Formatting Data for EAA
According to the CPM Data Documentation Criteria

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CPM-report 2002:2

1 Summary

This report presents the results of a collaboration project between European Aluminium Association and Centre for environmental assessment of Product and Material systems (CPM). The objectives were to format the Environmental Profile Report 2000 (EuropeanAluminiumAssociation 2000) for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at CPM and report the format procedure and result of the quality assessment. CPM made the formatting and reporting, while EAA supported the work with professional technical and environmental knowledge in the aluminium production and recycling activities.

The project started in September 2000 and was finalised one year later, however, the actual working-hours was about six weeks in all, including formatting, discussions with contact persons at EAA, and reporting. The fact that the project involved competence in industrial environmental informatics (at CPM) and technical and environmental aspects in aluminium production (at EAA) has been conclusive, just as the fact that the collaboration has been based on a common comprehension platform and mutual interest.

The SPINE methodology and data format was applied in the formatting. The formatting resulted in seven separately documented inventory models. The documentation of all seven SPINE formatted data sets can be found in appendix.

The environmental data presented in the Environmental Profile Report mainly describes the last phases in the design of a model of a technical system, according to PHASETS, i.e. the *aggregation* of models of technical systems and the *communication* of information between different contexts. It is concluded that the report for the aluminium industry presents aggregated mean values for the line of business in Europe and does not communicate e.g. information about the system synthesis, compilation of frequency functions etc. on each specific production plant.

The data supplier EAA has the right competence for handling information related to the aluminium industry as they have knowledge about the specific technology, equipment, and actual state of affairs etc. Nevertheless, the data credibility is dependent on the transparency of the documentation.

The transparency of the Environmental Profile Report can be further improved regarding the aggregation and communication aspects, as addressed in the chapter about data quality statement. Some recommendations on how this can be done are summarised in the result chapter.

2 Aims of the Project

There are three purposes associated with the project of formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM):

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

The Centre in Environmental Assessment of Product and Material Systems (CPM) initiated this project, after personal contact with Bernerd de Gélas at European Aluminium Association (EAA), Kurt Buxmann at Alusuisse, and Lage Knutsson at SAPA Technology.

3 SPINE Support for Documentation of a Model of a Technical System

The method for documentation of the model of the aluminium production is based on the SPINE concept. The concept is also applied in the data quality control. The SPINE concept supports a number of tools, all aiming at efficient and quality conscious industrial management of environmental information. For further information about SPINE, go to www.globalspine.com. Some of the main tools applied in this project are briefly presented in the following sub-chapters.

3.1 Method for Data Documentation

The method for data documentation in the SPINE data format according to the CPM documentation criteria is applied in the project. The definition of a life cycle inventory data set according to SPINE addresses five different information areas; identification of the technical system, methods used to obtain the data set, details on data acquisition, flows of material and energy, and recommendations when using the data. The CPM documentation criteria implies that all these five information areas have to be described in order for the user to be able to decide whether the data set is applicable in his or her study, or not.

For further information about the SPINE data documentation method and criteria, see the detailed manual “Introduction and guide to LCA data documentation using the CPM data documentation criteria and the SPINE format” by Pålsson A-C, CPM Report 1999:1, which can be ordered from CPM or downloaded at www.globalspine.com.

3.2 Tools for Data Quality Management, e.g. PHASETS

The data quality definition at CPM is based on the aspects Reliability, Accessibility, and Relevance, see figure 1. Reliability refers to precision and credibility (transparency and competence), Accessibility refers to data communication, openness, and semantic aspects, and Relevance, finally, refers to relevance generally for LCA and specifically for a study.

For further information about the data quality definition, see "Introduction and guide to LCA data documentation using the CPM data documentation criteria and the SPINE format" by Pålsson A-C, CPM Report 1999:1, which can be ordered from CPM or downloaded at www.globalspine.com.

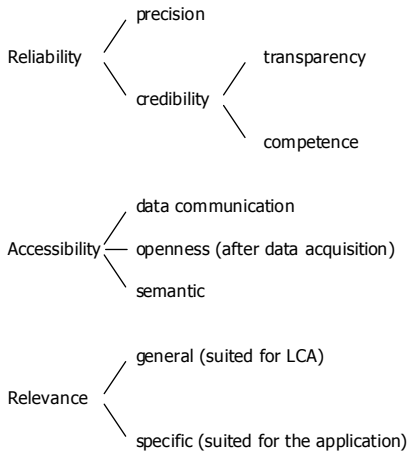

Figure 1 Dimensions of data quality according to CPM.

The PHASETS (PHASEs in the design of a model of a Technical System) model is also applied in the data quality control in the project. The model describes the design phases when modelling a technical system, i.e. starting with defining the measurement system, registration of the measurement data, compiling the frequency function, synthesising (model the technical system), aggregating models of technical systems (e.g. horizontal or vertical), and finally communicating information between different contexts, see figure 2.

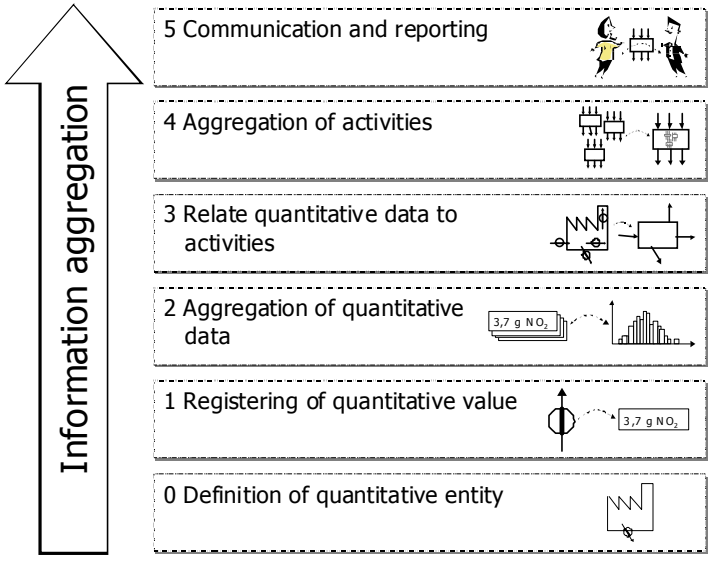

Figure 2 PHASETS describes how information on an entity representing a parameter of a system (inflow, outflow, internal state, etc.) starts existing at the point where the entity is defined, then quantified, transformed through analytical treatment, and finally reported (Carlson and Pålsson 2000).

For further information about PHASETS, see CPM report "PHASES, Information models for industrial environmental control" (Carlson and Pålsson 2000).

3.3 Software for Documentation, Communication, and Review

Two SPINE software tools have been used in the model data formatting work. The SPINE@CPM Data Tool has been used when documenting the data for aluminium production and recycling on the SPINE format. Further, this tool has also been used to generate reports on the result, both paper copies, presented as "SPINE Data Sets" in appendix, and web pages. The SPINE@CPM Data Tool simplifies the documentation, as it supports the practitioner in a structured and systematic documentation procedure and data quality system.

The SPINE Review Tool has been used in the final review work, when the data sets were compared, i.e. studied field by field next to each other in order to find and copy missing parts, correct contradictions etc.

The software tools are free to download at www.globalspine.com.

4 Method for Formatting the Aluminium Product System Data

The Environmental Profile Report has been formatted in three separate steps based on the presentation structure in the report; the primary aluminium production, the semi-finished product fabrication, and the recycling processes.

4.1 General Approach

The method for data formatting is based on the SPINE concept, see chapter on SPINE support for further information about this.

Maria Erixon at CPM has made the aluminium product system data formatting, with support from EAA. The support from specialists in the aluminium line of business has been crucial in the data formatting, as the unique knowledge and experience is essential to achieve a complete and correct description of the system. Bernard de Gèlas at EAA arranged a contact with Jostein Soreide at Hydro's Research Centre in Norway, who also is a member in the LCA working group in EAA. He was consulted regarding detailed questions on data acquisition and technical issues in the Environmental Profile Report. The collaboration has mainly been done over the phone, about three or four times in all. However, Mr Soreide also visited CPM once in the beginning of the project, during December 2000, to establish a good understanding of the project and relation to CPM, which has enabled an effective collaboration.

4.2 Practical Procedure

Firstly, the Environmental Profile Report was skimmed through, in order to get a picture of the activities and outline the structure of the model presentation in the SPINE format. The aim was to separate the models as far as possible, in order to get a flexible system with models that could be combined in different ways and parts of the system that could easily be exchanged or updated.

By ways of introduction, the models in the Environmental Profile Report was divided in three separate parts, similar to the presentation structure in the report, the primary aluminium production, the semi-finished product fabrication, and the recycling processes. Each part was

then studied separately, in order to decide on further divisions. The structure of the model presentation in the SPINE format was redefined several times during the project, due to that the models were not as easy to separate as it seemed at first sight.

When first skimming through the Environmental Profile Report in the beginning of the project, no less then nine inventory models could be perceived. However, when studying the data closer, a couple of the models had to be merged, due to the fact that the presentation form was not transparent enough. For example, the activities Alumina production and Aluminium electrolysis and casting had to be merged into one inventory model, namely "Primary aluminium production", because the transport data was merged for the two, otherwise separate, models. Further, the recycling processes scrap preparation for recycling of used aluminium and aluminium recycling by melting and alloying had to be merged into the inventory model, namely "Aluminium recycling by refiners", because of the scanty description of the two systems. It was impossible to distinguish which activities were included in which system and what system boundaries that were applied for the two models.

When the activities within each production part had been identified, the documentation work in SPINE@CPM Data Tool started. The Environmental Profile Report was read and available information inserted in the right fields in the SPINE format. When all available information seemed to be inserted, the SPINE format was studied, in order to try and find further information for empty fields, or in order to clarify certain information parts.

All questions that arose were noted, if possible, directly in the format and, in addition, questions and comments were collected in a separate working document, see "Questions and Comments during Formatting" in appendix.

When all activities within a production part had been documented, the questions were forwarded to the EAA contact person, who either answered them himself or sent them further to other persons within the organisation. The data sets within one production part were also compared by means of the SPINE Review Tool.

An assessment of the quality of the finalised data set was made from a PHASETS-perspective. The assessment is based on the data documented in the SPINE format, i.e. information taken both from the Environmental Profile Report and from the personal contacts.

Jostein Soreide has, as a representative for EAA, reviewed the formatted data in the SPINE format.

The structure of the model data presentation in SPINE:

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

5 Result

The outcome of this project is *seven SPINE formatted data sets*, based on the Environmental Profile Report 2000 for the European Aluminium Industry, documented by CPM and reviewed by EAA, a *method description of the formatting procedure*, a brief *data quality assessment*, and some general *recommendations for improvements* of the model data presentation, all found in this report. The SPINE formatted data sets can be studied in appendix, except for the numerical values in the inventory profile table, and can also be found in the SPINE@CPM database. The recommendations for improvements of the model data presentation are based on the memorandum in appendix.

5.1 The Formatting Procedure and Time Aspects

The Environmental Profile Report has been formatted in three separate steps based on the presentation structure in the report; the primary aluminium production, the semi-finished product fabrication, and the recycling processes. The SPINE methodology and data format is applied in the formatting, see chapter about SPINE support for further information about the methodology.

The first outline of how to format the inventory models in SPINE was quite a difficult task to achieve, as the models were not always consistently presented in the report. The model outline was in fact changed a few times during the documentation work, as new more detailed information about the systems came up.

The formatting of the data from the Environmental Profile Report resulted in seven separately documented inventory models, see schematic structure in figure3. The documentation of all seven SPINE formatted data sets can be found in appendix.

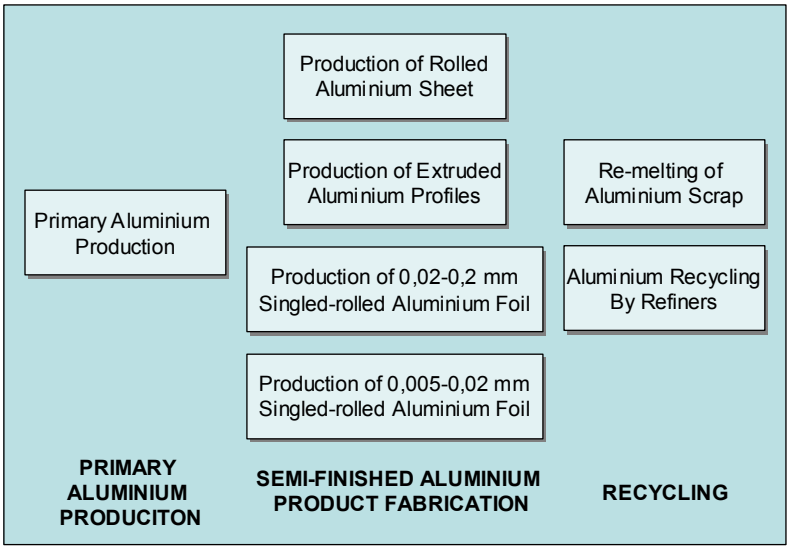

Figure 3 Inventory models for aluminium production documented in the SPINE data format, based on the Environmental Profile Report 2000 for the European Aluminium Industry.

