *subcategory* are inserted into *Specification of name*

For emissions to nature: (outputGroup = 4)

- *Receiving environment* = Translated value from *category* (see table 5 below)
- *Receiving environment specification* = *subCategory*

For flows from nature: (inputGroup = 4)

- For flows with *category*="resource"
 - o *Receiving environment* = Translated value from *subCategory*
- For flows with a different value in *category* than "resource"
 - o *Receiving environment* = Translated value from *category*
- *Receiving environment specification* = *subCategory*

Table 5. The translation of values in the category and subcategory nomenclatures which are performed on data conversion from EcoSpold to ISO/TS 14048 or SPINE.

EcoSpold value	Translated value
air	Air
soil	Ground
water	Water
in air	Air
biotic	Ground
in ground	Ground
land	Ground
in water	Water

3.3.4 EcoSpold fields excluded from the data conversion

3.3.4.1 Exclusion of local names

EcoSpold includes fields for specific information translated into a local language (German): *localName*, *localCategory*, *localSubCategory*, *localLanguage*, *languageCode*, *localLanguageCode*

The ISO/TS 14048 format does not have any such separate handling of translations of parts of the information into a local language, and there is no appropriate way of transferring this information to ISO/TS 14048 that will make sense to the users. Also, most of the intended users of the data conversion are not German speaking. All "local" information has consequently been excluded in this data conversion specification. This decision has also been discussed and approved by Rolf Frischknecht, with the reservation that the possibility to convert the data back to EcoSpold is lost.

3.3.4.2 Exclusion of internal version number

EcoSpold includes two fields for the version of the data sets, which are used for identification of the data sets; `version` and `internalVersion`. The corresponding field for these two fields in ISO/TS 14048 (*Version number*) is intended for only one version number. Since the information in `internalVersion` is only intended for internal use within theecoinvent network, the EcoSpold field `internalVersion` (207) was excluded from the mapping.

3.4 Specification of data conversion from EcoSpold to ISO/TS 14048 and SPINE

The specification of data conversion from EcoSpold to ISO/TS 14048 and SPINE is presented in table 6.

Table 6

EcoSpold		ISO/TS 14048		General comment on translation (correlation of concepts, nomenclatures, etc.)	Type of matching	SPINE
SpoldId	Name	Ref. number	Data field ³			Data field (mapping from CPM report 2003:8)
	PROCESS INFORMATION					
	Dataset Information					
200	number	3.1	Administrative information.Identification number Add "Ecolnvent" in registration authority (field 3.3)	This field is not described in the documentation of the EcoSpold format.	1:1	Inventory.Notes (append)
201	type	1.1.4	Process.Process description.Technical scope	This field does together with the field impactAssessmentResult supply the key to what type of dataset that is documented in the format, and consequently to how all other fields in the format should be interpreted (as LCI- data, as IA results, as elementary flows, or as impact categories). Table 2 contains information on how the different types av data sets can be identified. Datasets containing Unit processes, LCI results, or Multioutput processes are included within the scope of this data conversion specification from EcoSpold to ISO/TS 14048. Datasets containing Impact category data is converted to the IA98 format. Datasets of other types are excluded from the data conversion specification.	1:1	ObjectOfStudy.Category

³ The data fields are identified according to the naming and structure of the specification ISO/TS 14048. Each data field has an exactly corresponding element or attribute in the XML specification [ISO14048 Schema v102.xsd](#), which is an XML implementation of ISO/TS 14048 created by IMI. The names of the data fields in the XML specification are achieved by substituting all space characters with underscore ('_') and all capital letters with small letters in the names provided for the data fields. The structure of the XML specification is entirely based on the structure provided in the ISO/TS 14048 specification.

202	version	3.3	Administrative information.Version number	OK. Distortion of data is possible as an EcoSpold field with the data type decimal number is matched with a field with integer data type in ISO/TS 14048. The data type for the field Version number was changed to decimal number in the Chalmers implementation of the ISO/TS 14048 data documentation format.	1:1	Inventory.Notes (append)
203	energyValues	2.3.3.2	Modelling constants.Value where Modelling constants.Name = "energyValue"	Replace numeric code with the corresponding clear text as defined in the EcoSpold documentation. Example: If the value is "2" replace it by the corresponding text value which is "Gross values".	1:1	ObjectOfStudy.Function (append)
204	timestamp	3.7	Administrative information.Date completed	This field in ISO/TS 14048 only allows a date (and no specification of time). EcoSpold timestamp also includes time. This information is however excluded from the data conversion.	1:1	Inventory.DateCompleted
205	languageCode		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
206	localLanguageCode		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
207	internalVersion		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
208	impactAssessmentResult			ISO/TS 14048 and SPINE are both intended to be used for LCI data, while EcoSpold also is intended to be used for other types of environmental data. ImpactAssessment results are out of the scope of this data conversion specification. <i>See comment on type (201).</i>		
	Reference function					
400	datasetRelatesToProduct	1.1.6.2	Process.Process description.Technology.Technical content and functionality	Always yes as the dataset types "elementary flows" and "impact categories" are out scope of this data conversion to ISO/TS 14048 (Impact category datasets will however be mapped to IA98).	n:1	ObjectOfStudy.Function (append)
401	name	1.1.1 and 1.1.3.2	Process.Process description.Name AND Process.Process description.Quantitative reference.Name where Quantitative reference.Type = "Reference flow".	The name does according to the ecoinvent naming rules also contain information on the process which possibly could be parsed. The naming rules are however not followed in all cases which makes parsing problematic. We choose hence not to parse this information.	1:n	ObjectOfStudy.Name AND Inventory.FUExplanation (append)

402	IncludedProcesses	1.1.6.2	Process.Process description.Technology.Technical content and functionality	The EcoSpold field contains a textbased description of the (sub-)processes which are combined to form one unit process. ISO/TS 14048 supports documentation of the individual included processes, together with a detailed specification of how they have been combined.	1:n	ObjectOfStudy.Function (append)
403	unit	1.1.3.3	Process.Process description.Quantitative reference.Unit where Quantitative reference.Type = "Reference flow".	OK	1:1	Inventory.FUExplanation (append)
404	amount	1.1.3.4	Process.Process description.Quantitative reference.Amount where Quantitative reference.Type = "Reference flow".	OK	1:1	Inventory.FUExplanation (append)
490	local name		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
	Reference flow					
491	synonyms	1.1.6.2	Process.Process description.Technology.Technical content and functionality	OK. Synonyms of the reference product.	n:1	ObjectOfStudy.Function (append)
492	generalComment	2.1	Process.Process description.Technology.Technical content and functionality	The content corresponds to many fields in ISO/TS 14048 regarding modelling and validation (Intended application, Information sources, Data selection principles, Modeling choices). The choice of appropriate field in ISO/TS 14048 should be based on the most typical content for the field in ecoinvent. In discussion with Rolf Frischknecht and after assessment of the typical content in the ecoinvent data sets Technical content and functionality was decided to be the most appropriate mapping.	1:n	ObjectOfStudy.Function (append)
493	infrastructureProcess	1.1.6.1	Process.Process description.Technology.Short technology description	Information on the type of the process. If infrastructureProcess contains the value "true" then insert "InfrastructureProcess = Yes" in the converted data set.	1:1	ObjectOfStudy.Function (append)
494	infrastructureIncluded	1.1.6.2	Process.Process description.Technology.Technical content and functionality	Information on the scope of the process	n:1	ObjectOfStudy.Function (append)

495	category	1.1.2.1	Process.Process description.Class.Name where Class.Reference to nomenclature = "EcolInvent category nomenclature"	OK	1:1	First instance to ObjectOfStudy.Sector if "Sector" is found in Reference to nomenclature, else append to Inventory.Notes as list AND Sector.Notes if "Sector" is found in Reference to nomenclature, else Inventory.Notes (append)
496	subCategory	1.1.2.1	Process.Process description.Class.Name where Class.Reference to nomenclature = "EcolInvent subcategory nomenclature"	OK	1:1	First instance to ObjectOfStudy.Sector if "Sector" is found in Reference to nomenclature, else append to Inventory.Notes as list AND Sector.Notes if "Sector" is found in Reference to nomenclature, else Inventory.Notes (append)
497	localCategory		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
498	localSubCategory		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
499	formula	1.1.6.2	Process.Process description.Technology.Technical content and functionality	Specification of the reference product.	n:1	ObjectOfStudy.Function (append)
501	statisticalClassification	1.1.2.1	Process.Process.description.Class.Name where Reference to nomenclature = "EU-classification system NACE"	OK	1:1	First instance to ObjectOfStudy.Sector if "Sector" is found in Reference to nomenclature, else append to Inventory.Notes as list AND Sector.Notes if "Sector" is found in Reference to nomenclature, else Inventory.Notes (append)
502	CASNumber	1.1.6.2	Process.Process description.Technology.Technical content and functionality	Specification of the reference product.	n:1	ObjectOfStudy.Function (append)
	Timeperiod					

601	startDate	1.1.7.1	Process.Process description.Valid time span.Start date	Start date may in EcoSpold also be entered as year (0000) or year-month (0000-00) only. 2000 and 2000-01 means according to the specification from 2000-01-01. Add month and day on translation to ISO/TS 14048 if any of them not is provided in the EcoSpold dataset.	1:1	Inventory.TimeBoundary (append)
602	endDate	1.1.7.2	Process.Process description.Valid time span.End date	End date may in EcoSpold also be entered as year (0000) or year-month (0000-00) only. 2000 and 2000-12 means according to the specification until 2000-12-31. Add month and day on translation to ISO/TS 14048 if any of them not is provided in the EcoSpold dataset.	1:1	Inventory.TimeBoundary (append)
603	dataValidForEntirePeriod	1.1.7.3	Process.Process description.Valid time span.Time span description	OK	n:1	Inventory.TimeBoundary (append)
611	text	1.1.7.3	Process.Process description.Valid time span.Time span description	OK	n:1	Inventory.TimeBoundary (append)
	Geography					
662	location	1.1.8.1	Process.Process description.Valid geography.Area name	Use externally defined nomenclature to resolve area codes. Example: The value "RER" is replaced by "Europe".	1:1	Inventory.GeographicalBoundary (list) (append)
663	text	1.1.8.2	Process.Process description.Valid geography.Area description	OK	1:1	Inventory.GeographicalBoundary (append)
	Technology					
692	text	1.1.6.1	Process.Process description.Technology.Technical content and functionality	Short technology description would probably be a better mapping for this content, but the EcoSpold data field does not fit in this 14048 data field and Technical content and functionality is hence selected.	1:n	ObjectOfStudy.Function (append)
	MODELLING AND VALIDATION					
	Representativeness					
726	extrapolations	2.3.2	Modelling and validation.Adaptation principles	OK	1:1	Inventory.Data (append)
722	percent	1.1.9.4.2	Process.Process description.Data aquisition.Sample volume.Relative	OK. Clarification of EcoSpold concept: The market share of the processes included in the dataset of the total market volume (for the specified geographical area)	1:1	General QMetaData.Method (append)