After making the model outline, the data was documented according to the manual "Introduction and guide to LCA data documentation using the CPM data documentation criteria and the SPINE format" (Pålsson 1999), and questions discussed with the contact person from the LCA working group in EAA. Many of the questions that came up during the documentation were answered by EAA, which has been crucial for carrying out the formatting. However, some questions were not answered satisfactory e.g. due to limitations of project resources and time, e.g. regarding significant parameters and numbers in tables (see item 7, 13, and 20 in appendix chapter 7.2.2), and origin and specification of some of the flows (see item 5, and 21 in appendix chapter 7.2.2).

The project ran about one year, however, the actual working-hours was about six weeks in all, including formatting, discussions with contact persons at EAA, and reporting. The reasons for the drawn out project time are partly conscious and aim at establishing a common comprehension platform, shared by EAA and CPM, through a stepwise information flow combined with frequent personal contact. In addition, the "waiting time" during which the questions were answered at EAA is included in the drawn out project time. The prioritisation of other activities at CPM during the year also has to be regarded. Nevertheless, the actual working-hours of six weeks is indeed needed for a person who is educated and trained in the SPINE concept, to make a thorough formatting of the size of the Environmental Profile Report, from the start.

5.2 Data Quality Statement

This is a brief data quality statement regarding the SPINE formatted data sets, based on the data quality definition at CPM and the PHASETS model, see chapter about SPINE support for further information about these tools.

5.2.1 Reliability, Accessibility, and Relevance

Below, some general qualities of the data presentation in the Environmental Profile Report are stated, according to the data quality definition at CPM. The aspects mentioned are basically a summery of the most important and frequently noticed questions and comments that were made currently during the practical formatting, see memorandum in appendix for more detailed information.

Reliability
Reliability concerns the degree to which one may have confidence with data and it depends of the precision and credibility. Data precision concerns the uncertainty limitations of data. Further, according to CPM, the credibility of data is dependent on competence and transparency, i.e. whether the data supplier is trustworthy and the data acquisition procedure and source is described so that a review is possible.

Reliability – Margin or Errors and Significant Numbers
It is important to remember that precision makes no sense unless all other quality aspects of data are explicitly known, i.e. the system is well defined e.g. regarding the relevant (technical) transformation processes, system boundaries, allocation methods, flows passing through the system borders etc.

According to this, the report statement "for environmental data figures are usually accurate to a precision of 5%" can not be understood. The statement is very diffuse, and should be explained further: How relevant is the precision relatively other quality statements in the report? How is this figure obtained? What assumptions are made in the estimation or

calculation? For example, if it is not made clear to the practitioner whether a certain process or transport is included in the system or not, it is not relevant to apply the precision of 5% of the figures stated. The margin of error in the result is in this case obviously not dependent on the 5% precision of the figures in the main, but rather on the system boundaries.

There is also a lack of information about significant numbers in the tables. This is useful information e.g. when the data is aggregated, the models have to be re-modelled and the figures re-calculated. The information about significant numbers gives the practitioner a good picture of what is big and what is small in the processing of data. For example, when summing up quantities the rounding can have a great influence on the margin or errors.

Reliability – References
The reference chapter in the Environmental Profile Report is very scanty and does not give enough information for the practitioner or reviewer to find the information source for all parts of the reporting. It is recommended that a relevant reference can be found right next to the information in question, i.e. running in the text and connected to the tables. In addition, the relevant references should be found in the end of the report.

It is likely to assume that the data supplier EAA has the right competence for handling information related to the aluminium industry. They have competence concerning the specific technology, equipment, and actual state of affairs etc. Nevertheless, the data credibility is also based on the transparency of the documentation. The transparency can be further improved, as addressed in this chapter.

Accessibility
Accessibility is not an intrinsic property of data quality, but is a property of how accessible a data set or a part of a data set is, for data users. Unless others can access data, regardless of its credibility and precision, it is useless. Important aspects of accessibility are data communication (format), openness (secrecy issues), and semantics (language adapted to intended users).

Since the data formatting in this project, to an electronic version of the SPINE format, aim at increasing the accessibility, and the fact is, that the data currently is publicly available in the Environmental Profile Report, the comments below mainly addresses the semantic issues.

Accessibility – Technical Terms and Process Descriptions
LCA practitioners are mostly generalists, as they have an overall picture of the life cycle of one or several products, i.e. regarding extraction, refining, manufacturing, use, and recycling processes etc. This means that the specialists, e.g. within the aluminium industry, has to adapt the language of the technical and environmental information to that of a layman. Specific examples of technical terms from the Environmental Profile Report, which are not explained, are Prebake and Söderberg technology. The process descriptions and explanation of technical terms needs to be improved throughout the report.

Accessibility – Flows' Interface between the Environmental and Technical System
The inflows to and outflows from the technical system need to be thoroughly described in order for the LCA practitioner to e.g. make the environmental impact assessment. It is very important to state qualities like where the flow comes from or where it goes to (e.g. if it is a natural or refined resource input, a residue output to waste disposal or an emission to water etc.), what the flow consist of (e.g. a specification of the composition/content). In the

Environmental Profile Report it is very confusing that flows stated as “carbon blocks” and “packaging material” are natural resources. Further, flows like “anodes, refractory material, alloying elements, blasting material” should be specified with substance and/or material content in order to be useful in LCA.

Accessibility – Interpretation of Tables
It is important to clarify how the tables should be interpreted by providing descriptive text and to decide on one consistent way of presenting tables throughout the report. In the Environmental Profile Report one can notice that different persons have worked with different chapters as they vary in format and way of interpretation. For example, the energy presentation for primary aluminium production (table 2.4 in the Environmental Profile Report) and aluminium recycling by refiners (table 4.5.3 in the Environmental Profile Report) is totally different, which makes the interpretation and practical use much more difficult.

Relevance
Quality is an agreement between supplier and user. For data quality to exist, data needs to be relevant to the user's domain of interest. LCA is a systems analysis tool designed for solving specific environmental problems. In order for environmental data to be applicable in LCA it has to have a certain scoop. Descriptions of the model of the technical system and the system boundaries are examples of information parts that are very important in order for the practitioner to decide whether the data is applicable or not.

Relevance – Systems Analysis Approach and LCA Application
It is very important for a LCA practitioner to understand the object of study, i.e. the model of the technical system and the system boundaries. The Environmental Profile Report does not always give an unambiguous and distinct description of the models as mentioned earlier; see first section in the result chapter. The text in the report gives one picture of the models, whereas the tables show another. This confuses the comprehension and makes the interpretation of the models more difficult. Further, the aim should be to separate the models as far as possible, in regards of the feasibility and relevance. In this way the system will be flexible, with models that could be combined in different ways and parts of the system that could easily be exchanged or updated. However, there are other aspects to consider, such as secrecy issues.

Further, the system descriptions should explicitly clarify the system boundaries, i.e. which activities that are included in and excluded from the system. In the Environmental Profile Report it is quite complicated to make out these boundaries, e.g. regarding the transports (fuel consumption and transportation distances) and energy support (electrical energy generation etc.) related to each technical system.

It is also desirable that these activities are treated in the same way in all parts of the report, using similar terms and structure. For example, the energy chapter 2.2 in the Environmental Profile Report describes the energy supply for the primary aluminium production in a very detailed way, while for the other activities, i.e. semi-finished aluminium product fabrication and recycling, the energy supply is not mentioned at all outside the tables. Similarly, the transports should also be addressed outside the tables, explaining the conditions and limitations of the activities.

5.2.2 PHASETS, PHASEs in the design of a model of a Technical System

In this project the PHASETS model has been used as a base for a data quality assessment, chapter about SPINE support for further information about the model. According to PHASETS, the environmental data presented in the Environmental Profile Report mainly describes the last phases in the design of a model of a technical system, i.e. the aggregation of models of technical systems and the communication of information between different contexts. It is concluded that the report for the aluminium industry presents aggregated mean values for the line of business in Europe and does not communicate information about the system synthesis, compilation of frequency functions etc on each specific production plant.

The conclusion made from PHASETS is related to the transparency aspect in the data quality definition. According to the CPM data quality agreement, the credibility of the data source is partly dependent on the transparency, i.e. whether the data describes the acquisition procedure so that a review is possible. In this sense, the Environmental Profile Report does not give a transparent presentation of data.

5.3 Conclusions and Recommendations

The project and result turned out very successful. The formatting of the data from the Environmental Profile Report resulted in seven separately documented inventory models and the procedure is documented in this project report. The documentation of all seven SPINE formatted data sets can be found in appendix.

The fact that the project involved competence in industrial environmental informatics (at CPM) and technical and environmental aspects in aluminium production (at EAA) has been conclusive, just as the fact that the collaboration has been based on a common comprehension platform and mutual interest.

The Environmental Profile Report for the European Aluminium Industry is a very ambitious example of how the industry can provide LCA practitioners with LCI data. The models cover the life cycle phase stretching from bauxite mining to production of semi-finished products and the recycling processes are also included. Some parts of the reporting are described in detail, while others are described more generally.

The environmental data presented in the Environmental Profile Report mainly describes the last phases in the design of a model of a technical system, according to PHASETS, i.e. the *aggregation* of models of technical systems and the *communication* of information between different contexts. It is concluded that the report for the aluminium industry presents aggregated mean values for the line of business in Europe and does not communicate e.g. information about the system synthesis, compilation of frequency functions etc. on each specific production plant.

The data supplier EAA has the right competence for handling information related to the aluminium industry as they have knowledge about the specific technology, equipment, and actual state of affairs etc. Nevertheless, the data credibility is dependent on the transparency of the documentation.

The transparency of the Environmental Profile Report can be further improved regarding the aggregation and communication aspects, as addressed in the chapter about data quality statement. Some recommendations on how this can be done are summarised and stated below.

- Adapt the communication of the technical and environmental information to that of a layman; i.e. explain the processes and technical terms so that people outside the aluminium industry can make out the systems.

- Describe the model of the technical system and the system boundaries more in detail. Be consistent and thorough to enable a comprehensive picture of the aluminium production. Separate the models as far as possible, in order to get a flexible system with models that could be combined in different ways and parts of the system that could easily be exchanged or updated.

- State the qualities of the flows, where the flow comes from or where it goes to (e.g. if it is a natural or refined resource input, a residue output to waste disposal or an emission to water etc.), what the flow consist of (e.g. a specification of the composition/content).

- Put references right next to the information in question, i.e. running in the text and connected to the tables. In addition, make a complete list of all references in the end of the report.

- Clarify how the tables should be interpreted by providing descriptive text and decide on one consistent way of presenting tables throughout the report

6 References

Carlson, R. and A.-C. Pålsson (2000). PHASES, Information models for industrial environmental control. Göteborg, CPM.

EuropeanAluminiumAssociation (2000). Environmental Profile Report for the European Aluminium Industry. Brussels, European Aluminium Association.

Pålsson, A.-C. (1999). Introduction and guide to LCA data documentation using the CPM data documentation criteria and the SPINE format. CPM Report. Göteborg, Centre for Environmental Assessment of Product and Material Systems, Chalmers University of Technology.

7 APPENDIX

7.1 Introduction to appendix

Appendix contains the result of the SPINE data formatting of the Environmental Profile Report 2000 divided in three parts; Primary aluminium production, Semi-finished aluminium product fabrication, and Recycling. In addition, it includes the questions and comments that came up in the formatting that later were forwarded and posed to Jostein Soreide at EAA.

Appendix follows the structure of the resulting inventory models for aluminium production, which is sketched in figure 1.