724	productionVolume	1.1.9.4.1	Process.Process description.Data acquisition.Sample volume.Absolute	OK. Clarification of EcoSpold concept: The total market volume, used for the calculation of the "percent" amount	1:1	General QMetaData.Method (append)
725	sampling procedure	1.1.9.1	Process.Process description.Data acquisition.sampling procedure	OK	1:1	General QMetaData.Method (append)
727	uncertaintyAdjustments	2.3.2	Modelling and validation.Adaptation principles	OK	1:1	Inventory.Data (append)
	Source					
801	number	1.2.14.4 or 3.8	Process.Inputs and outputs.Documentation.Reference to data source (for flows) resp Administrative information.Publication (for process level references) depending on where the reference is referred.	Resolve internal reference whenever used and add internal headers with the EcoSpold field names.	n:1	QMetaData.LiteratureRef (list) (for flows) resp Inventory.Publication (list) (append) (for process level references) depending in where the reference is referred
802	sourceType	-"	-"	OK	n:1	
1002	firstAuthor	-"	-"	OK	n:1	
1003	additionalAuthors	-"	-"	OK	n:1	
1004	year	-"	-"	OK	n:1	
1005	title	-"	-"	OK	n:1	
1006	pageNumbers	-"	-"	OK	n:1	
1007	nameOfEditors	-"	-"	OK	n:1	
1008	titleOfAnthology	-"	-"	OK	n:1	
1009	placeOfPublications	-"	-"	OK	n:1	
1010	publisher	-"	-"	OK	n:1	
1011	journal	-"	-"	OK	n:1	
1012	volumeNo	-"	-"	OK	n:1	
1013	issueNo	-"	-"	OK	n:1	
803	sourcesText	-"	-"	OK	n:1	
	Validation					
5615	proofReadingDetails	2.6.3	Modelling and validation.Validation.Result	OK	n:1	Inventory.Data (list) (append)
5616	proofReadingValidator	2.6.4	Modelling and validation.Validation.Validator	Resolve internal reference. Important to keep the high resolution for data conversion to SPINE.	1:1	Inventory.Data (list) (append)
5619	otherDetails	2.6.3	Modelling and validation.Validation.Result	OK	n:1	Inventory.Data (list) (append)

	ADMINISTRATIVE INFORMATION					
	Data entry by					
302	person	3.6	Administrative information.Data documentor	Resolve internal reference. Important to keep the high resolution for data conversion to SPINE.	n:1	Inventory.Publication (also publication) (append)
304	qualityNetwork	3.6	Administrative information.Data documentor	OK	n:1	Inventory.Publication (also publication) (append)
	Data generator and publication					
751	person	3.5	Administrative information.Data generator	Resolve internal reference. Important to keep the high resolution for data conversion to SPINE.	n:1	JuridicalPerson.MailAddress referred by Inventory.Practitioner
756	dataPublishedIn	3.8	Administrative information.Publication	Resolve internal reference and add referred EcoSpold fields with internal headers.	n:1	Inventory.Publication (also data_documentor) (append)
757	referenceToPublishedSource	3.8	Administrative information.Publication	Resolve internal reference and add referred EcoSpold fields with internal headers.	n:1	Inventory.Publication (also data_documentor) (append)
758	copyright	3.9	Administrative information.Copyright	Translate numeric code to the corresponding clear text as defined in the EcoSpold documentation.	1:1	Inventory.Copyright
759	accessRestrictedTo	3.10	Administrative information.Access restrictions	Translate numeric code to the corresponding clear text as defined in the EcoSpold documentation.	n:1	Inventory.Availability
760	companyCode	3.10	Administrative information.Access restrictions	OK	n:1	Inventory.Availability
761	countryCode	3.10	Administrative information.Access restrictions	Use externally defined nomenclature to resolve area codes	n:1	Inventory.Availability
762	pageNumbers	3.8	Administrative information.Publication	OK	n:1	Inventory.Publication (also data_documentor) (append)
	Person					
5800	number	2.6.4, 3.6, or 3.5	Modelling and validation.Validation.Validator, Administrative information.Data documentor, or Administrative information.Data generator, depending on where the juridical person reference is referred.	Resolve internal reference whenever used and add internal headers with the EcoSpold field names. Important to keep the high resolution for data conversion to SPINE.		
5802	name	-"	-"			JuridicalPerson.Name
5803	address	-"	-"			JuridicalPerson.MailAddress
5804	telephone	-"	-"			JuridicalPerson.Telephone

5805	telefax	-"	-"			JuridicalPerson.Fax
5806	email	-"	-"			JuridicalPerson.EmailAddress
5807	companyCode	-"	-"			JuridicalPerson.Notes
5808	countryCode	-"	-"			JuridicalPerson.Notes
	FLOW DATA					
	Exchange					
3793	indexNumber	1.2.1	Process.Inputs and outputs.Identification number	OK		Flow.FlowNumber
3503	inputGroup	1.2.2 and 1.2.3	Process.Inputs and outputs.Direction and Process.Inputs and outputs.Group	For each exchange in an ecoinvent datasets either inputGroup or outputGroup is provided. A recommended translation of the possible inputGroup values when converting data to ISO/TS 14048 or SPINE is provided below. This recommended configuration should be possible for the users to change when translating a data set. If input = FromNature then direction = input and group = natural resource if input = FromTechnosphere then direction = input and group = refined resource <i>See comment on the next field for converting "flows of waste management" from inputs into outputs.</i>	1:1	Flow.SubType AND Flow.Category - add post to FlowType.Category nomenclature if not present

3504	outputGroup	1.2.2 and 1.2.4	Process.Inputs and outputs.Direction and Process.Inputs and outputs.Group	<p>For each exchange in an ecoinvent datasets either inputGroup or outputGroup is provided. A recommended translation of the possible outputGroup values when converting data to ISO/TS 14048 or SPINE is provided below. This recommended configuration should be possible for the users to change when translating a data set.</p> <p>If output = ReferenceProduct then direction = output and group = product If output = Allocated by product then direction = output and group = co-product if output = ToNature then direction = output and group = emission</p> <p>Waste management and transports are in ecoinvent modelled as inputs to processes. According to ISO/TS 14048 only physical flows are documented as inputs and outputs. These kinds of information are documented in separate processes. It should be possible for the users to configure if they want to change the direction of waste management flows when translating the data. Waste management flows are identified as flows with category = "waste management" where the name of the flow starts with either "disposal" or "treatment". Also flows with category = "nuclear power" and subcategory = "waste treatment" are identified as waste management flows.</p>	1:1	Flow.SubType AND Flow.Category - add post to FlowType.Category nomenclature if not present
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3506	category	1.2.3	Process.Inputs and outputs.Receiving environment (or Documentation.Data treatment where the documentation is referred to from the flow)	The field receiving environment in ISO/TS 14048 is associated with an exclusive nomenclature with the allowed values "Air", "Water", "Ground", or "Technosphere". If the corresponding EcoSpold field contains different values, these need to be translated on data conversion. if category = "Resource" then Translate nomenclature found in subcategory to the corresponding values for receiving environment in ISO/TS 14048. if category = "Soil" then Receiving environment = "Ground" For flows to or from technosphere: Receiving environment = "Technosphere", category and subcategory is inserted into Specification of name.	n:1	Flow.ImpactMedia if Receiving environment specification is empty (or QMetaData.Method referred by Flow.MetaId)
3507	subCategory	1.2.4 1.2.3	Process.Inputs and outputs.Receiving environment specification (or Documentation.Data treatment where the documentation is referred to from the flow)	Can be mapped to receiving environment specification for the elementary flows. For flows to or from technosphere: Receiving environment specification = "Technosphere", category and subcategory is inserted into Specification of name. For inputs from nature subcategory is mapped (and translated) to receiving environment.	n:1	Flow.ImpactMedia Add post to Environment if not present in nomenclature (or QMetaData.Method referred by Flow.MetaId)
3509	localCategory		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
3510	localSubCategory		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
3701	CASNumber	1.2.10.3	Process.Inputs and outputs.Name.Specification of name	OK	n:1	Substance.Notes referred by Flow.Substanceld
3702	name	1.2.10.1	Process.Inputs and outputs.Name.Name text where Name.Reference to nomenclature = "EcoInvent nomenclature"	The users of ISO/TS 14048 and SPINE will have problems with the ecoinvent substance nomenclature. It should be possible for the users to configure how the ecoinvent substance names shall be translated to substance names which are known in the target system on translation of data sets.	1:1	Substance.DefaultName referred by Flow.Substanceld Add post to Substance if not present in nomenclature
3703	location	1.2.7	Process.Inputs and outputs.Geographical location	Location refer to the process information.Geography.Location for the process that supply the intermediate product flow. Use externally defined nomenclature to resolve area codes.	1:1	Geography.AreaName referred by Flow.ImpactRegion Add post to Geography if not present in nomenclature

3706	unit	1.2.12.2.1	Process.Inputs and outputs.Amount.Unit.Symbol or name	OK	1:1	Flow.Unit Add post to Unit nomenclature if not present
3707	meanValue	1.2.12.3.2	Process.Inputs and outputs.Amount.Parameter.Value where Parameter.Name = "meanValue"	Maps to field 1.2.12.3.2, "Value" with field 1.2.12.3.1, "Name", set to "meanValue" and field 1.2.12.1, "Name", set to either "Normal" or "LogNormal". Use EcoInvent nomenclature for naming of distribution functions. The nomenclatures are however translated on data conversion to SPINE.	1:1	Flow.Quantity or Flow.QuantityMin or Flow.QuantityMax or Flow.StandardDev respectively if one or more of the corresponding parameters can be identified by the importer in the ISO/TS 14048 data set
3708	uncertainty Type	1.2.12.1	Process.Inputs and outputs.Amount.Name	Replace numeric code with the corresponding text as defined EcoSpold documentation.. ISO/TS 14048 nomenclature for amounts is not exclusive. Use EcoInvent nomenclature for naming of distribution functions. The nomenclatures are however translated on data conversion to SPINE.	1:1	N/A
3709	standardDeviation95	1.2.12.3.2	Process.Inputs and outputs.Amount.Parameter.Value where Parameter.Name = "StandardDeviation95"	Maps to field 1.2.12.3.2, "Value" with field 1.2.12.3.1, "Name", set to "standardDeviation95" and field 1.2.12.1, "Name", set to either "Normal" or "LogNormal".	1:1	Flow.Quantity or Flow.QuantityMin or Flow.QuantityMax or Flow.StandardDev respectively if one or more of the corresponding parameters can be identified by the importer in the ISO/TS 14048 data set
3711	formula	1.2.10.3	Process.Inputs and outputs.Name.Specification of name	OK	n:1	Substance.Notes referred by Flow.SubstanceId
3715	referenceToSource	1.2.14.4	Process.Inputs and outputs.Documentation.Reference to data source	Resolve internal reference and add referred EcoSpold fields with internal headers.	n:1	QMetaData.LiteratureRef (list)
3716	pageNumbers	1.2.14.4	Process.Inputs and outputs.Documentation.Reference to data source	OK	n:1	QMetaData.LiteratureRef (list)
3792	generalComment	1.2.14.3	Process.Inputs and outputs.Documentation.Data treatment	OK	1:1	QMetaData.Method
3794	localName		<i>Excluded</i>	<i>Excluded from data conversion to ISO/TS 14048 (and SPINE)</i>		
3508	infrastructureProcess	1.2.8.1	Process.Inputs and outputs.Related external system.Origin or destination	OK		Specific QMetaData.Notes

3795	minValue	1.2.12.3.2	Process.Inputs and outputs.Amount.Parameter.Value where field 1.2.12.1 Parameter.Name = "minValue"	Maps to field 1.2.12.3.2, "Value" with field 1.2.12.3.1, "Name", set to "minValue" and field 1.2.12.1, "Name", set to either "Uniform distribution" or "Triangular distribution".		Flow.Quantity or Flow.QuantityMin or Flow.QuantityMax or Flow.StandardDev respectively if one or more of the corresponding parameters can be identified by the importer in the ISO/TS 14048 data set
3796	maxValue	1.2.12.3.2	Process.Inputs and outputs.Amount.Parameter.Value where field 1.2.12.1 Parameter.Name = "maxValue"	Maps to field 1.2.12.3.2, "Value" with field 1.2.12.3.1, "Name", set to "maxValue" and field 1.2.12.1, "Name", set to either "Uniform distribution" or "Triangular distribution".		Flow.Quantity or Flow.QuantityMin or Flow.QuantityMax or Flow.StandardDev respectively if one or more of the corresponding parameters can be identified by the importer in the ISO/TS 14048 data set
3797	mostLikelyValue	1.2.12.3.2	Process.Inputs and outputs.Amount.Parameter.Value where field 1.2.12.1 Parameter.Name = "mostLikelyValue"	Maps to field 1.2.12.3.2, "Value" with field 1.2.12.3.1, "Name", set to "mostLikelyValue" and field 1.2.12.1, "Name", set to "Triangular distribution". The field mostLikelyValue shall however not be used in theecoinvent quality network.		Flow.Quantity or Flow.QuantityMin or Flow.QuantityMax or Flow.StandardDev respectively if one or more of the corresponding parameters can be identified by the importer in the ISO/TS 14048 data set
	Allocation					
2401	referenceToCoProduct	2.4.4.2	Modelling and validation.Modelling choices.Allocations.Allocation explanation	Allocations are only specified for multi-output processes. Allocated unit processes are automatically created from an allocated multi-output process when it is inserted into the EcoInvent database. Allocation is defined individually for each exchange.	n:1	Inventory.Allocations (append)
2403	allocationMethod	2.4.4.2	Modelling and validation.Modelling choices.Allocations.Allocation explanation		n:1	Inventory.Allocations (append)
2404	fraction		Modelling and validation.Modelling choices.Allocations.Allocation explanation		n:1	Inventory.Allocations (append)
2407	explanations		Modelling and validation.Modelling choices.Allocations.Allocation explanation		n:1	Inventory.Allocations (append)
2492	referenceToInputOutput		Modelling and validation.Modelling choices.Allocations.Allocation explanation		n:1	Inventory.Allocations (append)

4 Conversion of impact assessment datasets

The impact assessment data in ecoinvent in the EcoSpold format has been mapped to IA98, which is a data documentation format designed for impact assessment information compatible with both ISO/TS 14048 and SPINE. In the EcoSpold format, impact assessment data is named “Impact category” datasets, which corresponds to *Dataset information.type* = 4.

Issues regarding e.g. differences in definition of fields, resolution, constraints in field content or nomenclatures in the formats, have been handled in the data conversion to IA98. These issues are discussed in the previous section describing data conversion to ISO/TS 14048, and are not specifically discussed for IA98.

4.1 Overview of the IA98 format and the EcoSpold format for impact assessment data

4.1.1 The IA98 data documentation format

The IA98 format is a data documentation format for impact assessment data. The format structures documentation of impact assessment information according to the ISO 14042 standard. A full description of the structure is found in [7]. The structuring has been developed as an addition to the SPINE data documentation format, to include the capability to generally handle information about environmental impact assessment [8].

“The central concepts of life cycle impact assessment in ISO 14042 are:

- *Impact category and Category indicator*
Describes potential problem areas, where environmental impact may be observed.
- *Classification*
Assigns LCI results to impact categories or category indicators.
- *Characterisation*
Gives quantitative measure of the environmental impact on the impact categories or category indicators from the LCI results.
- *Weighting (optional)*
A quantitative measure of the relative importance between different impact categories or category indicators.

Having information and documentation about the four concepts, they can be combined in a structured manner into a consistent full *Impact assessment*. ” *Excerpt from [7]*.

The IA98 format also structures documentation for *specification of elementary flows, i.e. Aspects*. Impact assessment starts with the introduction of a disturbance that causes changes in the environment. The origin of the disturbance is generally specified as elementary flows, i.e. Aspects. The Aspects are used when assigning the elementary flows of the life cycle inventory to a characterization.

A brief description of the content of the different parts in the IA98 format for impact assessment is given below:

Documentation of specification of elementary flows i.e. Aspects

<i>Aspect selection principle</i>	Documentation of the principle that have been applied when selecting the aspects
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Aspect Specification of the aspect (elementary flow) in terms of substance name and different properties e.g. receiving environment, receiving environment specification and geographical location.

Documentation of *Impact category and category indicator*

Impact indication principle Documentation of the viewpoint from which the choice of how to express or indicate environmental impact is made

Impact category Names of classes of environmental impacts

Category indicator Names of quantifiable environmental impacts belonging to impact categories

Documentation of *characterisation*

Characterisation method The method used to assign and quantify the environmental consequences of an input or output in the LCI to a category indicator

Characterisation parameter The relation between an input or an output of an LCI result and a category indicator, based on a characterisation method, expressed as the characterisation factor

Documentation of *weighting*

Weighting method The method used to compile a quantitative measure of the relative importance between different impact categories or category indicators

Weighting factors The relative weights between impact categories and category indicators, based on a weighting method

Documentation of *full impact assessment*

Impact assessment method Describes the general prerequisites for the impact assessment

Impact assessment selections Lists of references to category indicators, characterisation parameters and weighting factors that have been selected in the impact assessment method

The IA98 format has been implemented as data communication format, which is intended to be used for communication of impact assessment data between any two information systems. The IA98 communication format is implemented as an XML schema [9].

4.1.2 The EcoSpold format for impact assessment data

The impact assessment (IA) data in the ecoinvent database is documented in the EcoSpold format, using the same data fields as for LCI data [10]. The technical specification for how to interpret the format for IA datasets is similar to the specification for how to interpret LCI datasets, and there are few recommendations on how to interpret the fields specifically for IA data. Further support for the interpretation was therefore extracted by reviewing of IA datasets documented in the EcoSpold format in ecoinvent. Based on the technical specification and the review, an interpretation of the content of the fields was created for the purpose of the conversion to IA98. The interpretation is found in appendix C.

In general, the documentation of IA datasets in the EcoSpold format does not distinguish between the different concepts according to the ISO 14042 standard, i.e. impact category and category indicator, characterisation and weighting. In ecoinvent, the format is used for both documentation of characterization factors and impact factors (i.e. factors that includes both characterization and weighting).

4.1.2.1 Interpretation of the EcoSpold format in terms of ISO 14042 concepts

The general structure of the EcoSpold format is described in section 3.1.1 *The EcoSpold data format*. Below a brief description is given of how the different concepts according to the ISO 14042 standard have been interpreted for impact assessment datasets in the EcoSpold format. The interpretation is mainly based on review of datasets in ecoinvent of how the format is typically used for impact assessment data.

The information in field *Reference function – subCategory* is interpreted as impact categories, and the information in *Reference function – name* is interpreted as category indicators. For datasets documented as characterization factors, the unit of the category indicator is documented in the field *Reference function – unit*. For datasets documented as impact factors, this field contains the unit of the weighting factor. Thus, each impact assessment dataset in EcoSpold contains only one category indicator.

The rest of the *Meta information* is either interpreted as information about the characterization or full impact assessment (i.e. combined characterization and weighting), depending on which type of factor that is documented in the format. For full impact assessment information, the EcoSpold format does not specifically structure information about the characterization and the weighting.

The information in *Flow data – Exchanges* is generally interpreted as specification of elementary flows to which characterization factors or impact factors are assigned. The actual characterization or impact factor is documented in data field *Exchanges – meanValue*

4.1.2.2 Impact assessment methods implemented in ecoinvent

Eight different impact assessment methods have been implemented in the ecoinvent database, see table 7 below. The assumptions and interpretations that have been made during the implementation of the methods in the database, e.g. how impact assessment factors have been assigned to elementary flows, are described in a separate report [11].

Table 7. *Impact assessment methods implemented in the database ecoinvent (from [11])*

Method	Background publication
CML 2001	(Guinée et al. 2001a; b)
Cumulative energy demand	Own meta-concept
Eco-indicator 99	(Goedkoop & Spriensma 2000a; b)
Ecological scarcity 1997	(Brand et al. 1998)
EDIP - Environmental Design of Industrial Products	(Hauschild & Wenzel 1997)
EPS - environmental priority strategies in product development	(Steen 1999)
IMPACT 2002+	(Jolliet et al. 2003)
IPCC 2001 (Global Warming Potential)	(Albritton & Meira-Filho 2001; IPCC 2001)

Depending on the method, the impact assessment factors for the method have either been implemented as characterisation factors or as impact factors, i.e. factor that includes both

characterization and weighting. In the ecoinvent documentation such impact factors are referred to as “damage factors”.

There is no specific field in the EcoSpold format that specifies which type of impact assessment factors that have been implemented for a specific method. Table 8 below provides an overview of which types of impact assessment factors that have been implemented for each method. The table is based on the description of how each method has been implemented in ecoinvent [11].

Table 8 Implemented methods, number of implemented datasets and type of impact assessment factors that are implemented for the method

Implemented method (Name of method in EcoSpold data field Category)	Number of implemented datasets	Type of implemented impact assessment factors
CML 2001	50 datasets	Characterisation factors
EDIP	46 datasets	Characterisation factors
EPS 2000	6 datasets	Impact factors
IMPACT 2002+(Endpoint)	16 datasets	Impact factors
IMPACT 2002+ (Midpoint)	2 datasets	Characterisation factors
IPCC 2001	3 datasets	Characterisation factors
cumulative energy demand	5 datasets	Characterisation factors or Impact factors ⁴
eco-indicator 99, (E,E)	14 datasets	Impact factors
eco-indicator 99, (H,A)	14 datasets	Impact factors
eco-indicator 99, (I,I)	14 datasets	Impact factors
ecological scarcity 1997	7 datasets	Impact factors

4.2 Conversion of ecoinvent impact assessment datasets in the EcoSpold format into IA98 format

Due to the fact that two different types of impact assessment factors is implemented in ecoinvent (characterization factors and impact factors), two different conversion alternatives had to be developed to convert ecoinvent/EcoSpold IA-data into the IA98 format.

Depending on which type of factors that are documented, the datasets is either converted according to “*characterization*” or according to “*full impact assessment*”.

4.2.1 Characterisation - Conversion of characterization factors

The ecoinvent IA datasets that are documented as *characterization factors* are converted according to “*characterization*”. The documentation of *characterization* in IA98 consists of documentation of *aspects, impact category and category indicators* and *characterization*.