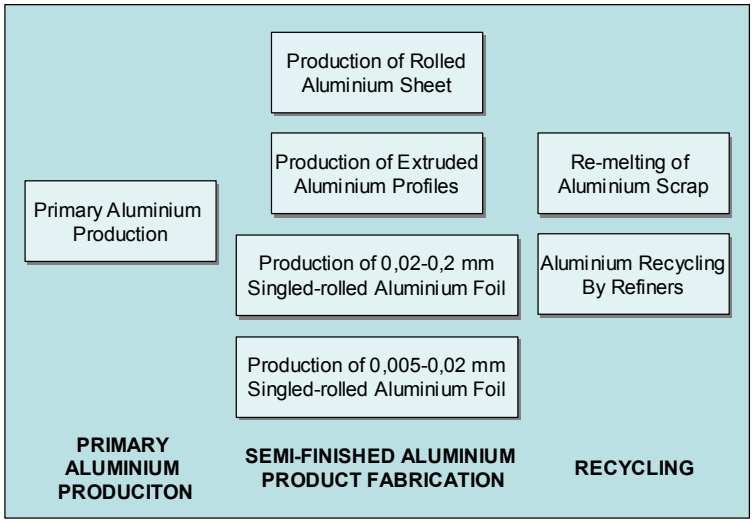

Figure 4 Inventory models for aluminium production documented in the SPINE data format, based on the Environmental Profile Report 2000 for the European Aluminium Industry.

Further, the data sets are presented in the SPINE format, which involves five documentation parts, see figure 2. The documentation presented in appendix includes all information, except for two parts; the flow table (4 in the figure), i.e. the inventory profile, and the specific flow meta data (parts of 5), i.e. specific description of methods used to obtain each flow quantity in the table. This information can be purchased from CPM at www.globalspine.se.

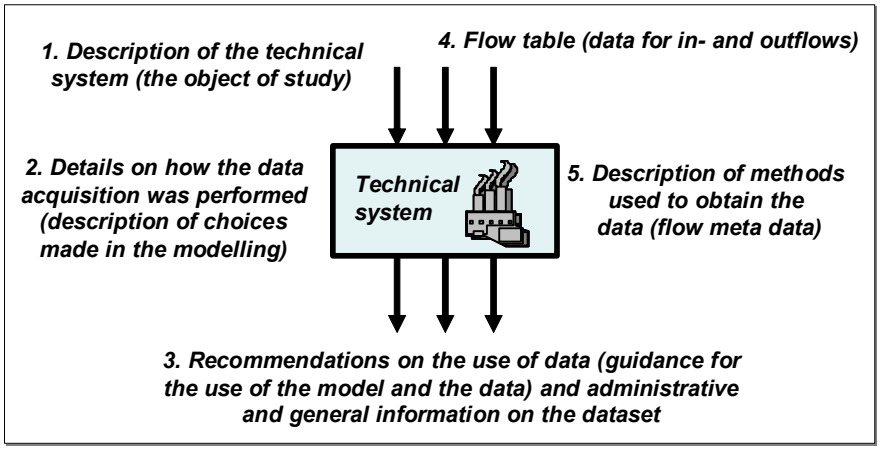

Figure 5 Scope of a data set in the SPINE data format (Ann-Christin Pålsson, CPM, 1997).

7.2 Primary Aluminium Production

7.2.1 Preliminary SPINE Data Set: Primary Aluminium Production

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

SPINE@CPM Data Tool 3.3
Transparent LCI Data Documentation and Reporting

START DATA SET DOCUMENTATION:

1. Description of the technical system; The Object of Study
ActivityId: cthesa002-2000-08-31-835
ObjectOfStudyId: cthesa002-2000-08-31-217
Name: Primary aluminum production
Category: Cradle to gate
Sector: Materials and components
Function: This system represents the production of primary aluminium that are sold on the European market. Some import of aluminium is included. About 40% of the primary aluminium used in Europe is imported (19% from Russia and 20% from the western world outside Europe, during the years 1990-1999).

The production includes the following process steps:

1. Bauxite mining
2. Transport of bauxite to alumina production plant (7453 km)
3. Production of alumina (aluminium oxide)
4. Transport of alumina to electrolysis (3998 km)
5. Electrolysis
6. Casting

Some of the process steps are described in more detail below.

3. Production of alumina (aluminium oxide): ----------

3.1. Production of NaOH (caustic soda)
3.2. Transport of NaOH to alumina production plant
3.3. Limestone mining, lime calcination
3.4. Transport of lime to alumina production plant
3.5. Production of alumina at the alumina production plant.The main raw material for alumina is bauxite, which is extracted from bauxite mines and processed into aluminium oxide at alumina production plants.

5. Electrolysis: ----------

5.1. Anode production, including anode butt recycling and transport to Electrolysis
    5.1.1 Petrol coke and filling material production and transport to Anode production
    5.1.2 Pitch production and transport to Anode production
5.2. Cathode production and transport to Electrolysis
5.3 AlF3 production and transport to Electrolysis

5.4. Production of liquid aluminium metal at the Electrolysis This system represents the European average situation, which uses about 15% Söderberg technology (anode consists of söderberg paste) and 85% Prebake technology (newer and cleaner technology with solid anodes) in the electrolysis.

6. Casting: ----------

Input material to this activity is liquid metal (from the electrolysis), alloying metals, and fluxing agents. A basic cast house have been worked out, i.e. typically yielding primary aluminium ingot for rolling, extrusion or remelting. No data for the production of alloying metals and fluxing agents is included in this data set.

ENERGY CONSUMPTION/PRODUCTION

The electrolysis, also referred to as the smelter, is by far the most energy consuming process in primary aluminium production. The total consumption in this system consists of the following elements:

- rectifying loss
- DC power usage
- pollution control equipment
- auxillary power (general plant use)
- net electric transmission losses of 2% have been taken into account from power stations to primary smelters, as all primary smeltershave their energy delivered by high voltage lines from power stations located nearby, and operate their own transformer facilities.

Use of energy and fossil fuel for electricity production and related air emissions is also included, except for nuclear and hydroelectricity which only includes the energy consumption in the distribution net.

A model for electricity production has been applied to this system, in accordance with the fact that about 40% of the primary aluminium used in Europe is imported (19% from Russia and 20% from the western world outside Europe, during the years 1990-1999). See headline Method under the section General QMetaData to get more details on the electricity production model.

Geographical location:

SiteId (in table JuridicalPerson): cpmcth000-2001-10-17-371
Name: Not specified.
MailAddress: See Geographical boundaries for further information.

Owner:

OwnerId (in table JuridicalPerson): cpmcth000-2001-10-17-370
Name: Not relevant

2. Details on how the data acquisition was performed; The Inventory

Persons and organisations involved with the data acquisition

Practitioner:
PractitionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

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Horsham GB-West Sussex RH13 7BD

Purpose of the data acquisition

Commissioner:
CommissionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
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Intended User:
LCA-practitioners.
General Purpose:
The European Aluminium Association (EAA) aims to contribute to further environmental improvements in aluminium products in a life cycle concept.
Detailed Purpose:
The purpose with the Environmental Profile Report 2000 is to provide LCA-practitioners with detailed and up-to-date information representing the aluminium industry activities in Europe.

The purposes with formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM) are:

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, regarding LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

Choice of functional unit

Functional Unit: 1000 kg aluminium ingot
Explanation of Functional Unit:
The aluminium ingots are delivered as slabs, billets etc.

Choice of system boundaries

Nature Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
Cut-off criteria through out this inventory is basically relevance, as checked by the industry expert team monitoring the work and confirmed by reviewer I. Boustead. As a rough guideline ''less than 1% of total mass'' is applied for the inputs, i.e if the input is less than 1% of the total mass, then it is not included in the inventory table. The base for the choices of included inventory parameters is not further described in the EAA report.

Time Boundary:
The data is collected between 1995 and 1998.
Data for Bauxite mining is from 1991.
Production of alumina (aluminium oxide): data for Limestone production from 1989-1994, data for Caustic soda production from 1999.
Data for the electricity supply systems, the fuel production and use (energy carrier consumption, emissions) is from 1998. **Geographical Boundary:**
--- SPECIFIC BOUNDARIES FOR THIS DATA SET---
The aim of the study was to represent the European aluminium market, i.e. the environmental performance of aluminium products sold in Europe. The data is collected from European aluminum producers to provide LCA-practitioners with detailed and up-to-date information representing the aluminium industry activities in Europe. For the aluminium imported to Europe, the electricity production system in Russia and the west world have been regarded.

--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
It is not always explicit in the report where the different included process steps take place. Data may be acquired from outside of Europe, e.g. regarding ancillary processes such as NaOH production, limestone mining, lime calcination, petrol coke production, pitch production, and AlF3 production. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for further information about the data sources for each process step.

Other Boundaries:
See Nature boundaries for a specification of the cut-off criteria that has been applied.

The production of alloying metals and fluxing agents is not included in this data set.

The energy use presented as electricity (nuclear and hydro) in the inventory table includes the energy loss in the distribution net. The production of electricity by nuclear and hydro is however not included.

Description on use of allocation methods; Allocations:
Allocations are not explicitly specified in the Environmental Profile Report 2000.
Systems expansions:
System expansions are not explicitly specified in the Environmental Profile Report 2000.

3. Recommendations on the use of data

Applicability:
--- SPECIFIC INFORMATION FOR THIS DATA SET ---

INFORMATION ABOUT THE SYSTEM

This system represents the European average situation, which uses about 15% Söderberg technology (anode consists of söderberg paste) and 85% Prebake technology (newer and cleaner technology with solid anodes) in the electrolysis.

The electrolysis, also referred to as the smelter, is by far the most energy consuming process in primary aluminium production. About 40% of the primary aluminium used in Europe is imported (19% from Russia and 20% from the western world outside Europe, during the years 1990-1999). An European model for electricity production has been applied to this system, according to this information. See headline Method under the section General QMetaData to get more information about the European electricity production model.

CASTING

At present cast houses in this industry vary significantly in age and size, and produce a wide variety of products and alloys. It has not been possible to produce one set of figures for every type of product and alloy, figures for a basic cast house have therefore been worked out, i.e. typically yielding primary aluminium ingot for rolling, extrusion or remelting. Data relative to specific further treatment of rolling and extrusion ingots, such as homogenisation, sawing, scalping etceteras are covered in later process steps, in the semi-finished product sections, also documented in SPINE format, see headline Semi-finished aluminium product fabrication above.

ENERGY USE IN THE DIFFERENT INCLUDED PROCESS STEPS

The energy directly consumed by the operations enclosed within the system bounderies, i.e. in the various production steps, are presented below. See the headline "DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION" in About Data for further information.

---3. Production of alumina (aluminium oxide) ---
Fuel oil (kg) 487,5
Hard coal (kg) 16,4
Gas (kg) 65,1
Electricity UCTPE* (kWh) 602,0

---5. Electrolysis---
Fuel oil (kg) 5,1
Gas (kg) 1,8
Electricity EAA-mix (kWh) 15574
Electricity UCTPE* (kWh) 2,6

---5.1. Anode production, including anode butt recycling and transport to Electrolysis---
Fuel oil (kg) 25,7
Hard coal (kg) 2,0
Gas (kg) 65,3
Electricity UCTPE* (kWh) 84,3

---5.2. Cathode production and transport to Electrolysis ---
Fuel oil (kg) 0,1
Gas (kg) 0,6
Electricity UCTPE* (kWh) 4,0

---6. Casting---
Fuel oil (kg) 10,5
Gas (kg) 13,9
Electricity EAA-mix (kWh) 16

* UCTPE 94 is an electrical energy model for energy supporting all processes in this system (including transports), except electrolysis and cast house. It is described in BUWAL 250, see litterature references.

--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

RECOMMENDATIONS BY EAA WHEN USING THE DATA

The data provided by the EAA members for their own process steps are the most up-to-date average data available for these processes, and it is recommended that they be used for LCA purposes. Older literature data should be disregarded, as it may no longer be representative due to technological improvements, progress in operating performance, changes with regard to raw materials or waste treatment, etc.

To complete the product system inventory, data
- on the production of consumer products, from semi-fabricated aluminium,
- on the performance of consumer products in the use phase, and
- on the recovery of scrap prior to remelting at the end of the product's useful life
should be acquired.

EAA recommend that these data be used in LCA studies in accordance with methodologies within the framework of the international standards in the ISO 14040-series.

RELATED DATA SETS IN SPINE DATA FORMAT

The data presented in the Environmental Profile Report is reformatted in to the SPINE format and structured according to the SPINE concept in as many separate activities (sub-systems) as possible. The system scope for the study as a whole is primary aluminium production, semi-finished aluminium production, and recycling. The SPINE formatting resulted in 7 activities. These activities are all published in the SPINE@CPM database.

The production and recycling step are intended to be used together. For example, to obtain a cradle to gate-system for rolled aluminium sheet, the activity Primary aluminium production should be connected to the activity Production of rolled aluminium sheet. A recycling step (Aluminium recycling by refiners) could also be connected to such a system, depending on the scope.