In the conversion to IA98, the information in the EcoSpold data field *Reference function – name* and *unit* is converted to the field *Category indicator – name* and default unit in IA98. The rest of the general documentation in *Meta information* is converted into documentation of *Characterization method*. The *Exchanges* are converted into *Aspects*, except for the

⁴ According personal communication with Rolf Frischknecht at the ecoinvent centre, one can perceive cumulative energy demand (CED) as both characterisation factors (CED being a energy resource impact category) or impact factors (where CED being a proxy indicator representing environmental impacts)

information about amounts (meanValue, uncertainty type, etc). The amounts are converted into Characterization parameters that refer to the Aspects and the Category indicator. Each Aspect is described using a set of Properties. The ISO/TS 14048 nomenclature is used in the conversion for the naming of these properties.

4.2.2 Full impact assessment - Conversion of impact factors

Theecoinvent IA datasets that are documented as *impact factors* are converted according to “full impact assessment”. The documentation of *full impact assessment* in IA 98 consists of all parts of the IA 98 format; *aspects, impact category and category indicators, characterization, weighting and full impact assessment*.

For the documentation of impact factors, the EcoSpold format does not distinguish between characterization and weighting. The documentation in the IA98 format, however, requires this distinction. In the IA98 format, characterization and weighting are documented separately, in line with requirements of ISO 14042. Therefore, in order to keep the consistency in the conversion of impact factors, “dummy” entries need to be created in the IA98 format. In the IA98 format, a full impact assessment method is created by selecting and referencing documented characterization parameters and weighting factors. The impact factors are derived by multiplying the characterization parameter for a specific aspect and category indicator with the corresponding weighting factor for the category indicator.

In the conversion of datasets implemented as impact factors into IA98, this has been solved by creating “dummy” entries in the characterization and weighting parts.

The information in the EcoSpold data field *Reference function – name* is converted to the field *Category indicator – name*, whereas the information in *Reference function – unit* is converted to field *Weighting factor – Unit of weighting measure* in IA98. The unit of the category indicator is not specified in the EcoSpold format, and therefore a “dummy” entry needs to be created in the IA98 field *Category indicator – unit*.

The rest of the general information in *Meta information* is converted into documentation of *Impact assessment method*. The *Exchanges* are converted into *Aspects*, except for the information about amounts (*meanValue, uncertainty type, etc*). The amounts are converted into “dummy” Characterization parameters that refer to the Aspects and the Category indicator. A “dummy” *Weighting factor* for the category indicator is created with the value “1”. The impact factors in the *Impact assessment selections* are created by referencing the *Category indicator, Aspects, Characterisation parameters and Weighting factors*. Each Aspect is described using a set of Properties. The ISO/TS 14048 nomenclature is used in the conversion for the naming of these properties.

Important note when using impact factor datasets converted from EcoSpold into IA98:

The dummy entries that are created in conversion of impact factors, in the characterization and weighting parts of the IA98 format, shall NOT be used for impact assessment! They are only created in order to keep the consistency of the information as required by IA98, in line with ISO 14042.

4.3 Specification of data conversion from EcoSpold to IA98

The specification of data conversion from EcoSpold to IA98 is presented in table 9. The specification of the conversion into IA98 is expressed both in the IA98 data documentation format as described in IMI-report 2002:1 (2nd ed), and in the IA98 data communication format in XML as described in CPM-report 2004:5 (1st rev.). The reason that these two are slightly different depends on the actual choice of implementation into XML⁵.

Table 9

EcoSpold format	IA98 data documentation format Reference: IMI-report 2002:1 (2nd ed)			Comment	
	Characterisation Conversion of characterisation factors	Full impact assessment Conversion of Impact factors		Characterisation Conversion of characterisation factors	Full impact assessment Conversion of Impact factors
META INFORMATION					
<i>Process information</i>					
Reference function					
datasetRelatesToProduct	<i>Excluded</i>	<i>Excluded</i>	Not relevant for IA data	<i>Excluded</i>	<i>Excluded</i>
name	Category indicator.Name with prefix "Ecoinvent: "	<i>See Characterisation</i>		ImpactAssessmentData.ImpactIndicationPrinciple.CategoryIndicator.Name with prefix "Ecoinvent: "	<i>See Characterisation</i>
localName	<i>Excluded</i>	<i>Excluded</i>	In line with scope for LCI, local names are excluded from mapping	<i>Excluded</i>	<i>Excluded</i>
amount	<i>Excluded</i>	<i>Excluded</i>	Not relevant for IA data	<i>Excluded</i>	<i>Excluded</i>

⁵ The XML structure for IA98 is modeled as a few hierarchically structured overarching objects, which makes it necessary to address each element in terms of the full address, like "ImpactAssessmentData.ImpactIndicationPrinciple.CategoryIndicator.Unit", instead of only Category indicator.default unit. The differences in terminology are due to avoidance of ambiguity in the full information systems models.

unit	Category indicator.default unit	Weighting factor.Unit of weighting measure and Weighting factor.Amount.Parameter.Value = 1 and Weighting factor.Amount.Parameter.Name = "meanValue" and Weighting factor.Amount.Name="Normal" and Category indicator.default unit="Dummy"	Due to that EcoSpold does not distinguish between characterisation, weighting and combined impact assessment, "dummy" entries needs to be created in the conversion of impact factors to ensure consistency according to IA 98 and ISO 14042. In the conversion to IA98, a dummy weighting factor with value "1" is created, and a the unit of the category indicator is set to "dummy", since a unit for the category indicator is not specified for impact factors in the EcoSpold format	ImpactAssessmentData.ImpactIndicationPrinciple.CategoryIndicator.Unit and ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CIUnit	ImpactAssessmentData.WeightingMethod.WeightingFactor.Unit and ImpactAssessmentData.WeightingMethod.WeightingFactor.WeightingFactorAmount.WeightingFactorAmountParameter.Value = "1" where WeightingFactorAmountParameter.Name = "meanValue", and "WeightingFactorAmount.Name" is set to "Normal". and ImpactAssessmentData.ImpactIndicationPrinciple.CategoryIndicator.Unit="Dummy" and ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CIUnit = "Dummy"
category	Characterisation method.Name with prefix "Ecoinvent: " and Impact indication principle.Name with prefix "Ecoinvent: "	Impact assessment method.Name with prefix "Ecoinvent: " and Impact indication principle.Name with prefix "Ecoinvent: " and Characterisation method.Name with prefix "Ecoinvent: " and suffix "Characterisation method dummy" and Weighting method.Name with prefix "Ecoinvent: " and suffix "Weighting method dummy" The created Characterisation method and Weighting method, with corresponding Characterisation parameters and Weighting factor is referred to in Impact assessment selections	Due to that EcoSpold does not distinguish between characterisation, weighting and combined impact assessment, "dummy" entries needs to be created in the conversion of impact factors to ensure consistency according to IA 98 and ISO 14042. In the conversion to IA98, a dummy characterisation method and a dummy weighting method is created.	ImpactAssessmentData.CharacterisationMethod.Name with prefix "Ecoinvent: " and ImpactAssessmentData.ImpactIndicationPrinciple.Name with prefix "Ecoinvent: "	ImpactAssessmentData.ImpactAssessmentMethod.Name with prefix "Ecoinvent:" and ImpactAssessmentData.ImpactIndicationPrinciple.Name with prefix "Ecoinvent:" and ImpactAssessmentData.CharacterisationMethod.Name with prefix "Ecoinvent:" and suffix "Characterisation method dummy" and ImpactAssessmentData.WeightingMethod.Name with prefix "Ecoinvent:" and suffix "Weighting method dummy" ImpactAssessmentData.ImpactAssessmentMethod refers to the created Characterisation method and Weighting method via Name and Version

subCategory	Impact category.Name with prefix "Ecoinvent: "	See Characterisation		ImpactAssessmentData.ImpactIndicationPrinciple.ImpactCategory.Name with prefix "Ecoinvent: "	See Characterisation
localCategory	Excluded	Excluded	In line with scope for LCI, local names are excluded from mapping	Excluded	Excluded
localSubCategory	Excluded	Excluded	In line with scope for LCI, local names are excluded from mapping	Excluded	Excluded
generalComment	Characterisation method.Notes	Impact assessment method.Notes		ImpactAssessmentData.CharacterisationMethod.Notes	ImpactAssessmentData.ImpactAssessmentMethod.Notes
formula	Excluded	Excluded		Excluded	Excluded
synonym	Characterisation method.Principal method name	Impact assessment method.Principal method name		ImpactAssessmentData.CharacterisationMethod.PrincipalMethodName	ImpactAssessmentData.ImpactAssessmentMethod.PrincipalMethodName
Geography					
location	Characterisation method.Geographical area	Impact assessment method.Geographical area		ImpactAssessmentData.CharacterisationMethod.GeographicalArea	ImpactAssessmentData.ImpactAssessmentMethod.GeographicalArea
text	Characterisation method.Area description	Impact assessment method.Area description		ImpactAssessmentData.CharacterisationMethod.AreaDescription	ImpactAssessmentData.ImpactAssessmentMethod.AreaDescription
Technology					
text	Excluded	Excluded	Not relevant for IA data	Excluded	Excluded
Timeperiod					
dataValidForEntirePeriod	Characterisation method.Valid time span.Description	Impact assessment method.Valid time span.Description		ImpactAssessmentData.CharacterisationMethod.ValidTimeSpanDescription	ImpactAssessmentData.ImpactAssessmentMethod.ValidTimeSpanDescription
text	Characterisation method.Valid time span.Description	Impact assessment method.Valid time span.Description		ImpactAssessmentData.CharacterisationMethod.ValidTimeSpanDescription	ImpactAssessmentData.ImpactAssessmentMethod.ValidTimeSpanDescription
startDate	Characterisation method.Valid time span.Start date	Impact assessment method.Valid time span.Start date		ImpactAssessmentData.CharacterisationMethod.ValidTimeSpanStart	ImpactAssessmentData.ImpactAssessmentMethod.ValidTimeSpanStart
endDate	Characterisation method.Valid time span.End date	Impact assessment method.Valid time span.End date		ImpactAssessmentData.CharacterisationMethod.ValidTimeSpanEnd	ImpactAssessmentData.ImpactAssessmentMethod.ValidTimeSpanEnd
Dataset Information					
type	Only datasets where type = 4 is converted into IA 98	See Characterisation		Only datasets where type = 4 is converted into IA 98	See Characterisation
impactAssessmentResult	Excluded	Excluded	Not relevant for IA data	Excluded	Excluded
timestamp	Characterisation method.Date completed	Impact assessment method.Date completed		ImpactAssessmentData.CharacterisationMethod.DateCompleted	ImpactAssessmentData.ImpactAssessmentMethod.DateCompleted