-- List of activities formatted in the SPINE-format, published in SPINE@CPM --

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

Please note: The recycling process 6. Re-melting of aluminium scrap is included in the semi-finished aluminium product fabrication, i.e. activities 2-5. When designing a product system with the activities above where recycled aluminium is regarded, the activity Aluminium recycling by refiners should be used. The Re-melting of aluminium activity is only a specification if the user is specifically interested in this process step.

RECYCLING RATES FOR ALUMINIUM PRODUCTS AFTER USE

After use, aluminium products are a valuable re-usable resource. The European recycling rates for end products are currently around 95% for the automotive sector and 85% for the building sector.

IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE OF ALUMINIUM PRODUCTS AND PROCESSES OVER THE PAST FEW YEARS

Over the past few years EAA has achieved major improvements in the environmental performance of its production processes by means of the following:
- improvement on existing technology
- development and introduction of new technology and operations
- increased recycling of all materials in the production process.

Examples of major environmental improvements in aluminium products achieved over the past few years include:
- weight reduction by downgauging in the packaging sector
- energy savings through weight reduction and subsequent fuel reduction in the transport sector
- reduction of maintenance in the building sector

The previous Ecological Profile Report from EAA was published in 1996.

About Data:
--- SPECIFIC INFORMATION FOR THIS DATA SET ---

DATA SOURCES

The sources of the various figures are aluminium company data in all cases in which the industry is directly involved in production. For other ancillary materials the data are in most cases supplied by the manufacturers of the products, but not necessarly all the plants supplying the European market.

In addition to the figures provided by the EAA members, data has also been collected from elsewhere for the process steps in which the European aluminium industry is not involved, i.e.:
- Bauxite mining

- Limestone production
- Caustic soda production
- Aluminium fluoride production
- Petrol coke production
- Pitch production

For those cases where EAA members' manufacturers' data were not available, published data have been used, see literature references.

DATA COLLECTION

The data is based on two surveys performed 1995 and 1998. LCI data for primary aluminium production derive from a survey for 1995, covering 92% of total European primary aluminium output. Another survey was carried out in 1998, covering 98% of the total European primary aluminium output, concentrating on parameters likely to have changed since 1995, i.e. about 30 major consumption or emission data items.

No data for the production of alloying metals and fluxing agents (added in the casthouse) is included in this data set.

AGGREGATION METHOD

Horizontal aggregation, i.e. averaging between primary plants for each fabrication step has been used in this report. This is chiefly because, apart from bauxite delivered to alumina plants, the supply of raw material to each individual plant varies with time (the bauxite supply to alumina production is relatively constant while the supply to other later process steps varies). The alternative would have been vertical aggregation, i.e. averaging the total production data for each smelter from bauxite, through the alumina plant and down to the smelter itself. However, the variation between the alumina plants, regarding the environmental profile, is in the range of +/- 15%, and as such would not have altered the overall result.

--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

PRECISION

According to EAA, the environmental data figures in the inventory table are usually accurate to a precision of 5%.

DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION

The electricity supply systems and fuel production and use (transport energy and emission data) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

All emissions connected with total fuel consumption (i.e. production and combustion of oil, gas or coal) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250', table 16.9. Emissions from combustion only, i.e. excluding the contribution of the production of the fuel, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of production and combustion of fuels in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, in view of the fact that the survey results were not sufficiently

reliable due to inconsistent use of conversion factors.

REVIEW OUTSPOKE

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, April 2000, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. Ian Bousteds' review comments on the Environmental Profile Report for the European Aluminium Industry, April 2000:

''...I have received the detailed calculations on which this present environmental report is based. All of the queries that I raised after working through these reports were answered satisfactory.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Good-quality data were supplied by the EAA member companies, and the number of companies participating provides good coverage of the various processes, meaning that the results can be regarded as representative of the industryas a whole for the production of primary aluminium and subsequent conversion processes.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Because of the very fragmented nature of the recycling industry and wide variations in practices, it is recognised that the data presented for this sector of the industry can only be regarded as indicative. Nevertheless it is helpful to have such information from an authorative source.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000 **Notes:**
REVIEWER

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. See AboutData for review comments.

Administrative and general information on the dataset

Copyright:
EAA
Availability: Public
Publication:
Environmental Profile Report for the European Aluminium Industry, European Aluminium Association, April 2000

Date Completed: 2002-05-07

4. Flow table (the inventory table is excluded from the presentation in this report).

5. Description of methods used to obtain the data; Flow Meta Data

For the entire data set; General Flow Meta Data

Meta Data Id: cthesa002-2000-08-31-870
Time period during which the data was acquired; Date Conceived: 1989-1999
Type of method used to obtain the data; Data Type: Derived, unspecified

Description of Method:
The data is taken from the report ''Environmental Profile Report for the European Aluminium Industry'', European Aluminium Association, April 2000.

INTERPRETATION OF FLOW TYPE AND ENVIRONMENT FOR INPUT FLOWS
Several of the input flows is ambigously presented in the report. It is not clear whether they should be regarded as natural resources or refined resources. The interpretation in the documentation in this format is made based on the naming of the flows, e.g. steel bars is not considered to be a natural resource, and the description of included process steps.

DATA SOURCES IN THE EAA-REPORT

The sources of the various figures are aluminium company data in all cases in which the industry is directly involved in production. For other ancillary materials the data are in most cases supplied by the manufacturers of the products, but not necessarly all the plants supplying the European market.

LCI data for primary aluminium production in this study derive from a survey for 1995, covering 92% of total European primary aluminium output. Another survey was carried out in 1998, covering 98% of the total European primary aluminium output, concentrating on parameters likely to have changed since 1995, i.e. about 30 major consumption or emission data items.

The data is collected from the aluminium companies in all cases where this industry is directly involved in the production. For other ancillary materials the data are in most cases collected from the manufacturers of the products, but not necessarly all the plants supplying the European market. For those cases where EAA members' manufacturers' data were not available, published data have been used. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for information about the data sources from which the inventory parameters is derived.

In addition to the figures provided by the EAA members, data has also been collected from elsewhere for the process steps in which the European aluminium industry is not involved, published data have been used, as referenced below:

- Bauxite mining: BUWAL Environmental series no. 132 (1991), IPAI Bauxite Mine survey, other sources

- Limestone production: I. Fecker, EMPA (1989), BUWAL Environmental series no. 132 (1991), Pechiney (1994), VAW (1994)

- Caustic soda production: I.Boustead. Ecoprofiles of plastics and related intermediates, APME Brussels (1999)

- Aluminium fuoride production: Norzinc/Alufluor/Pechiney (1994)

- Petrol coke production: Pechiney (1994), APME report no.2 (1995), Statoil (Norway, 1995)

- Pitch production: Hoogovens Staal, note 21 November 1997

METHOD FOR CALCULATION AND PRESENTATION OF ENERGY RESOURCES IN THE INVENTORY TABLE

The procedure for calculating and presenting the input parameters (energy carriers) brown coal, hard coal, natural gas, and crude oil in the inventory table is presented below. It is based on the tables in the EAA report (see litterature reference). Each of the input parameters stated are described in the inventory table and related note field according to this procedure:

A. Summary of the total energy resources for each energy carrier, respectively(from table 2.4 or 7.2)
B. Statement of how many kg that are used for transport, process, and production of fuel and electricity (from table 2.4 or 7.2)
C. Division of the energy resource input on the different process steps and statement on how much that are used for heat, electricity, feedstock and/or other (from table 7.2)
D. Division of the transport data in to the various types of transports means in the different process steps (from table 7.2)

METHOD FOR PRESENTATION OF SUBSTANCES, EXCEPT ENERGY RESOURCES

The substances stated in the table is flows to the system as a whole, described in Function. In order to get information about the relevant connection of a substance to a process step, see Note for each specific flow. Further information regarding the contribution to a flow from a specific process step can be found in table 7.2 and 7.3 in the Environmental Profile Report, see Literature reference. However, due to the presentation form in the Environmental Profile Report, it is not possible to separate the data for all the process steps completely.

SIGNIFICANT NUMBERS

The numbers stated in this table is taken directly from the EAA report (see litterature reference), except for the energy resources, which is taken from the EAA report but recalculated as described above in ''Method for calculation and ...''. For the energy resources two significant numbers are always stated in the inventory table. This was chosen because of insufficient specification of the significant numbers stated in the report. For further details about the calculation and rounding, see Method for the specific flow.

ELECTRICITY PRODUCTION MODEL FOR ELECTROLYSIS (PRIMARY SMELTER)

A model for electricity production has been applied to this system, in accordance with the fact that about 40% of the primary aluminium used in Europe is imported (19% from Russia and 20% from the western world outside Europe, during the years 1990-1999).

In the table below the share of aluminium produced in Europe, Russia and the West world (except Europe) is presented. Further, a specification of the electricity production model that has been used for the respective parts is presented.

Smelters:	European	Russian	West world (exc. Eur.)	Total model
Share of aluminium produced:	61%	19%	20%	100%
Energy resources:				
brown coal	7,7%	16,1%	-	5,1%
hard coal	17,5%	-	30,9%	20,0%
natural gas	5,5%	-	7,1%	4,6%
crude oil	5,1%	-	0,7%	3,1%

nuclear electricity	23,6%	2,2%	0,4%	14,6%
hydroelectricity	40,5%	81,7%	60,9%	52,6%
Total	100%	100%	100%	100%

The electricity supply systems have been taken from SAEFL Environmental Series 250 (1998) ''Buwal 250'' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems. Electricity used in Russian primary aluminium production is taken from a report by J. Schäfer (GDA, 1998) (a full reference to this report is not supplied in the Environmental Profile Report 2000).

ELECTRICITY MODEL OUTSIDE ELECTROLYSIS AND CAST HOUSE OPERATIONS

For all manufacturing operation other than electrolysis and cast house, the consumption of fossil fuels and emissions linked to electricity production was calculated according to the UCTPE 94 electrical energy model as described in BUWAL 250.

Represents:
See LitteratureRef.
Literature reference:
- ''Environmental Profile Report for the European Aluminium Industry'', European Aluminium Association, April 2000.

- Bauxite mining: BUWAL Environmental series no. 132 (1991), IPAI Bauxite Mine survey, other sources

- Limestone production: I. Fecker, EMPA (1989), BUWAL Environmental series no. 132 (1991), Pechiney (1994), VAW (1994)

- Caustic soda production: I.Boustead. Ecoprofiles of plastics and related intermediates, APME Brussels (1999)

- Aluminium fuoride production: Norzinc/Alufluor/Pechiney (1994)

- Petrol coke production: Pechiney (1994), APME report no.2 (1995), Statoil (Norway, 1995)

- Pitch production: Hoogovens Staal, note 21 November 1997

- SAEFL Environmental Series 250 (1998) ''Buwal 250''

- EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems

- Electricity used in Russian primary aluminium production is taken from a report by J. Schäfer (GDA, 1998)

Notes:
The residues arising in alumina production often called ''red mud'', have been separated into major constituents, the main one being bauxite residue, which is a mixture of chemically inert mineral oxides.

Specific for each flow; Specific Flow Meta Data (the description of methods used to obtain each figure in the table is excluded from the presentation in this report).

:END DATA SET DOCUMENTATION
SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

7.2.2 Questions and Comments during Formatting (Memorandum)

The questions and comments noted below arose when working with the re-formatting of data from the Environmental Profile Report to the SPINE format. They are not rewritten for this report. The questions and comments were currently discussed throughout the project, in a personal contact with a representative of EAA. The result of the discussions can be studied in the final SPINE data set.

1. What do you mean by Prebake and Söderberg technology? In which part of the process step is this technology applied?
2. The use of electricity in the smelter is obviously of great importance when calculating the environmental impact, but in which production step does the smelter occur?
3. Is the transport of lime and NaOH to the alumina production plant included in the study? It is included in the flow chart 2.3, but not described further in any text or table, e.g. table 7.2.
4. In appendix, e.g. in table 7.2, you can find the information “input from non-elementary flows mentioned in italics”. Is the correct interpretation that for caustic soda the system boundary is drawn at the production plant, i.e. the environmental load from the production plant is included, but not from the production steps before that, (e.g. semi-manufactured products, additives etc.)? Further, e.g. salt is followed to the nature system, as it is not written in Italics, i.e. the environmental load from all process steps in the production (from the cradle) of salt is included?
5. Is water (consumed and cooling, see input table 7.2) taken from the nature or a sewage treatment works? According to the interpretation in (4), both of the water input-parameters indicate that the water is taken from the nature?
6. What do you mean by the flow “emission to land”? Does it really go directly to the nature or does it go to another technical system e.g. for treatment or storage?
7. How many significant numbers are there in the tables?
8. Is there a predetermined date for the release of the next updated version of the Environmental Profile Report?
9. Is it true that the final production of Caustic soda (NaOH, 50%) and CaO (where can I find this production in the flow chart at page 14? Limestone mining or Lime calcination?) are included in the system, but not the previous process steps, i.e. refining and processing of material input to these production processes? Compare comment from Bernard de Gélas with the text in table: ”non-elementary flows mentioned in Italics”. What about Petrol coke and Pitch (table 7.2)?
10. AlF3, CaO, and others, is not stated as primary ingots, see Total column in table 7.2. Looking at the flow chart at page 14, I do not make this conclusion. What does the Total column mean?
11. Text from report with questions in brackets “Horizontal aggregation, i.e. averaging between primary plants for each fabrication step has been used in this report. This is chiefly because, apart from bauxite delivered to alumina plants, the supply of raw material to each individual plant varies with time (so what?). “The alternative would have been vertical aggregation, i.e. averaging the total production data for each smelter from bauxite,

through the alumina plant and down to the smelter itself. The variation (of what?) between the alumina plants is in the range of +/- 15%, however, and as such would not have altered the overall result." Does this statement concern alumina production as well as all the other process steps?

12. "448 kg Anodes net" is input in table 2.4, what kind of anode (material) is it? See also refractory material, cathodes, alloying elements, blasting material, fibre material etc.
13. What is the reason for choosing to present the parameters in the tables, e.g. table 2.4? It says above the table that "the most significant data are reported", but there is no explanation to what the word "significant" refers to.
14. The flows stated as emissions to land in the tables (e.g. table 2.4) are they really emissions to the nature or should they be regarded as residue (e.g. waste to treatment)?
15. Some raw materials in table 7.2 in appendix are not included in the table 2.4, e.g. N2-gas, Cast iron in the input list and ammonia, mercury in the output list etc. Why this separation, or rather, what is the motivation and the (consistent) rule for this?
16. Is the raw material for transports included in table 2.4 under "Energy resource"? What about the emissions from transportation?
17. In table 7.2, p.50, what is the meaning of the header "Fuels (direct use)", compared to the other energy-tables? Should it be included in the table, together with "Energy resources" (p.15) and Transport (p.51)?
18. P. 11 under headline "European model…" Do the nuclear electricity and hydroelectricity presentation not include the fuel production (but the energy generation)? Compare with other electricity production, which is presented as fuel (crude oil, natural gas etc.).
19. The total transport column in table 2.4 is not a summary of the transport columns in table 7.2 (bauxite and alumina transport), but also an addition of short and light transports incorporated in the other process steps. This information is not made clear in the tables, or the text. Further the transport column in output table 7.3, represents all transport, i.e. not only the bauxite and alumina transport as in the input table. This information is not made clear in the tables, or the text. This is crucial information e.g. if someone wants to re-model the system and separate the alumina production from the electrolysis and casting processes.
20. When summering the energy resources e.g. for processes, fuel production, electricity production (table 2.4), and the transportation (table 7.2) there are different significant numbers given.
21. The name of the natural resources is not always stating the raw material input, e.g. blasting material, carbon blocks, packaging materials, and refractory materials. This is confusing and will probably be a problem when making the impact assessment.
22. Alumina is input in table 2.4 (for Electrolysis to cast house), but it is not mentioned in the table as raw material input. This is an inconsistent representation when comparing with table 7.2, where all raw material input is stated: bauxite (Alumina production), alumina (Electrolysis), and liquid metal (Cast house).
23. There are no transport distances given in table 7.2, p. 50 for other transports than bauxite and alumina, but energy resources for transportation are stated at p. 51. An explanation for this is desired.

7.3 Semi-finished Aluminium Product Fabrication

7.3.1 Preliminary SPINE Data Set: Production of Rolled Aluminium Sheet

SPINE@CPM Data Tool 3.3
Transparent LCI Data Documentation and Reporting

START DATA SET DOCUMENTATION:

1. Description of the technical system; The Object of Study

ActivityId: CPMXFRTOOL2001-01-25834
ObjectOfStudyId: CPMXFRTOOL2001-01-25217
Name: Production of rolled aluminium sheet
Category: Gate to gate
Sector: Materials and components
Function: The inventory data cover rolled aluminium sheet production, e.g. sheet used in Europe for the outer parts of cars in the following typical delivered condition:
- surface mill-finish
- without lubrication/foil cadding/intermediate paper
- wooden EURO-pallets, sheets wrapped in PE foil, steel bands

The internal recycling of process scrap during sheet production is included.

The starting material for the production of rolled aluminium sheet is aluminium slab (rolling ingot) with alloy properties tailored to final use weighting up to 25 tinnes, and of a thickness of 500-700 mm. In this documentation form the starting material is referred to as ''aluminium ingot'' when it comes from an external primary aluminium or secondary aluminium plant. The starting material aluminium slab is also produced by remelting process scrap (Ingot remelting and casting) and this input is referred to as ''casting scrap''.

The aluminium ingot and casting scrap goes to the first process step ''Sawing and scalping''. After heating the aluminium slab to around 500 degrees Celsius, it is hot rolled, typically to 2-5 mm thickness, followed by cold rolling to the final gauge. An alternative production route, starting with continuous cast strip, is not considered here.

The process steps are:

- Production of semi-finished aluminium -
1. Sawing and scalping
2. Hot rolling
3. Cold rolling
4. Solution heat treatment
5. Finishing
6. Packaging
- Recycling of process scrap -
7. Ingot remelting and casting

Production of electricity is included in the system.

Some further details on the recycling of process scrap is given below.

From the process steps Sawing and scalping (154 kg), Hot rolling (139 kg), Cold rolling (73 kg), and Finishing (110 kg) scrap is going to the process step Ingot remelting and casting. The values in brackets is the amount of scrap delivered from each process step.
21 kg scrap is recycled within the process ingot remelting and casting.

Geographical location:

SiteId (in table JuridicalPerson): cpmcth000-2001-10-17-371
Name: Not specified.
MailAddress: See Geographical boundaries for further information.

Owner:

OwnerId (in table JuridicalPerson): cpmcth000-2001-10-17-370
Name: Not relevant

2. Details on how the data acquisition was performed; The Inventory

Persons and organisations involved with the data acquisition

Practitioner:
PractitionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Reviewer:

ReviewerId (in table JuridicalPerson): cthesa002-2000-08-31-373
Name: Dr. Ian Boustead,
MailAddress: 2 Black Cottages
West Grinstead,
Horsham GB-West Sussex RH13 7BD

Purpose of the data acquisition

Commissioner:
CommissionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Intended User:
LCA-practitioners.
General Purpose:
The European Aluminium Association (EAA) aims to contribute to further environmental improvements in aluminium products in a life cycle concept.
Detailed Purpose:

To provide LCA-practitioners with detailed and up-to-date information representing the aluminium The purpose with the Environmental Profile Report 2000 is to provide LCA-practitioners with detailed and up-to-date information representing the aluminium industry activities in Europe.

The purposes with formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM) are:

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, regarding LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

Choice of functional unit

Functional Unit: 1000 kg rolled aluminium sheet
Explanation of Functional Unit:
Typical delivered condition of rolled aluminium sheet:
- surface mill-finish
- without lubrication/foil cadding/intermediate paper
- wooden EURO-pallets, sheets wrapped in PE foil, steel bands

Choice of system boundaries

Nature Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
Cut-off criteria through out this inventory is basically relevance, as checked by the industry expert team monitoring the work and confirmed by reviewer I. Boustead. As a rough guideline ''less than 1% of total mass'' is applied for the inputs, i.e if the input is less than 1% of the total mass, then it is not included in the inventory table. The base for the choices of included inventory parameters is not further described in the EAA report.

Time Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
The data derived from an industry survey from 1998 and includes literature data from reports dated 1998 and 1999.

Geographical Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
It is not always explicit in the report where the different included process steps take place. Data may be acquired from outside of Europe, e.g. regarding ancillary materials. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for further information about the data sources for each process step.
Other Boundaries:
See Nature boundaries for a specification of the cut-off criteria that has been applied.

Description on use of allocation methods; Allocations:
Allocations are not explicitly specified in the Environmental Profile Report 2000.
Systems expansions:
System expansions are not explicitly specified in the Environmental Profile Report 2000.

3. Recommendations on the use of data

Applicability:
--- SPECIFIC INFORMATION FOR THIS DATA SET ---

ENERGY USE IN THE DIFFERENT INCLUDED PROCESS STEPS

The energy directly consumed by the operations enclosed within the system bounderies, i.e. in the various production steps, are presented below. See the headline "DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION" in About Data for further information.

---Production of semi-finished aluminium---
Fuel oil (kg) 0,34
Gas (kg) 46,5
Electricity UCTPE* (kWh) 547

---Process scrap recycling---
Fuel oil (kg) 0,41
Gas (kg) 33
Electricity UCTPE* (kWh) 75

* UCTPE 94 is an electrical energy model for energy supporting all processes in this system (including transports), except electrolysis and cast house. It is described in BUWAL 250, see litterature references.

ENERGY CONSUMPTION - INFLUENCE OF ALLOY GRADE AND INGOT HOMOGENEISATION TREATMENT

This data set represents an average aluminium alloy. Different alloy types have different energy consumption data; some alloys undergo ingot homogeneisation thermal treatment; hard alloys need more energy for rolling than soft alloys or unalloyed aluminium. In the table below you can find some examples of the variation. The values are presented per 1000 kg rolled aluminium sheet.

Alloy groups:
I. includes unalloyed aluminium (all 1xxx designations)
II. includes alloyed aluminium designated 3xxx, 5xxx (Mg<2,5%), 6xxx and 8xxx
III. includes alloyed aluminium designated 2xxx, 5xxx (Mg>2,5%) and 7xxx

Electricity consumption (kWh)	I	II	III	Overall weighted average
non-homogenised	592	642	661	622
homogenised	637	687	706	667
Gas consumption (kg)				
non-homogenised	79,3	79,6	79,5	79,5

homogenised	94,3	94,6	94,5	94,5

--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

RECOMMENDATIONS BY EAA WHEN USING THE DATA

The data provided by the EAA members for their own process steps are the most up-to-date average data available for these processes, and it is recommended that they be used for LCA purposes. Older literature data should be disregarded, as it may no longer be representative due to technological improvements, progress in operating performance, changes with regard to raw materials or waste treatment, etc.

To complete the product system inventory, data
- on the production of consumer products, from semi-fabricated aluminium,
- on the performance of consumer products in the use phase, and
- on the recovery of scrap prior to remelting at the end of the product's useful life

should be acquired.

EAA recommend that these data be used in LCA studies in accordance with methodologies within the framework of the international standards in the ISO 14040-series.

RELATED DATA SETS IN SPINE DATA FORMAT

The data presented in the Environmental Profile Report is reformatted in to the SPINE format and structured according to the SPINE concept in as many separate activities (sub-systems) as possible. The system scope for the study as a whole is primary aluminium production, semi-finished aluminium production, and recycling. The SPINE formatting resulted in 7 activities. These activities are all published in the SPINE@CPM database.

The production and recycling step are intended to be used together. For example, to obtain a cradle to gate-system for rolled aluminium sheet, the activity Primary aluminium production should be connected to the activity Production of rolled aluminium sheet. A recycling step (Aluminium recycling by refiners) could also be connected to such a system, depending on the scope.

-- List of activities formatted in the SPINE-format, published in SPINE@CPM --

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

Please note: The recycling process 6. Re-melting of aluminium scrap is included in the semi-finished aluminium product fabrication, i.e. activities 2-5. When designing a product system with the activities above where recycled aluminium is regarded, the activity Aluminium

recycling by refiners should be used. The Re-melting of aluminium activity is only a specification if the user is specifically interested in this process step.

RECYCLING RATES FOR ALUMINIUM PRODUCTS AFTER USE

After use, aluminium products are a valuable re-usable resource. The European recycling rates for end products are currently around 95% for the automotive sector and 85% for the building sector.

IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE OF ALUMINIUM PRODUCTS AND PROCESSES OVER THE PAST FEW YEARS

Over the past few years EAA has achieved major improvements in the environmental performance of its production processes by means of the following:
- improvement on existing technology
- development and introduction of new technology and operations
- increased recycling of all materials in the production process.

Examples of major environmental improvements in aluminium products achieved over the past few years include:
- weight reduction by downgauging in the packaging sector
- energy savings through weight reduction and subsequent fuel reduction in the transport sector
- reduction of maintenance in the building sector

The previous Ecological Profile Report from EAA was published in 1996.