version	Characterisation method.Version with prefix "ecoinvent"	Impact assessment method.Version with prefix "ecoinvent" and Characterisation method.Version with prefix "ecoinvent" and Weighting method.Version with prefix "ecoinvent"	Due to that EcoSpold does not distinguish between characterisation, weighting and combined impact assessment, "dummy" entries needs to be created in the conversion of impact factors to ensure consistency according to IA 98 and ISO 14042	ImpactAssessmentData.CharacterisationMethod.Version with prefix "ecoinvent"	ImpactAssessmentData.ImpactAssessmentMethod.Version with prefix "ecoinvent" and ImpactAssessmentData.CharacterisationMethod with prefix "ecoinvent" and ImpactAssessmentData.WeightingMethod.Version with prefix "ecoinvent"
internalVersion	<i>Excluded</i>	<i>Excluded</i>	In line with scope for LCI, internalVersion are excluded from mapping	<i>Excluded</i>	<i>Excluded</i>
energyValues	Characterisation method.Notes with prefix "ecoinvent". Resolve coded nomenclature to the corresponding text according to the EcoSpold specification	Impact assessment method.Notes with prefix "ecoinvent". Resolve coded nomenclature to the corresponding text according to the EcoSpold specification		ImpactAssessmentData.CharacterisationMethod.Notes with prefix "ecoinvent". Resolve coded nomenclature to text	ImpactAssessmentData.ImpactAssessmentMethod.Notes with prefix "ecoinvent". Resolve coded nomenclature to text
languageCode	<i>Excluded</i>	<i>Excluded</i>	In line with scope for LCI, local names are excluded from mapping	<i>Excluded</i>	<i>Excluded</i>
localLanguageCode	<i>Excluded</i>	<i>Excluded</i>	In line with scope for LCI, local names are excluded from mapping	<i>Excluded</i>	<i>Excluded</i>
Modelling and validation					
Source	Resolve internal reference whenever used and add internal headers with the EcoSpold field names.	<i>See Characterisation</i>		Resolve internal reference whenever used and add internal headers with the EcoSpold field names.	<i>See Characterisation</i>
number					
sourceType					
firstAuthor					
additionalAuthors					
year					
title					
pageNumbers					
nameOfEditors					
titleOfAnthology					
placeOfPublications					
publisher					

journal					
volumeNo					
issueNo					
text					
Validation					
proofReadingDetails	Characterisation method.Notes	Impact assessment method.Notes		ImpactAssessmentData.CharacterisationMethod.Notes	ImpactAssessmentData.ImpactAssessmentMethod.Notes
proofReadingValidator	Characterisation method.Notes Resolve internal reference	Impact assessment method.Notes Resolve internal reference		ImpactAssessmentData.CharacterisationMethod.Notes. Resolve internal reference	ImpactAssessmentData.ImpactAssessmentMethod.Notes Resolve internal reference
otherDetails	Characterisation method.Notes	Impact assessment method.Notes		ImpactAssessmentData.CharacterisationMethod.Notes	ImpactAssessmentData.ImpactAssessmentMethod.Notes
Administrative information					
Data entry by					
person	Characterisation method.Juridical person role.Address where Characterisation method.Juridical person role.Role="Data documentor" Resolve internal reference	Impact assessment method.Juridical person role.Address where Impact assessment method.Juridical person role.Role="Data documentor" Resolve internal reference		ImpactAssessmentData.CharacterisationMethod.CMJuridicalPersonRole.JuridicalPerson where CMJuridicalPersonRole.Role = "Data documentor" Resolve internal reference	ImpactAssessmentData.ImpactAssessmentMethod.IAMJuridicalPersonRole.JuridicalPerson where IAMJuridicalPersonRole.Role = "Data documentor" Resolve internal reference
qualityNetwork	Characterisation method.Juridical person role.Address where Characterisation method.Juridical person role.Role="Data documentor"	Impact assessment method.Juridical person role.Address where Impact assessment method.Juridical person role.Role="Data documentor"		ImpactAssessmentData.CharacterisationMethod.CMJuridicalPersonRole.JuridicalPerson where CMJuridicalPersonRole.Role = "Data documentor"	ImpactAssessmentData.ImpactAssessmentMethod.IAMJuridicalPersonRole.JuridicalPerson where IAMJuridicalPersonRole.Role = "Data documentor"
Data generator and publication					
person	Characterisation method.Juridical person role.Address where Characterisation method.Juridical person role.Role="Data generator" Resolve internal reference	Impact assessment method.Juridical person role.Address where Impact assessment method.Juridical person role.Role="Data generator" Resolve internal reference		ImpactAssessmentData.CharacterisationMethod.CMJuridicalPersonRole.JuridicalPerson where CMJuridicalPersonRole.Role = "Data generator" Resolve internal reference	ImpactAssessmentData.ImpactAssessmentMethod.IAMJuridicalPersonRole.JuridicalPerson where IAMJuridicalPersonRole.Role = "Data generator" Resolve internal reference
dataPublishedIn	Characterisation method.Literature reference	Impact assessment method.Literature reference		ImpactAssessmentData.CharacterisationMethod.LiteratureReference	ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference

referenceToPublishedSource	Characterisation method.Literature reference	Impact assessment method.Literature reference		ImpactAssessmentData.CharacterisationMethod.LiteratureReference	ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference
copyright	Characterisation method.Literature reference	Impact assessment method.Literature reference		ImpactAssessmentData.CharacterisationMethod.LiteratureReference	ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference
accessRestrictedTo	Characterisation method.Literature reference	Impact assessment method.Literature reference		ImpactAssessmentData.CharacterisationMethod.LiteratureReference	ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference
companyCode	Characterisation method.Literature reference	Impact assessment method.Literature reference		ImpactAssessmentData.CharacterisationMethod.LiteratureReference	ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference
countryCode	Characterisation method.Literature reference	Impact assessment method.Literature reference		ImpactAssessmentData.CharacterisationMethod.LiteratureReference	ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference
pageNumbers	Characterisation method.Literature reference	Impact assessment method.Literature reference		ImpactAssessmentData.CharacterisationMethod.LiteratureReference	ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference
Person	Resolve internal reference whenever used and add internal headers with the EcoSpold field names.	<i>See Characterisation</i>		Resolve internal reference whenever used and add internal headers with the EcoSpold field names.	<i>See Characterisation</i>
number					
name					
address					
telephone					
telex					
email					
companyCode					
countryCode					
FLOW DATA					
Exchange	Each exchange is defining an Aspect. These Aspects are then referred to from the characterisation parameters (Characterisation parameter.Reference to Aspect). The reference to the Aspect is made by the Aspect selection principle.Name and the Aspect.Name For all Aspects the Aspect selection principle.Name =	<i>See Characterisation</i>		Each exchange is on data conversion defining an Aspect (ImpactAssessmentData.AspectSelectionPrinciple.Aspect). These Aspects are then referred to from the characterisation parameters (ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.AspectName) For all aspects (and characterisation parameters): ImpactAssessmentData.Aspec	<i>See Characterisation</i>

	"Ecoinvent exchanges".			tSelectionPrinciple.Name = "Ecoinvent exchanges"	
number	Aspect.Name with prefix "EcoinventExchangeNr_" and Characterisation parameter.Reference to Aspect	<i>See Characterisation</i>		ImpactAssessmentData.AspectSelectionPrinciple.Aspect.Name with prefix "EcoInventExchangeNr_" This aspect is referred from ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.AspectName ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.Name with prefix "EcoInventExchangeNr_"	<i>See Characterisation</i>
category	Aspect.Property.Value where Aspect.Property.Name = "Receiving environment" and if category="Resource": Aspect.Property.Value = "Inputs" where Aspect.Property.Property name="Direction" otherwise (i.e. if category="Air" etc.): Aspect.Property.Value="Outputs" where Aspect.Property.Property name="Direction"	<i>See Characterisation</i>	The field receiving environment in ISO/TS 14048 which is going to be matched with this information on impact assessment is associated with an exclusive nomenclature with the allowed values "Air", "Water", "Ground", or "Technosphere". If the corresponding EcoSpold field contains different values, these need to be translated on data conversion. if category = "Resource" then Translate nomenclature found in subcategory to the corresponding values for receiving environment in ISO/TS 14048. if category = "Soil" then Receiving environment = "Ground" For flows to or from technosphere: Receiveing environment = "Technosphere", category and subcategory is inserted into Aspect.Notes.	ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value where AspectProperty.Name = "Receiving Environment". if category = "Resource" ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value = "Inputs" where AspectProperty.Name = "Direction". else ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value = "Outputs" where AspectProperty.Name = "Direction".	<i>See Characterisation</i>
subCategory	Aspect.Property.Value where Aspect.Property.Name = "Receiving environment specification"	<i>See Characterisation</i>	ISO/TS 14048 field names are used for defining the properties of the aspects.	ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value where AspectProperty.Name = "Receiving Environment Specification".	<i>See Characterisation</i>

localCategory	<i>Excluded</i>	<i>Excluded</i>	In line with scope for LCI, local names are excluded from mapping	<i>Excluded</i>	<i>Excluded</i>
localSubCategory	<i>Excluded</i>	<i>Excluded</i>	In line with scope for LCI, local names are excluded from mapping	<i>Excluded</i>	<i>Excluded</i>
name	Aspect.Substance name where Aspect.Substance nomenclature="Ecoinvent nomenclature"	<i>See Characterisation</i>		ImpactAssessmentData.AspectSelectionPrinciple.Aspect.SubstanceName where Aspect.SubstanceNomenclature = "Ecoinvent nomenclature"	<i>See Characterisation</i>
location	Aspect.Property.Value where Aspect.Property.Name="Geographical location"	<i>See Characterisation</i>	ISO/TS 14048 field names are used for defining the properties of the aspects.	ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value where AspectProperty.Name = "Geographical Location".	<i>See Characterisation</i>
unit	Aspect.Unit	<i>See Characterisation</i>		ImpactAssessmentData.AspectSelectionPrinciple.Aspect.Unit and ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.AspectUnit	<i>See Characterisation</i>
meanValue	Characterisation parameter.Amount.Parameter.Value where Characterisation parameter.Amount.Parameter.Name="meanValue"	<i>See Characterisation. Note: the amount of the impact factors are inserted as "dummy" characterisation parameters.</i>	Due to that EcoSpold does not distinguish between characterisation, weighting and combined impact assessment, "dummy" entries needs to be created in the conversion of impact factors to ensure consistency according to IA 98 and ISO 14042. The value of the impact factor is inserted as a dummy characterisation parameter in IA98. A dummy weighting factor is also inserted (see conversion of field Reference function - unit). The impact factor in IA98 is obtained by multiplying the characterisation parameter with the weighting factor.	ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CharacterisationParameterAmount.CharacterisationParameterAmountParameter.Value where CharacterisationParameterAmountParameter.Name = "meanValue"	<i>See Characterisation</i>

uncertaintyType	Characterisation parameter.Amount.Name Replace numeric coded nomenclature with corresponding text as defined in the EcoSpold documentation, i.e useecoinvent nomenclature for naming of distribution functions	See Characterisation. Note: the amount of the impact factors are inserted as "dummy" characterisation parameters	--"	ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CharacterisationParameterAmount.Name Replace numeric coded nomenclature with corresponding text as defined in the EcoSpold documentation, i.e useecoinvent nomenclature for naming of distribution functions	See Characterisation
standardDeviation95	Characterisation parameter.Quantity.Parameter.Value where Characterisation parameter.Quantity.Parameter.Name="standardDeviation95"	See Characterisation. Note: the amount of the impact factors are inserted as "dummy" characterisation parameters	--"	ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CharacterisationParameterAmount.CharacterisationParameterAmountParameter.Value where CharacterisationParameterAmountParameter.Name = "standardDeviation95"	See Characterisation
minValue	Characterisation parameter.Amount.Parameter.Value where Characterisation parameter.Amount.Parameter.Name="minValue"	See Characterisation. Note: the amount of the impact factors are inserted as "dummy" characterisation parameters	--"	ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CharacterisationParameterAmount.CharacterisationParameterAmountParameter.Value where CharacterisationParameterAmountParameter.Name = "minValue"	See Characterisation
maxValue	Characterisation parameter.Amount.Parameter.Value where Characterisation parameter.Amount.Parameter.Name="maxValue"	See Characterisation. Note: the amount of the impact factors are inserted as "dummy" characterisation parameters	--"	ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CharacterisationParameterAmount.CharacterisationParameterAmountParameter.Value where CharacterisationParameterAmountParameter.Name = "maxValue"	See Characterisation
mostLikelyValue	Characterisation parameter.Amount.Parameter.Value where Characterisation parameter.Amount.Parameter.Name="mostLikelyValue"	See Characterisation. Note: the amount of the impact factors are inserted as "dummy" characterisation parameters	--"	ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.CharacterisationParameterAmount.CharacterisationParameterAmountParameter.Value where CharacterisationParameterAmountParameter.Name = "mostLikelyValue"	See Characterisation

formula	Aspect.Notes	See Characterisation		ImpactAssessmentData.AspectSelectionPrinciple.Aspect.Notes	See Characterisation
referenceToSource	Characterisation parameter.Notes	See Characterisation		ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.Notes	See Characterisation
pageNumbers	Characterisation parameter.Notes	See Characterisation		ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.Notes	See Characterisation
generalComment	Characterisation parameter.Notes	See Characterisation		ImpactAssessmentData.CharacterisationMethod.CharacterisationParameter.Notes	See Characterisation
localName	Excluded	See Characterisation	In line with scope for LCI, local names are excluded from mapping	Excluded	See Characterisation
inputGroup	Aspect.Property.Value = "Inputs" where Aspect.Property.Name="Direction" and Aspect.Property.Value = "Natural resource" where Aspect.Property.Name="Group"	See Characterisation	Only inputGroup "4=FromNature" is relevant for impact category datasets. However, The field seems to be missing in the ecoinvent datasets. The direction of the aspect is therefore derived from the information in EcoSpold field category ISO/TS 14048 field names are used for defining the properties of the aspects.	ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value = "Inputs" where AspectProperty.Name = "Direction" and ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value = "Natural resource" where AspectProperty.Name = "Group"	See Characterisation
outputGroup	Aspect.Property.Value = "Outputs" where Aspect.Property.Name="Direction" and Aspect.Property.Value = "Emission" where Aspect.Property.Name="Group"	See Characterisation	Only inputGroup "4=FromNature" is relevant for impact category datasets. However, The field seems to be missing in the ecoinvent datasets. The direction of the aspect is therefore derived from the information in EcoSpold field category ISO/TS 14048 field names are used for defining the properties of the aspects.	ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value = "Outputs" where AspectProperty.Name = "Direction" and ImpactAssessmentData.AspectSelectionPrinciple.Aspect.AspectProperty.Value = "Emission" where AspectProperty.Name = "Group"	See Characterisation

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- [7] Carlson R., Pålsson A-C. "Documentation of environmental impact assessment, compatible with SPINE and ISO/TS 14048" IMI-report 2002:1 (second edition)
- [8] Carlson R., Steen B.; "A Data Model for LCA Impact Assessment"; 8th Annual Meeting of SETAC-Europe 1998 14-18 April; Bordeaux, 1998
- [9] Flemström K., Geiron K., Erlandsson M., Tivander J. "Industrial applications of future information systems for impact assessment A procedure for data format mapping and nomenclature issues"; CPM-report 2004:5 (1st revision)
- [10] EcoSpold01ImpactDataset_Simple.html and EcoSpold01ImpactDataset.html, downloaded from the ecoinvent web-site (www.ecoinvent.ch)
- [11] Frischknecht R., Jungbluth N., Althaus H.-J., Doka, G., Dones, R., Hellweg S., Hischer R., Humbert S., Margni M., Nemecek, T., Spielmann M. (2004) Implementation of Life Cycle Impact Assessment Methods. Final report ecoinvent 2000 No. 3, Swiss Centre for Life Cycle Inventories, Duebendorf, CH.

Appendix A: Specification of ordering of EcoSpold fields in corresponding fields in the target format

For the cases when several fields in EcoSpold are translated to the same field in the target format as described in 4.1.2, internal headings with the original EcoSpold field name followed by the value of that EcoSpold field have been added in these fields in the target format. This section does both provide an overview of all these cases as well as specifies the internal ordering of the EcoSpold fields within the matching field of the target format. Below the internal ordering of the EcoSpold fields is provided for the target formats ISO/TS 14048 and IA98. Due to the fact that two different types of impact assessment factors is implemented within ecoinvent (see 4.2), two different versions of the internal ordering is provided for IA98 (one for characterization factors and one for impact factors).

The internal headers are created by surrounding the EcoSpold field name by square brackets. To make the headers more readable, the field names have been divided into several words with a capital letter. For example the field name “includedProcesses” results in the header [Included processes].

ISO/TS 14048

Process.Process description.Technology.Technical content and functionality

[Included processes]

[General comment]

[Process information – Technology – Text]

[Infrastructure included]

(Replace EcoSpold values “true” or ”false” by “Yes” respectively “No”)

[Synonyms]

[Formula]

[CAS number]

[Dataset relates to product]

(Replace EcoSpold values “true” or ”false” by “Yes” respectively “No”)

Process.Process description.Valid time span.Time span description

[Timeperiod - Data valid for entire period]

(Replace EcoSpold values “true” or ”false” by “Yes” respectively “No”)

[Timeperiod - Text]

Modelling and validation.Adaptation principles

[Representativeness - Extrapolations]

[Representativeness - Uncertainty adjustments]

Modelling and validation.Validation.Result

[Proofreading details]

[Other details]

Administrative information.Data documentor

(resolve reference to person as described below)

[Quality network]

Administrative information.Publication

[Data published in] Translation of coded nomenclature to clear text of “dataPublishedIn”

[Reference to published source]

(resolve reference to literature reference as described below)

[Page numbers]

Administrative information.Access restrictions

[Access restricted to]

Translation of coded nomenclature to clear text of “accessRestrictedTo”

[Company code]

[Country code] Use externally defined nomenclature to resolve area codes

Process.Inputs and outputs.Name.Specification of name

[CAS number]

[Formula]

[Originalecoinvent substance name] (in case of translation to other nomenclature)

Documentation.Data treatment

[Originalecoinvent Category/Subcategory] category/subcategory (for flows from technosphere)

(reliability, completeness, temporal correlation, geographical correlation, further technical correlation, sample size)

Modelling and validation.Modelling choices.Allocations.Allocation explanation

[Reference to co-product]

Translation of number to name of co-product

[Allocation method]

Translation of coded nomenclature to clear text

[Fraction]

[Explanations]

[Reference to input output]

Translation of number to name of flow

Literature reference referred to from Process.Inputs and outputs.Documentation.Reference to data source (for flows) resp Administrative information.Publication (for process level references) are resolved into

[Number]

[Source type]

[First author]

[Additional authors]

[Year]

[Title]

[Page numbers]

[Name of editors]

[Title of anthology]

[Place of publications]

[Publisher]

[Journal]

[Volume no]

[Issue no]

[Sources text]

Person referred to from Administrative information.Data documentor, Administrative information.Data generator or Modelling and validation.Validation.Validator are resolved into

[Number]
[Name]
[Address]
[Telephone]
[Telefax]
[Email]
[Company code]
[Country code]

IA98 – Characterization factors

ImpactAssessmentData.CharacterisationMethod.LiteratureReference

[Data published in] Translation of coded nomenclature to clear text of “dataPublishedIn”
[Reference to published source]
(resolve reference to literature reference as described below)
[Page numbers]
[Copyright]
[AccessRestrictedTo]
Translation of coded nomenclature to clear text
[Company code]
[Country code] Use externally defined nomenclature to resolve area codes

ImpactAssessmentData.CharacterisationMethod.ValidTimeSpanDescription

[Timeperiod - Data valid for entire period]
(Replace EcoSpold values “true” or ”false” by “Yes” respectively “No”)
[Timeperiod - Text]

ImpactAssessmentData.CharacterisationMethod.Notes

[Reference function – General comment]
[Data set information – Energy values]
[Validation - Proofreading details]
[Validation - Proofreading validator]
(resolve reference to person as described below)
[Validation - Other details]

ImpactAssessmentData.AspectSelectionPrinciple.Aspect.Notes

[Formula]
[Originalecoinvent substance name] (in case of translation to other nomenclature)
[Originalecoinvent Category/Subcategory] category/subcategory (in case of translation of Subcategory value)

Literature reference referred to from

ImpactAssessmentData.CharacterisationMethod.LiteratureReference are resolved into

[Number]
[Source type]

[First author]
[Additional authors]
[Year]
[Title]
[Page numbers]
[Name of editors]
[Title of anthology]
[Place of publications]
[Publisher]
[Journal]
[Volume no]
[Issue no]
[Sources text]

Person referred to from

**ImpactAssessmentData.CharacterisationMethod.CMJuridicalPersonRole.
JuridicalPerson or ImpactAssessmentData.CharacterisationMethod.Notes
are resolved into**

[Number]
[Name]
[Address]
[Telephone]
[Telefax]
[Email]
[Company code]
[Country code]

IA98 – Impact factors

ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference

[Data published in] Translation of coded nomenclature to clear text of “dataPublishedIn”
[Reference to published source]
(resolve reference to literature reference as described below)
[Page numbers]
[Copyright]
[AccessRestrictedTo]
Translation of coded nomenclature to clear text
[Company code]
[Country code] Use externally defined nomenclature to resolve area codes

ImpactAssessmentData.ImpactAssessmentMethod.ValidTimeSpanDescription

[Timeperiod - Data valid for entire period]
(Replace EcoSpold values “true” or ”false” by “Yes” respectively “No”)
[Timeperiod - Text]

ImpactAssessmentData.ImpactAssessmentMethod.Notes

[Reference function – General comment]
[Data set information – Energy values]
[Validation - Proofreading details]

[Validation - Proofreading validator]
(resolve reference to person as described below)
[Validation - Other details]

ImpactAssessmentData.AspectSelectionPrinciple.Aspect.Notes

[Formula]
[Original ecoinvent substance name] (in case of translation to other nomenclature)
[Original ecoinvent Category/Subcategory] category/subcategory (in case of translation of Subcategory value)

Literature reference referred to from

ImpactAssessmentData.ImpactAssessmentMethod.LiteratureReference are resolved into

[Number]
[Source type]
[First author]
[Additional authors]
[Year]
[Title]
[Page numbers]
[Name of editors]
[Title of anthology]
[Place of publications]
[Publisher]
[Journal]
[Volume no]
[Issue no]
[Sources text]

Person referred to from

ImpactAssessmentData.ImpactAssessmentMethod.IAMJuridicalPersonRole.JuridicalPerson or **ImpactAssessmentData.ImpactAssessmentMethod.Notes** are resolved into

[Number]
[Name]
[Address]
[Telephone]
[Telefax]
[Email]
[Company code]
[Country code]

Appendix B: Implementation of the data conversion specification

Chalmers implementation of the data conversion specification

Overview

The data conversion specification provided in this report has been implemented as a web-based data conversion tool by the research group Industrial Environmental Informatics at Chalmers University of Technology. An overview of the functionality of the implemented data conversion application is provided in figure 3 below. The user selects the target format of the data conversion, and uploads an EcoSpold XML file which by the data conversion application is transferred to the target format. EcoSpold XML files containing LCI-data are translated into an ISO/TS 14048 XML file or a SPINE XFR file, if the target format is ISO/TS 14048 respectively SPINE. EcoSpold XML files containing IA-data are translated into an IA98 XML file. The translated file can be downloaded as an xfr-file (SPINE) or viewed and downloaded as an html-, pdf- or xml-file (ISO/TS 14048 and IA98). The xfr- and xml-files can then be used in applications compatible with SPINE respectively ISO/TS 14048. More information on how to practically work with the data conversion application can be found in [2].