About Data:
--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

PRECISION

According to EAA, the environmental data figures in the inventory table are usually accurate to a precision of 5%.

DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION

The electricity supply systems and fuel production and use (transport energy and emission data) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

All emissions connected with total fuel consumption (i.e. production and combustion of oil, gas or coal) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250', table 16.9. Emissions from combustion only, i.e. excluding the contribution of the production of the fuel, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of production and combustion of fuels in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, in view of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.

REVIEW OUTSPOKE

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, April 2000, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. Ian Bousteds' review comments on the Environmental Profile Report for the European Aluminium Industry, April 2000:

''...I have received the detailed calculations on which this present environmental report is based. All of the queries that I raised after working through these reports were answered satisfactory.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Good-quality data were supplied by the EAA member companies, and the number of companies participating provides good coverage of the various processes, meaning that the results can be regarded as representative of the industryas a whole for the production of primary aluminium and subsequent conversion processes.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Because of the very fragmented nature of the recycling industry and wide variations in practices, it is recognised that the data presented for this sector of the industry can only be regarded as indicative. Nevertheless it is helpful to have such information from an authorative source.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

Notes:

REVIEWER

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. See AboutData for review comments.

Administrative and general information on the dataset

Copyright:
EAA
Availability: Public
Publication:
Environmental Profile Report for the European Aluminium Industry, European Aluminium Association, April 2000
Date Completed: 2002-05-07

4. Flow table (the inventory table is excluded from the presentation in this report).

5. Description of methods used to obtain the data; Flow Meta Data

For the entire data set; General Flow Meta Data

Meta Data Id: CPMXFRTOOL2001-01-25869
Time period during which the data was acquired; Date Conceived: 1998
Type of method used to obtain the data; Data Type: Derived, unspecified

Description of Method:

PRODUCTION OF SEMI-FINISHED ALUMINIUM
The data derive from an industry survey with a coverage ranging from 20% to 70%, depending on the product in question.

INGOT REMELTING AND CASTING (RECYCLING OF PROCESS SCRAP)
Data were obtained from aluminium-integrated cast house operations, i.e. cast houses associated with semi-finished aluminium production. The 1998 survey on semi-finished aluminium products also encompassed aluminium-integrated cast houses, with 37% coverage for the recycling of process scrap.

TRANSPORTS
Transport energy and air emission data have been taken from SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9

ELECTRICITY
For all manufacturing operations, the consumption of fossil fuels and emissions linked to electricity production was calculated according to the UCTPE 94 electrical energy model as described in BUWAL 250.

Emissions from combustion only, i.e. without the precombustion contribution, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of precombustion and combustion in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, inview of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.
Represents:
Not relevant.
Literature reference:
---Rolled sheet production and process scrap recycling
Industry survey from 1998

---Transport energy, electricity, and air emission
- SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9
- EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

Notes:

In this inventory profile it is possible to identify which process step (Rolled sheet production, Process scrap recycling) the flow is connected to and if it derives from the energy use, see Note-field for each specific flow. However, in order to get the numerical data devided on these two process steps, see Environmental Profile Report (EAA, 2000).

Specific for each flow; Specific Flow Meta Data (the description of methods used to obtain each figure in the table is excluded from the presentation in this report).

:END DATA SET DOCUMENTATION
SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

7.3.2 Preliminary SPINE Data Set: Production of Extruded Aluminium Profiles

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

SPINE@CPM Data Tool 3.3
Transparent LCI Data Documentation and Reporting

START DATA SET DOCUMENTATION:

1. Description of the technical system; The Object of Study

ActivityId: cthesa002-2000-11-27-843
ObjectOfStudyId: cthesa002-2000-11-27-221
Name: Production of extruded aluminium profiles
Category: Gate to gate
Sector: Materials and components
Function: The inventory data cover the total semi-fabrication process steps, from extrusion billet production up to packaging before delivery, for the production of aluminium profiles such as those typically used in window or car component manufacture. The internal recycling of process scrap during the extrusion production is included.

The starting material for the production of rolled aluminium extrusion is an extrusion billet (extrusion ingot). In this documentation the starting material is referred to as ''aluminium ingot'' when it comes from an external primary aluminium or secondary aluminium plant. Rolled aluminium extrusion is also produced by remelting process scrap (Ingot remelting and casting) and this input is referred to as ''casting scrap''.

The billet is preheated before extrusion to the required profile. Further processing steps include stretching, sawing and ageing before packaging and shipment to customer.

The included process steps are:

- Production of semi-finished aluminium -
1. Sawing and scalping
2. Preheating
3. Extrusion
4. Stretching
5. Sawing
6. Ageing
7. Packaging
- Recycling of process scrap -
8. Ingot remelting and casting

Production of electricity included in the system.

Some further details on the process step Ingot remelting and casting is given below:
From the process steps 1 and 3-6, Sawing and scalping , Extrusion, Stretching, Sawing and Ageing scrap is going to the process step Ingot remelting and casting. 268 kg scrap is delivered from Sawing and scalping and 309 kg scrap is delivered from Extrusion, Stretching, Sawing and Ageing.

23 kg casting scrap is recycled within the ingot remelting and casting process.

Geographical location:

SiteId (in table JuridicalPerson): cpmcth000-2001-10-17-371
Name: Not specified.
MailAddress: See Geographical boundaries for further information.

Owner:

OwnerId (in table JuridicalPerson): cpmcth000-2001-10-17-370
Name: Not relevant

2. Details on how the data acquisition was performed; The Inventory

Persons and organisations involved with the data acquisition

Practitioner:
PractitionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Reviewer:

ReviewerId (in table JuridicalPerson): cthesa002-2000-08-31-373
Name: Dr. Ian Boustead,
MailAddress: 2 Black Cottages
West Grinstead,
Horsham GB-West Sussex RH13 7BD

Purpose of the data acquisition

Commissioner:
CommissionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Intended User:
LCA-practitioners.
General Purpose:
The European Aluminium Association (EAA) aims to contribute to further environmental improvements in aluminium products in a life cycle concept.
Detailed Purpose:
The purpose with the Environmental Profile Report 2000 is to provide LCA-practitioners with

detailed and up-to-date information representing the aluminium industry activities in Europe.

The purposes with formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM) are:

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, regarding LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

Choice of functional unit

Functional Unit: 1000 kg extruded aluminium profile

Choice of system boundaries

Nature Boundary:

--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

Cut-off criteria through out this inventory is basically relevance, as checked by the industry expert team monitoring the work and confirmed by reviewer I. Boustead. As a rough guideline ''less than 1% of total mass'' is applied for the inputs, i.e if the input is less than 1% of the total mass, then it is not included in the inventory table. The base for the choices of included inventory parameters is not further described in the EAA report.

Time Boundary:

--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

The data derived from an industry survey from 1998 and includes literature data from reports dated 1998 and 1999.

Geographical Boundary:

--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

It is not always explicit in the report where the different included process steps take place. Data may be acquired from outside of Europe, e.g. regarding ancillary materials. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for further information about the data sources for each process step.

Other Boundaries:

See Nature boundaries for a specification of the cut-off criteria that has been applied.

Description on use of allocation methods; Allocations:

Allocations are not explicitly specified in the Environmental Profile Report 2000.

Systems expansions:

System expansions are not explicitly specified in the Environmental Profile Report 2000.

3. Recommendations on the use of data

Applicability:
--- SPECIFIC INFORMATION FOR THIS DATA SET ---

ENERGY USE IN THE DIFFERENT INCLUDED PROCESS STEPS

The energy directly consumed by the operations enclosed within the system bounderies, i.e. in the various production steps, are presented below. See the headline "DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION" in About Data for further information.

--- Production of semi-finished aluminium ---
Fuel oil (kg) 0,65
Gas (kg) 66
Electricity UCTPE* (kWh) 1142

--- Recycling of process scrap ---
Gas (kg) 35
Electricity UCTPE* (kWh) 179

* UCTPE 94 is an electrical energy model for energy supporting all processes in this system (including transports), except electrolysis and cast house. It is described in BUWAL 250, see litterature references.

ENERGY CONSUMPTION - INFLUENCE OF ALLOY GRADE AND INGOT HOMOGENEISATION TREATMENT

This data set represents an average aluminium alloy. Different alloy types have different energy consumption data; some alloys undergo ingot homogeneisation thermal treatment; hard alloys need more energy for rolling than soft alloys or unalloyed aluminium. In the table below you can find some examples of the variation. The values are presented per 1000 kg rolled aluminium sheet.

Alloy groups:
I. includes unalloyed aluminium (all 1xxx designations)
II. includes alloyed aluminium designated 3xxx, 5xxx (Mg<2,5%), 6xxx and 8xxx
III. includes alloyed aluminium designated 2xxx, 5xxx (Mg>2,5%) and 7xxx

Electricity consumption (kWh)	I	II	III	Overall weighted average
non-homogenised	592	642	661	622
homogenised	637	687	706	667
Gas consumption (kg)				
non-homogenised	79,3	79,6	79,5	79,5
homogenised	94,3	94,6	94,5	94,5

--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

RECOMMENDATIONS BY EAA WHEN USING THE DATA

The data provided by the EAA members for their own process steps are the most up-to-date average data available for these processes, and it is recommended that they be used for LCA purposes. Older literature data should be disregarded, as it may no longer be representative due to technological improvements, progress in operating performance, changes with regard to raw materials or waste treatment, etc.

To complete the product system inventory, data
- on the production of consumer products, from semi-fabricated aluminium,
- on the performance of consumer products in the use phase, and
- on the recovery of scrap prior to remelting at the end of the product's useful life

should be acquired.

EAA recommend that these data be used in LCA studies in accordance with methodologies within the framework of the international standards in the ISO 14040-series.

RELATED DATA SETS IN SPINE DATA FORMAT

The data presented in the Environmental Profile Report is reformatted in to the SPINE format and structured according to the SPINE concept in as many separate activities (sub-systems) as possible. The system scope for the study as a whole is primary aluminium production, semi-finished aluminium production, and recycling. The SPINE formatting resulted in 7 activities. These activities are all published in the SPINE@CPM database.

The production and recycling step are intended to be used together. For example, to obtain a cradle to gate-system for rolled aluminium sheet, the activity Primary aluminium production should be connected to the activity Production of rolled aluminium sheet. A recycling step (Aluminium recycling by refiners) could also be connected to such a system, depending on the scope.

-- List of activities formatted in the SPINE-format, published in SPINE@CPM --

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

Please note: The recycling process 6. Re-melting of aluminium scrap is included in the semi-finished aluminium product fabrication, i.e. activities 2-5. When designing a product system with the activities above where recycled aluminium is regarded, the activity Aluminium recycling by refiners should be used. The Re-melting of aluminium activity is only a specification if the user is specifically interested in this process step.

RECYCLING RATES FOR ALUMINIUM PRODUCTS AFTER USE

After use, aluminium products are a valuable re-usable resource. The European recycling rates for end products are currently around 95% for the automotive sector and 85% for the building sector.

IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE OF ALUMINIUM PRODUCTS AND PROCESSES OVER THE PAST FEW YEARS

Over the past few years EAA has achieved major improvements in the environmental performance of its production processes by means of the following:
- improvement on existing technology
- development and introduction of new technology and operations
- increased recycling of all materials in the production process.

Examples of major environmental improvements in aluminium products achieved over the past few years include:
- weight reduction by downgauging in the packaging sector
- energy savings through weight reduction and subsequent fuel reduction in the transport sector
- reduction of maintenance in the building sector

The previous Ecological Profile Report from EAA was published in 1996.

About Data:
--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

PRECISION

According to EAA, the environmental data figures in the inventory table are usually accurate to a precision of 5%.

DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION

The electricity supply systems and fuel production and use (transport energy and emission data) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

All emissions connected with total fuel consumption (i.e. production and combustion of oil, gas or coal) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250', table 16.9. Emissions from combustion only, i.e. excluding the contribution of the production of the fuel, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of production and combustion of fuels in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, in view of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.

REVIEW OUTSPOKE

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, April 2000, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. Ian Bousteds' review comments on the Environmental Profile Report for the European Aluminium Industry, April 2000:

''...I have received the detailed calculations on which this present environmental report is based. All of the queries that I raised after working through these reports were answered satisfactory.'' Ian Bousted, Environmental Profile Report for the European Aluminium

Industry, April 2000

''Good-quality data were supplied by the EAA member companies, and the number of companies participating provides good coverage of the various processes, meaning that the results can be regarded as representative of the industryas a whole for the production of primary aluminium and subsequent conversion processes.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Because of the very fragmented nature of the recycling industry and wide variations in practices, it is recognised that the data presented for this sector of the industry can only be regarded as indicative. Nevertheless it is helpful to have such information from an authorative source.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

Notes:

REVIEWER

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. See AboutData for review comments.

Administrative and general information on the dataset

Copyright:
EAA
Availability: Public
Publication:
Environmental Profile Report for the European Aluminium Industry, European Aluminium Association, April 2000
Date Completed: 2002-05-07

4. Flow table (the inventory table is excluded from the presentation in this report).

5. Description of methods used to obtain the data; Flow Meta Data

For the entire data set; General Flow Meta Data

Meta Data Id: cthesa002-2000-11-27-1004
Time period during which the data was acquired; Date Conceived: 1998
Type of method used to obtain the data; Data Type: Derived, unspecified

Description of Method:
PRODUCTION OF SEMI-FINISHED ALUMINIUM
The data derive from an industry survey with a coverage ranging from 20% to 70%, depending on the product in question.

INGOT REMELTING AND CASTING (RECYCLING OF PROCESS SCRAP)
Data were obtained from aluminium-integrated cast house operations, i.e. cast houses associated with semi-finished aluminium production. The 1998 survey on semi-finished

aluminium products also encompassed aluminium-integrated cast houses, with 37% coverage for the recycling of process scrap.

TRANSPORTS
Transport energy and air emission data have been taken from SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9

ELECTRICITY
For all manufacturing operations, the consumption of fossil fuels and emissions linked to electricity production was calculated according to the UCTPE 94 electrical energy model as described in BUWAL 250.

Emissions from combustion only, i.e. without the precombustion contribution, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of precombustion and combustion in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, inview of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.
Represents:
Not relevant.
Literature reference:
---Rolled sheet production and process scrap recycling
Industry survey from 1998

---Transport energy, electricity, and air emission
- SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9
- EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

Notes:

In this inventory profile it is possible to identify which process step (Extruded profile production, Process scrap recycling) the flow is connected to and if it derives from the energy use, see Note-field for each specific flow. However, in order to get the numerical data devided on these two process steps, see Environmental Profile Report (EAA, 2000).

Specific for each flow; Specific Flow Meta Data (the description of methods used to obtain each figure in the table is excluded from the presentation in this report).

:END DATA SET DOCUMENTATION
SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

7.3.3 Preliminary SPINE Data Set: Production of 0,02-0,2 mm Single-rolled Aluminium Foil

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

SPINE@CPM Data Tool 3.3

Transparent LCI Data Documentation and Reporting

START DATA SET DOCUMENTATION:

1. Description of the technical system; The Object of Study

ActivityId: CPMXFRTOOL2001-02-01834
ObjectOfStudyId: CPMXFRTOOL2001-02-01217
Name: Production of 0,02-0,2 mm single-rolled aluminium foil
Category: Gate to gate
Sector: Materials and components
Function: Aluminium foil is used in varying gauges and in a number of alloys for a variety of applications. It is available in thickness from 5 microns to 200 microns (i.e. 0,005 to 0,2 mm) and can be supplied in a range of finishes. This data set represents the describes of aluminium foil in a thickness of 0,02-0,2 mm.

The starting material for the production of rolled aluminium foil is aluminium slab (rolling ingot), which is first rolled into foil stock, i.e. the specific input for foil fabrication. In this documentation, the starting material is referred to as ''aluminium ingot'' when is comes from an external primary or secondary aluminium plant. It is also produced by remelting process scrap internally within this system (Ingot remelting and casting) and this input is referred to as ''casting scrap''.

The process steps are:

- Aluminium foil production
1. Sawing and scalping
2. Preheating
3. Hot rolling
4. Cold rolling foil stock
5. Cold rolling single
6. Final anneal
7. Finishing
8. Packaging
- Process scrap recycling
9. Ingot remelting and casting

The production of electricity and fuels that are used is included in the system.

Some further details on the process step Ingot remelting and casting is given below

From the process steps 1-4, Sawing and scalping, Preheating, Hot rolling, and Cold rolling foil stock 589 kg scrap is going to the process step Ingot remelting and casting

The process steps 5-8 Cold rolling single, Final anneal, Finishing, and Packaging contributes with additional 234 kg scrap. 36 kg scrap is recycled within the process ingot remelting and casting.

Geographical location:

SiteId (in table JuridicalPerson): cpmcth000-2001-10-17-371
Name: Not specified.
MailAddress: See Geographical boundaries for further information.

Owner:

OwnerId (in table JuridicalPerson): cpmcth000-2001-10-17-370
Name: Not relevant

2. Details on how the data acquisition was performed; The Inventory

Persons and organisations involved with the data acquisition

Practitioner:
PractitionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Reviewer:
ReviewerId (in table JuridicalPerson): cthesa002-2000-08-31-373
Name: Dr. Ian Boustead,
MailAddress: 2 Black Cottages
West Grinstead,
Horsham GB-West Sussex RH13 7BD

Purpose of the data acquisition

Commissioner:
CommissionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Intended User:
LCA-practitioners.
General Purpose:
The European Aluminium Association (EAA) aims to contribute to further environmental improvements in aluminium products in a life cycle concept.
Detailed Purpose:
The purpose with the Environmental Profile Report 2000 is to provide LCA-practitioners with detailed and up-to-date information representing the aluminium industry activities in Europe.

The purposes with formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM) are:

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for

aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, regarding LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

Choice of functional unit

Functional Unit: 1000 kg aluminium foil (0,02-0,2 mm)
Explanation of Functional Unit:
Aluminium foil with thickness between 0,02 mm and 0,2 mm

Choice of system boundaries

Nature Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
Cut-off criteria through out this inventory is basically relevance, as checked by the industry expert team monitoring the work and confirmed by reviewer I. Boustead. As a rough guideline ''less than 1% of total mass'' is applied for the inputs, i.e if the input is less than 1% of the total mass, then it is not included in the inventory table. The base for the choices of included inventory parameters is not further described in the EAA report.

Time Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
The data derived from an industry survey from 1998 and includes literature data from reports dated 1998 and 1999.

Geographical Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
It is not always explicit in the report where the different included process steps take place. Data may be acquired from outside of Europe, e.g. regarding ancillary processes. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for further information about the data sources for each process step.
Other Boundaries:
See Nature boundaries for a specification of the cut-off criteria that has been applied.

Description on use of allocation methods; Allocations:
Allocations are not explicitly specified in the Environmental Profile Report 2000.
Systems expansions:
System expansions are not explicitly specified in the Environmental Profile Report 2000.

3. Recommendations on the use of data

Applicability:
--- SPECIFIC INFORMATION FOR THIS DATA SET ---

ENERGY USE IN THE DIFFERENT INCLUDED PROCESS STEPS

The energy directly consumed by the operations enclosed within the system bounderies, i.e. in the various production steps, are presented below. See the headline "DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION" in About Data for further

information.

Aluminium foil production---
Fuel oil (kg) 5,2
Gas (kg) 75
Electricity UCTPE* (kWh) 1475

---Process scrap recycling---
Fuel oil (kg) 0,7
Gas (kg) 57
Electricity UCTPE* (kWh) 130

* UCTPE 94 is an electrical energy model for energy supporting all processes in this system (including transports), except electrolysis and cast house. It is described in BUWAL 250, see litterature references.

--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

RECOMMENDATIONS BY EAA WHEN USING THE DATA

The data provided by the EAA members for their own process steps are the most up-to-date average data available for these processes, and it is recommended that they be used for LCA purposes. Older literature data should be disregarded, as it may no longer be representative due to technological improvements, progress in operating performance, changes with regard to raw materials or waste treatment, etc.

To complete the product system inventory, data
- on the production of consumer products, from semi-fabricated aluminium,
- on the performance of consumer products in the use phase, and
- on the recovery of scrap prior to remelting at the end of the product's useful life
should be acquired.

EAA recommend that these data be used in LCA studies in accordance with methodologies within the framework of the international standards in the ISO 14040-series.

RELATED DATA SETS IN SPINE DATA FORMAT

The data presented in the Environmental Profile Report is reformatted in to the SPINE format and structured according to the SPINE concept in as many separate activities (sub-systems) as possible. The system scope for the study as a whole is primary aluminium production, semi-finished aluminium production, and recycling. The SPINE formatting resulted in 7 activities. These activities are all published in the SPINE@CPM database.

The production and recycling step are intended to be used together. For example, to obtain a cradle to gate-system for rolled aluminium sheet, the activity Primary aluminium production should be connected to the activity Production of rolled aluminium sheet. A recycling step (Aluminium recycling by refiners) could also be connected to such a system, depending on the scope.

-- List of activities formatted in the SPINE-format, published in SPINE@CPM --

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

Please note: The recycling process 6. Re-melting of aluminium scrap is included in the semi-finished aluminium product fabrication, i.e. activities 2-5. When designing a product system with the activities above where recycled aluminium is regarded, the activity Aluminium recycling by refiners should be used. The Re-melting of aluminium activity is only a specification if the user is specifically interested in this process step.

RECYCLING RATES FOR ALUMINIUM PRODUCTS AFTER USE

After use, aluminium products are a valuable re-usable resource. The European recycling rates for end products are currently around 95% for the automotive sector and 85% for the building sector.

IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE OF ALUMINIUM PRODUCTS AND PROCESSES OVER THE PAST FEW YEARS

Over the past few years EAA has achieved major improvements in the environmental performance of its production processes by means of the following:
- improvement on existing technology
- development and introduction of new technology and operations
- increased recycling of all materials in the production process.

Examples of major environmental improvements in aluminium products achieved over the past few years include:
- weight reduction by downgauging in the packaging sector
- energy savings through weight reduction and subsequent fuel reduction in the transport sector
- reduction of maintenance in the building sector

The previous Ecological Profile Report from EAA was published in 1996.

About Data:
--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

PRECISION

According to EAA, the environmental data figures in the inventory table are usually accurate to a precision of 5%.

DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION

The electricity supply systems and fuel production and use (transport energy and emission data) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

All emissions connected with total fuel consumption (i.e. production and combustion of oil, gas or coal) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250', table 16.9. Emissions from combustion only, i.e. excluding the contribution of the production of the fuel, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of production and combustion of fuels in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, in view of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.

REVIEW OUTSPOKE

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, April 2000, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. Ian Bousteds' review comments on the Environmental Profile Report for the European Aluminium Industry, April 2000:

''...I have received the detailed calculations on which this present environmental report is based. All of the queries that I raised after working through these reports were answered satisfactory.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Good-quality data were supplied by the EAA member companies, and the number of companies participating provides good coverage of the various processes, meaning that the results can be regarded as representative of the industryas a whole for the production of primary aluminium and subsequent conversion processes.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Because of the very fragmented nature of the recycling industry and wide variations in practices, it is recognised that the data presented for this sector of the industry can only be regarded as indicative. Nevertheless it is helpful to have such information from an authorative source.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

Notes:

REVIEWER

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. See AboutData for review comments.

Administrative and general information on the dataset

Copyright:
EAA
Availability: Public
Publication:
Environmental Profile Report for the European Aluminium Industry, European Aluminium Association, April 2000
Date Completed: 2002-05-07

***4. Flow table** (the inventory table is excluded from the presentation in*

this report).

5. Description of methods used to obtain the data; Flow Meta Data

For the entire data set; General Flow Meta Data

Meta Data Id: CPMXFRTOOL2001-02-01869
Time period during which the data was acquired; Date Conceived: 1998
Type of method used to obtain the data; Data Type: Derived, unspecified

Description of Method:
PRODUCTION OF SEMI-FINISHED ALUMINIUM
The data derive from an industry survey with a coverage ranging from 20% to 70%, depending on the product in question.

INGOT REMELTING AND CASTING (RECYCLING OF PROCESS SCRAP)
Data were obtained from aluminium-integrated cast house operations, i.e. cast houses associated with semi-finished aluminium production. The 1998 survey on semi-finished aluminium products also encompassed aluminium-integrated cast houses, with 37% coverage for the recycling of process scrap.

TRANSPORTS
Transport energy and air emission data have been taken from SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9

ELECTRICITY
For all manufacturing operations, the consumption of fossil fuels and emissions linked to electricity production was calculated according to the UCTPE 94 electrical energy model as described in BUWAL 250.

Emissions from combustion only, i.e. without the precombustion contribution, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of precombustion and combustion in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, inview of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.
Represents:
Not relevant.
Literature reference:
---Aluminium foil production and process scrap recycling
Industry survey from 1998

---Transport energy, electricity, and air emission
- SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9
- EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

Notes:
Includes electricity produced by nuclear and hydro power (hydro 263 kWh and nuclear 647

kWh).