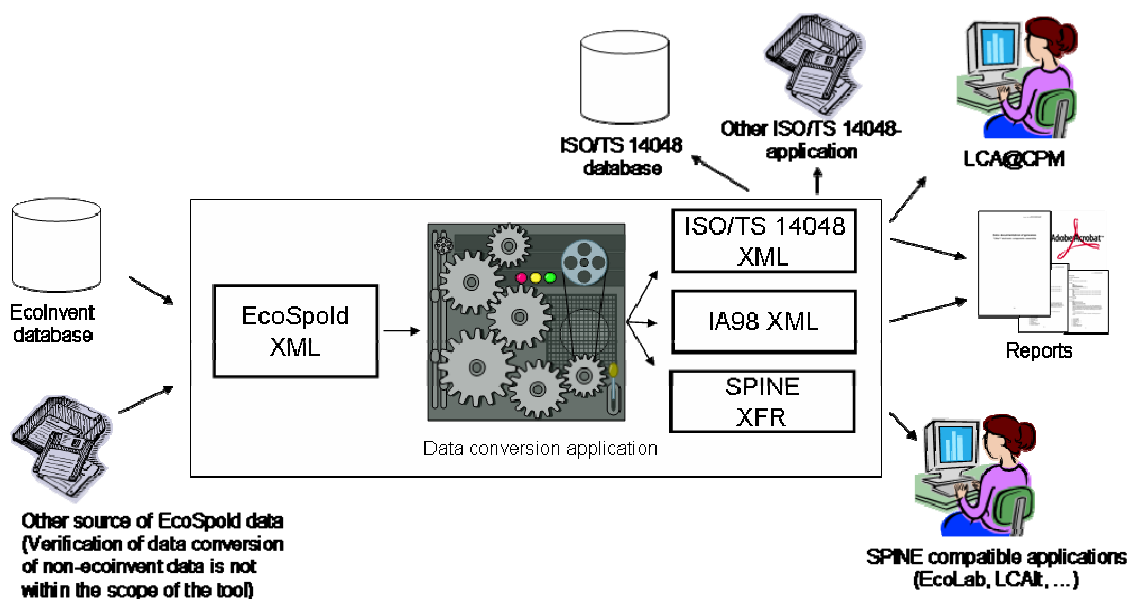


Figure 3: Overview of how the functionality of a data conversion application which implements the data conversion specification provided in this report

Translation options

When the data conversion application is used as specified above, the EcoSpold data files are converted into the target format as specified in this report (see table 6 and table 9). Ecoinvent nomenclatures and conventions are then kept in as high extend as possible. This may however result in problems when using the translated data sets in existing applications compatible with SPINE (e.g. Ecolab and LCAiT) or ISO/TS 14048 (e.g. LCA@CPM). For that reason translation options were introduced in the data conversion application which provides the functionality to adapt the data set to increase the compatibility of the translated

data sets with the nomenclature and conventions used in the LCA tool of the user, e.g. to nomenclatures specified in the SPINE, ISO/TS 14048, or IA98 format.

In the translation options of the implemented data conversion application the following can be changed:

- EcoSpold InputGroup and OutputGroup -> ISO/TS 14048 Group (not relevant for IA datasets)
- EcoSpold Subcategory -> ISO/TS 14048 Receiving environment specification
- Direction of waste flows (not relevant for IA datasets)
- Substance nomenclature

If any configuration has been performed the user is provided the possibility to save it as an XML file. It is also possible to use a saved configuration by uploading a data conversion configuration XML file. The same data conversion configuration file can be used for all translations to ISO/TS 14048, SPINE and IA98.

EcoSpold InputGroup and OutputGroup -> ISO/TS 14048 Group

The input group and output group indicates the type of input or output flow. The option is only available for translation of LCI datasets. Input group and output is not specified for IA datasets inecoinvent.

In ecoinvent data sets, the nomenclature for input group is either “FromNature” or “FromTechnosphere” and the nomenclature for output group is “ReferenceProduct”, “Allocated by product” or “ToNature”.

The default option is to replace the ecoinvent nomenclature with the one agreed upon between CPM and several SPINE software vendors⁶, i.e. “Natural resource”, “Refined resource”, “Product”, “Co-product”, “Residue” or “Emission”.

EcoSpold Subcategory -> ISO/TS 14048 Receiving environment specification

The ecoinvent nomenclature for subcategory, which specifies the environment, can be translated to a user defined nomenclature in order to make the data set compatible with other LCI data and impact assessment models. The option is available for both LCI datasets and IA datasets, and the same configuration can be used for both types.

For elementary flows, the EcoSpold field “subcategory” is translated to the ISO/TS 14048 field “Receiving environment specification” respectively the SPINE field Flow.ImpactMedia. When an ecoinvent subcategory is translated, the original subcategory name from ecoinvent will be saved in the ISO/TS 14048 field “Documentation.Data treatment” respectively the SPINE field ”QMetaData.Method”. For IA datasets the EcoSpold field “subcategory” is translated to the IA98 field Aspect.Property.Value where Aspect.Property.Name = “Receiving environment specification”. The original subcategory name from ecoinvent will be saved in the IA98 field Aspect.Notes.

⁶ Erixon M. (Editor) et al; "Facilitating Data Exchange between LCA Software involving the Data Documentation System SPINE"; CPM Report 2000:2

Direction of waste flows

Waste flows are modeled as inputs of services in ecoinvent, whereas they are generally modeled as outputs of materials in ISO/TS 14048 and SPINE. The translation option is only available for LCI datasets, since it is not relevant for IA datasets.

The translation can either be configured to:

- keep the ecoinvent modeling or
- change to the modeling generally used in ISO/TS 14048 and SPINE

In ecoinvent, the only outputs to technosphere are the reference product(s) and by-products. All other outputs to technosphere, e.g. waste to waste treatment, are modeled as inputs to the process, and are seen as “services” to the unit process. “WasteToTreatment” is used as output group for waste flows when the direction is changed and will be translated to “Residue”.

Substance nomenclature

The ecoinvent nomenclature for substances can be translated to a user defined nomenclature in order to make the data set compatible with other LCI data and impact assessment models. The same translation can be used for both LCI datasets and IA datasets from ecoinvent.

When an ecoinvent name for a flow is translated, the original substance name from ecoinvent will be saved in the ISO/TS 14048 field “Process.Inputs and outputs.Name.Specification of name” respectively the SPINE field ”Substance.Notes”. For IA datasets the original substance name will be saved in the IA98 field “Aspect.Notes”.

In the data conversion tool, the CPM 2004 nomenclature is available to facilitate a match with the impact assessment models available in e.g. LCA@CPM. The user can also choose to use a different nomenclature.

The user can choose to always use the ecoinvent name for a substance. If the ecoinvent name is not actively chosen, it will not be added to the user defined translation configuration. The option to choose to translate the substance name will thus reappear again at the next translation.

Default translation configuration

The choice of translation option is a voluntary step. If no choice is made a default data conversion configuration is used in the data conversion. The default translation configuration is set to make the translated data sets compatible with ISO/TS 14048 and SPINE tools as far as possible without changing the data too much.

- The EcoSpold nomenclature for “inputGroup” and “outputGroup” is translated to the nomenclature used within CPM.
- The ecoinvent nomenclature for subCategory is kept
- The direction of waste treatment processes is not changed.
- The ecoinvent nomenclature for substance names is kept.

Translation of XML files containing multiple data sets

The ecoinvent database gives the possibility to save up to 10 data sets in one EcoSpold XML file, and this conversion tool therefore supports conversion of XML files with both one and several data sets in them. This is however not recommended for LCI results from ecoinvent in case a nomenclature match is going to be made. This is because the ecoinvent LCI results contain very many inputs and outputs and the matching will take a long time. It is hence

recommended to convert XML files containing only one LCI result when a nomenclature match will be made.

Scope of the data conversion tool

The conversion tool is developed for conversion of LCI and IA datasets from the ecoinvent database in the EcoSpold format. The LCI datasets is converted into the ISO/TS 14048 format and/or the SPINE format. The IA datasets is converted into IA98, a format compatible with both ISO/TS 14048 and SPINE.

The translation has been optimized and tested for data sets from the ecoinvent database. Conversion of other datasets that may be available on the EcoSpold format, e.g. created from SimaPro or GaBi may function with this tool, but this has not been tested.

The ecoinvent database contains different types of data sets documented on the EcoSpold format. This conversion tool supports conversion of LCI datasets, i.e. unit processes (type=1), LCI results (type=2) and multi-output processes (type=5), and impact assessment datasets, i.e. impact category (type=4)

Excluded from the scope of the tool are data sets of type 3, i.e. elementary flow. Ecoinvent also provides data sets with ready-made impact assessment results, based on the data set of type unit process or LCI result, but this is outside the scope of the tool as well, since it is outside of the scope of ISO/TS 14048 and SPINE.

Adaptations performed to the existing functionality for conversion of data from ISO/TS 14048 to SPINE

Overview

The translation of a data set from EcoSpold to SPINE is achieved by first translating the data set to ISO/TS 14048 followed by a translation from ISO/TS 14048 to SPINE using already existing functionality for the latter translation. The data conversion functionality from ISO/TS 14048 to SPINE has been optimized for handling of translated EcoSpold data, to make sure that data translation functionality between EcoSpold and SPINE is of a good quality, even if it is performed via the intermediate format ISO/TS 14048. Examples of improvements that have been performed:

- Translation of ecoinvent nomenclatures in case of exclusive nomenclatures in SPINE.
Example: The different types of amounts in the EcoSpold format which can be stored in the general structure for amounts in ISO/TS 14048, have been translated to the corresponding types of amounts in SPINE.
- Parsing of ISO/TS 14048 fields in cases when a field in ISO/TS 14048 corresponds to several fields in both EcoSpold and in SPINE and these fields in EcoSpold and SPINE can be matched.
Example: Data on a person is stored in several fields both in EcoSpold and SPINE. ISO/TS 14048 does not support this kind of internal register of persons, and store instead information on a person in a single field. Functionality has been added in the translation from ISO/TS 14048 to SPINE to parse data on juridical persons so that the higher resolution in the data on persons in EcoSpold is maintained in SPINE.

Handling of essential fields in SPINE without a corresponding field in ISO/TS 14048

There is a set of fields in the SPINE data format which contain vital information for the usage and understanding of the information in the data set. These fields are in the automatic translation ofecoinvent data assigned values according to the table below.

Table 7. The translation of values in the category and subcategory nomenclatures which are performed on data conversion from EcoSpold to ISO/TS 14048 or SPINE.

Spine field with no corresponding field in ISO/TS 14048	Value on translation of EcoSpold data
Activity.Category	"Process"
Activity.Subtype	<i>Left empty</i>
Activity.Finished	"Yes"
ObjectOfStudy.ActivityType	"Process"

Handling of the Environment nomenclature in SPINE

The field Flow.ImpactMedia in SPINE is associated with the Environment nomenclature, which is a categorizing nomenclature. Each value in the nomenclature is related to a parent value in a hierarchical structure, and a value can only occur once in the hierarchical structure. The Environment nomenclature is also an inclusive nomenclature which means that new values can be added to the nomenclature. When converting data from ISO/TS 14048 to SPINE the Environment nomenclature is extended in the following way:

- If both *Receiving environment* and *Receiving environment specification* are defined
 - o Add *Receiving environment* to the Environment nomenclature with "Global" as parent
 - o Add *Receiving environment specification* to the Environment nomenclature with *Receiving environment* as parent
- If only *Receiving environment* is defined
 - o Add *Receiving environment* to the Environment nomenclature with "Global" as parent
- If only *Receiving environment specification* is defined
 - o Add *Receiving environment specification* to the Environment nomenclature with "Global" as parent

This approach is though not working if a data source is trying to add a value to the Environment nomenclature which already exists in the nomenclature with a different parent. The suggested approach is however the best possible solution if no assumption can be made on the appearance of the Environment nomenclature in the target database or of the corresponding nomenclature in the data source.

A nomenclature for Environment that is recommended within CPM is specified in [8]. When translating data from ecoinvent and extending the Environment nomenclature as specified above there should according to the specified EcoSpold nomenclatures only be the value "river" that causes problems. This problem was solved by replacing the EcoSpold subCategory value "river" by "River" on translation to SPINE, and inserting the value in the Environment nomenclature with "Water" as parent.

However, there are potentially more violations of the Environment nomenclature on import of ecoinvent data if the CPM nomenclature for Environment has been extended in the target database. For that reason the functionality to configure a translation for EcoSpold subcategory values was implemented as described in “Translation options” above.

Technical aspects of the Chalmers implementation

Overview

The implemented data conversion application has been integrated in the IMI portal⁷, which contains a set of integrated tools for industrial environmental information management facilitating efficient environmental work in accordance with standards. The IMI portal did already contain tools for translation of data between SPINE and ISO/TS 14048. This existing functionality has been extended with functionality for automatic conversion of ecoinvent data set stored in the EcoSpold data format to ISO/TS 14048, SPINE, or IA98.

The IMI portal is implemented using Java 2 Enterprise Edition (J2EE) and is built on the existing portal PHP Nukes⁸ which is an open source solution built on the JBoss⁹ application server. The Nukes portal provides a lot of functionality; among others handling of users and groups, security system with encrypted passwords and layout functions, which decreased the costs for developing the IMI portal. The java technology does also involve a highly modularized way of programming, which is very useful when integrating systems. The same implemented functionality can be used in many different contexts and in many different applications, which diminishes the costs for both maintaining the systems as well as development of new functionality.

Data conversion functionality

The data conversion application is based on a translation of XML documents using XSLT¹⁰, which is a W3C recommendation for transforming of XML documents. An XSLT stylesheet has been created which is used to translate an EcoSpold XML file into an ISO/TS 14048 XML file. Existing functionality also based on XSLT has been used to translate the resulting ISO/TS 14048 data into SPINE. For the translation from EcoSpold to IA98, two different translations have been implemented; one for conversion of characterization factors and one for conversion of impact factors (see 4.2 for more information). These translations have also been implemented using XSLT stylesheets. A more detailed overview of the different modules used in the implemented data conversion is provided in figure 4 below.

⁷ <http://databases.imi.chalmers.se/imiportal/>

⁸ <http://www.jboss.org/products/nukesjboss>

⁹ <http://www.jboss.org/>

¹⁰ <http://www.w3.org/TR/xslt>

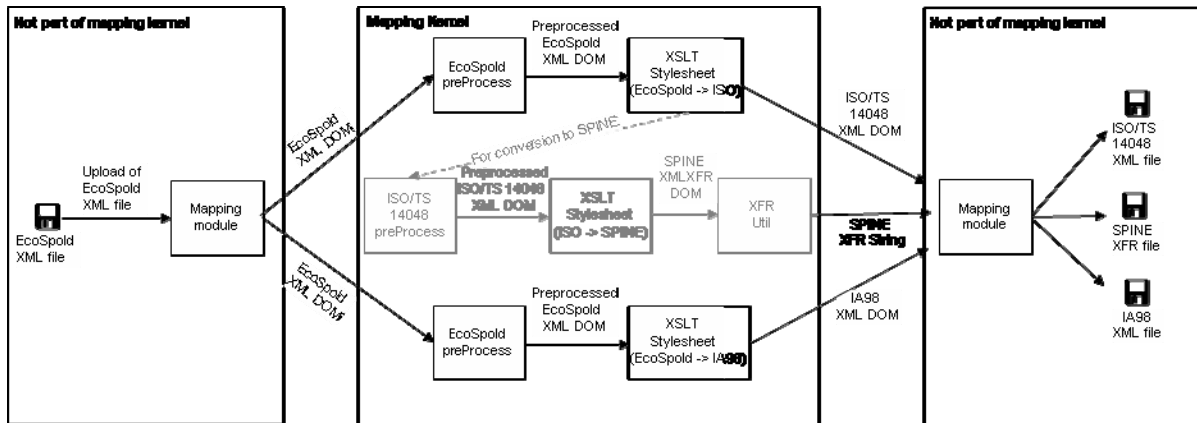


Figure 4: Overview of the different modules that are providing the functionality to convert an EcoSpold XML file into either an ISO/TS 14048 XML file, a SPINE XFR file, or an IA98 XML file.

Report generation functionality

The data conversion application supports generation of PDF- and HTML-reports from the ISO/TS 14048 and IA98 XML files. This is achieved by using the application Cocoon¹¹. First a general stylesheet is applied which transfers the communication file into a general document format with formatting tags (e.g. sections and headers). After this another stylesheet is applied to create the either an HTML or and PDF.

¹¹ <http://cocoon.apache.org/>

Appendix C: Interpretation of the EcoSpold format for impact assessment datasets

In the table below an interpretation is provided of how the EcoSpold format is applied for impact assessment datasets. The interpretation was developed for the purpose of data conversion into IA98. The interpretation is based on the technical specification and review of impact assessment datasets in ecoinvent.

Interpretation of the EcoSpold format for impact assessment datasets	
Name	Typical content of the field, based on review of datasets in ecoinvent and the specification of the format
META INFORMATION	Meta information for the impact category dataset Note: The EcoSpold fields "infrastructureProcess" and "infrastructureIncluded" is present in datasets, but missing in the specification. These fields have been excluded from the mapping
Process information	
Reference function	
datasetRelatesToProduct	Always "no" for impact category datasets Not relevant for IA data
name	Contains different types of information depending on method, e.g. type of impact (e.g. acidification), geographical specification (e.g. average European), or type of exchanges (e.g. emissions to air).
localName	The name translated into a local language (German)
amount	Amount of reference unit. Always "1" The amount is however not used
unit	The unit in which characterisation, or impact factors are expressed.
category	Contains the method name
subCategory	Contains different types of information depending on method, generally type of impact (e.g. climate change, acidification potential, ecosystem quality)
localCategory	The information in category translated into a local language (German)
localSubCategory	The information in subCategory translated into a local language (German)
generalComment	Can contain a description of the method or specifics regarding the implementation
formula	Not applicable for impact category datasets according to the EcoSpold specification
synonym	Alternative name for the method
Geography	
location	Geographical validity of the method/documentated characterisation or impact factors
text	Text description of the geographical validity of the method/documentated characterisation or impact factors
Technology	
text	Not applicable for impact category datasets according to the EcoSpold specification
Timeperiod	
dataValidForEntirePeriod	Indication of whether the data is valid for the entire specified timeperiod
text	Description of timeperiod for which the impact assessment data are valid
startDate	Start date for timeperiod for which the impact assessment data are valid
endDate	End date for timeperiod for which the impact assessment data are valid
Dataset Information	
type	Always "4" for impact category datasets
impactAssessmentResult	Always "false" for impact category datasets
timestamp	Timestamp for the last editing of dataset
version	Version number for the dataset
internalVersion	Internal version number for the dataset
energyValues	Type of energy values used in the dataset
languageCode	Code for the language in which the dataset is documented
localLanguageCode	Code for the language in which local names are documented

Modelling and validation	
Source	Specification of sources referred to in the documentation
number	
sourceType	
firstAuthor	
additionalAuthors	
year	
title	
pageNumbers	
nameOfEditors	
titleOfAnthology	
placeOfPublications	
publisher	
journal	
volumeNo	
issueNo	
text	
Validation	
proofReadingDetails	Contains the comment of the reviewer of the dataset.
proofReadingValidator	Reference to the person responsible for the review
otherDetails	Other details of the review
Administrative information	
Data entry by	Specification of the person who documented the data in the format
person	Reference to the person responsible for entering the documentation in the format
qualityNetwork	
Data generator and publication	Specification of the person who generated the data and the source for the data
person	Reference to the person responsible for generating the data
dataPublishedIn	
referenceToPublishedSource	
copyright	
accessRestrictedTo	
companyCode	
countryCode	
pageNumbers	
Person	Specification of persons referenced to in the documentation
number	
name	
address	
telephone	
telefax	
email	
companyCode	
countryCode	
FLOW DATA	
Exchange	Contains characterisation, damage or weighting factors for elementary flows.
number	Number of the elementary flow
category	Category for the elementary flow
subCategory	Subcategory for the elementary flow
localCategory	The information in category translated into a local language (German)
localSubCategory	The information in subCategory translated into a local language (German)
name	Name of elementary flow

localName	The information in name translated into a local language (German)
location	Geographical area for which the IA method is valid. In reviewed datasets, this information seem to be missing.
unit	Unit of the elementary flow. The amount (meanValue) and unit should be interpreted as "reference function unit"/"unit for exchange"
meanValue	The amount of the characterisation factor or impact factor
uncertaintyType	Type of distribution function for the amount, according to a nomenclature
standardDeviation95	Not available for ecoinvent impact assessment datasets
minValue	--"--
maxValue	--"--
mostLikelyValue	--"--
formula	Chemical formula for the elementary flow
referenceToSource	Not available for ecoinvent impact assessment datasets
pageNumbers	--"--
generalComment	--"--
inputGroup	The field seems to be missing in the ecoinvent impact assessment datasets
outputGroup	--"--
Allocation	Not included in the impact category specification of EcoSpold
referenceToCoProduct	
allocationMethod	
fraction	
explanations	
referenceToInputOutput	