In this inventory profile it is possible to identify which process step (Aluminium foil production, Process scrap recycling) the flow is connected to, see Note-field for each specific flow. However, in order to get the numerical data devided on these two process steps, see Environmental Profile Report (EAA, 2000).

Specific for each flow; Specific Flow Meta Data (the description of methods used to obtain each figure in the table is excluded from the presentation in this report).

:END DATA SET DOCUMENTATION
SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

7.3.4 Preliminary SPINE Data Set: Production of 0,005-0,02 mm Double-rolled Aluminium Foil

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

SPINE@CPM Data Tool 3.3
Transparent LCI Data Documentation and Reporting

START DATA SET DOCUMENTATION:

1. Description of the technical system; The Object of Study
ActivityId: CPMXFRTOOL2001-02-06834
ObjectOfStudyId: CPMXFRTOOL2001-02-06217
Name: Production of 0,005-0,02 mm double-rolled aluminium foil
Category: Gate to gate
Sector: Materials and components
Function: Aluminium foil is used in varying gauges and in a number of alloys for a variety of applications. It is available in thickness from 5 microns to 200 microns (i.e. 0,005 to 0,2 mm) and can be supplied in a range of finishes. This data set describes the production of aluminium foil in a thickness of 0,005-0,02 mm.

The starting material for the production of rolled aluminium foil is aluminium slab (rolling ingot), which is first rolled into foil stock, i.e. the specific input for foil fabrication. In this documentation, the starting material is referred to as ''aluminium ingot'' when is comes from an external primary or secondary aluminium plant. It is also produced by remelting process scrap internally within this system (Ingot remelting and casting) and this input is referred to as ''casting scrap''.

The included process steps are:

- Aluminium foil production -
1. Sawing and scalping
2. Preheating
3. Hot rolling
4. Cold rolling foil stock
5. Cold rolling single
6. Final anneal

7. Finishing
8. Packaging
- Process scrap recycling -
9. Ingot remelting and casting

Electricity production is included in the system.

The process step "Ingot remelting and casting" is described in some further detail below.

From the process steps 1-4, Sawing and scalping, Preheating, Hot rolling, and Cold rolling foil stock 643 kg scrap is going to the process step ingot remelting and casting.

The process steps 5-8, Cold rolling single, Final anneal, Finishing, and Packaging contributes with additional 347 kg scrap. 44 kg scrap is recycled within the process ingot remelting and casting.

2. Details on how the data acquisition was performed; The Inventory

Persons and organisations involved with the data acquisition

Practitioner:
PractitionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Reviewer:
ReviewerId (in table JuridicalPerson): cthesa002-2000-08-31-373
Name: Dr. Ian Boustead,
MailAddress: 2 Black Cottages
West Grinstead,
Horsham GB-West Sussex RH13 7BD

Purpose of the data acquisition

Commissioner:
CommissionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Intended User:
LCA-practitioners.
General Purpose:

The European Aluminium Association (EAA) aims to contribute to further environmental improvements in aluminium products in a life cycle concept.
Detailed Purpose:
The purpose with the Environmental Profile Report 2000 is to provide LCA-practitioners with detailed and up-to-date information representing the aluminium industry activities in Europe.

The purposes with formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM) are:

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, regarding LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

Choice of functional unit
Functional Unit: 1000 kg aluminium foil (0,005-0,02 mm)
Explanation of Functional Unit:
Aluminium foil with thickness between 0,005 mm and 0,02 mm.

Choice of system boundaries
Nature Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
Cut-off criteria through out this inventory is basically relevance, as checked by the industry expert team monitoring the work and confirmed by reviewer I. Boustead. As a rough guideline ''less than 1% of total mass'' is applied for the inputs, i.e if the input is less than 1% of the total mass, then it is not included in the inventory table. The base for the choices of included inventory parameters is not further described in the EAA report.
Time Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
The data derived from an industry survey from 1998 and includes literature data from reports dated 1998 and 1999.
Geographical Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
It is not always explicit in the report where the different included process steps take place. Data may be acquired from outside of Europe, e.g. regarding ancillary processes. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for further information about the data sources for each process step.
Other Boundaries:
See Nature boundaries for a specification of the cut-off criteria that has been applied.

The production of primary or recycled aluminium is not included in the system.

Description on use of allocation methods; Allocations:

Allocations are not explicitly specified in the Environmental Profile Report 2000.
Systems expansions:
System expansions are not explicitly specified in the Environmental Profile Report 2000.

3. Recommendations on the use of data

Applicability:
--- SPECIFIC INFORMATION FOR THIS DATA SET ---

ENERGY USE IN THE DIFFERENT INCLUDED PROCESS STEPS

The energy directly consumed by the operations enclosed within the system bounderies, i.e. in the various process steps, are presented below. See the headline "DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION" in About Data for further information.

-- Aluminium foil production---
Fuel oil (kg) 15,2
Gas (kg) 98
Electricity UCTPE* (kWh) 1780

---Process scrap recycling---
Fuel oil (kg) 0,8
Gas (kg) 69
Electricity UCTPE* (kWh) 156

* UCTPE 94 is an electrical energy model for energy supporting all processes in this system (including transports), except electrolysis and cast house. It is described in BUWAL 250, see litterature references.

--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

RECOMMENDATIONS BY EAA WHEN USING THE DATA

The data provided by the EAA members for their own process steps are the most up-to-date average data available for these processes, and it is recommended that they be used for LCA purposes. Older literature data should be disregarded, as it may no longer be representative due to technological improvements, progress in operating performance, changes with regard to raw materials or waste treatment, etc.

To complete the product system inventory, data
- on the production of consumer products, from semi-fabricated aluminium,
- on the performance of consumer products in the use phase, and
- on the recovery of scrap prior to remelting at the end of the product's useful life

should be acquired.

EAA recommend that these data be used in LCA studies in accordance with methodologies within the framework of the international standards in the ISO 14040-series.

RELATED DATA SETS IN SPINE DATA FORMAT

The data presented in the Environmental Profile Report is reformatted in to the SPINE format and structured according to the SPINE concept in as many separate activities (sub-systems) as possible. The system scope for the study as a whole is primary aluminium production,

semi-finished aluminium production, and recycling. The SPINE formatting resulted in 7 activities. These activities are all published in the SPINE@CPM database.

The production and recycling step are intended to be used together. For example, to obtain a cradle to gate-system for rolled aluminium sheet, the activity Primary aluminium production should be connected to the activity Production of rolled aluminium sheet. A recycling step (Aluminium recycling by refiners) could also be connected to such a system, depending on the scope.

-- List of activities formatted in the SPINE-format, published in SPINE@CPM --

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

Please note: The recycling process 6. Re-melting of aluminium scrap is included in the semi-finished aluminium product fabrication, i.e. activities 2-5. When designing a product system with the activities above where recycled aluminium is regarded, the activity Aluminium recycling by refiners should be used. The Re-melting of aluminium activity is only a specification if the user is specifically interested in this process step.

RECYCLING RATES FOR ALUMINIUM PRODUCTS AFTER USE

After use, aluminium products are a valuable re-usable resource. The European recycling rates for end products are currently around 95% for the automotive sector and 85% for the building sector.

IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE OF ALUMINIUM PRODUCTS AND PROCESSES OVER THE PAST FEW YEARS

Over the past few years EAA has achieved major improvements in the environmental performance of its production processes by means of the following:
- improvement on existing technology
- development and introduction of new technology and operations
- increased recycling of all materials in the production process.

Examples of major environmental improvements in aluminium products achieved over the past few years include:
- weight reduction by downgauging in the packaging sector
- energy savings through weight reduction and subsequent fuel reduction in the transport sector
- reduction of maintenance in the building sector

The previous Ecological Profile Report from EAA was published in 1996.
About Data:
--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL

PROFILE REPORT 2000 ---

PRECISION

According to EAA, the environmental data figures in the inventory table are usually accurate to a precision of 5%.

DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION

The electricity supply systems and fuel production and use (transport energy and emission data) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

All emissions connected with total fuel consumption (i.e. production and combustion of oil, gas or coal) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250', table 16.9. Emissions from combustion only, i.e. excluding the contribution of the production of the fuel, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of production and combustion of fuels in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, in view of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.

REVIEW OUTSPOKE

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, April 2000, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. Ian Bousteds' review comments on the Environmental Profile Report for the European Aluminium Industry, April 2000:

''...I have received the detailed calculations on which this present environmental report is based. All of the queries that I raised after working through these reports were answered satisfactory.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Good-quality data were supplied by the EAA member companies, and the number of companies participating provides good coverage of the various processes, meaning that the results can be regarded as representative of the industryas a whole for the production of primary aluminium and subsequent conversion processes.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Because of the very fragmented nature of the recycling industry and wide variations in practices, it is recognised that the data presented for this sector of the industry can only be regarded as indicative. Nevertheless it is helpful to have such information from an authorative source.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

Notes:

REVIEWER

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. See AboutData for review comments.

Administrative and general information on the dataset

Copyright:
EAA
Availability: Public
Publication:
Environmental Profile Report for the European Aluminium Industry, European Aluminium Association, April 2000
Date Completed: 2002-05-06

4. Flow table (the inventory table is excluded from the presentation in this report).

5. Description of methods used to obtain the data; Flow Meta Data

For the entire data set; General Flow Meta Data

Meta Data Id: CPMXFRTOOL2001-02-06869
Time period during which the data was acquired; Date Conceived: 1998
Type of method used to obtain the data; Data Type: Derived, unspecified

Description of Method:
PRODUCTION OF SEMI-FINISHED ALUMINIUM
The data derive from an industry survey with a coverage ranging from 20% to 70%, depending on the product in question.

INGOT REMELTING AND CASTING (RECYCLING OF PROCESS SCRAP)
Data were obtained from aluminium-integrated cast house operations, i.e. cast houses associated with semi-finished aluminium production. The 1998 survey on semi-finished aluminium products also encompassed aluminium-integrated cast houses, with 37% coverage for the recycling of process scrap.

TRANSPORTS
Transport energy and air emission data have been taken from SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9

ELECTRICITY
For all manufacturing operations, the consumption of fossil fuels and emissions linked to electricity production was calculated according to the UCTPE 94 electrical energy model as described in BUWAL 250.

Emissions from combustion only, i.e. without the precombustion contribution, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of precombustion and combustion in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, inview of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.
Represents:

Not relevant.
Literature reference:
---Aluminium foil production and process scrap recycling
Industry survey from 1998

---Transport energy, electricity, and air emission
- SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9
- EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

Notes:
In this inventory profile it is possible to identify which process step (Aluminium foil production, Process scrap recycling) the flow is connected to, see Note-field for each specific flow. However, in order to get the numerical data devided on these two process steps, see Environmental Profile Report (EAA, 2000).

Specific for each flow; Specific Flow Meta Data (the description of methods used to obtain each figure in the table is excluded from the presentation in this report).

:END DATA SET DOCUMENTATION
SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

7.3.5 Questions and Comments during Formatting (Memorandum)

The questions and comments noted below arose when working with the re-formatting of data from the Environmental Profile Report to the SPINE format. They are not rewritten for this report. The questions and comments were currently discussed throughout the project, in a personal contact with a representative of EAA. The result of the discussions can be studied in the final SPINE data set.

Production of rolled aluminium sheet

1. Should all input substances (flows in the table 3.2.2.) be regarded as refined resources, except for the energy resources (brown coal, hard coal, natural gas, and crude oil)? What about nuclear and hydroelectricity?
2. The substances stated under "Fuels (direct use) and electricity" in the table 3.2.2 are excluded from the inventory profile according to the information given in "Primary aluminium production". Is this a correct interpretation?
3. Is "aluminium skimmings" also an internal parameter?
4. How should one interpret the information on page 22 regarding energy consumption?
5. Information regarding transport and electricity is used for semi-finished products, as in "Primary aluminium production", except for the Russian electricity production part. Is this correct?

Production of 0,005-0,02 mm double-rolled aluminium foil

1. According to the tables presenting the previous process steps (for Alumina production and Aluminium electrolysis and casting) the table double-rolled aluminium foil, 0,005-0,02 mm at page 33 indicates all substances in Italic if they are not followed to the nature? How about "aluminium ingot"?

7.4 Recycling

7.4.1 Preliminary SPINE Data Set: Re-melting of Aluminium Scrap

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

SPINE@CPM Data Tool 3.3
Transparent LCI Data Documentation and Reporting

START DATA SET DOCUMENTATION:

1. Description of the technical system; The Object of Study
ActivityId: CPMXFRTOOL2001-02-28834
ObjectOfStudyId: CPMXFRTOOL2001-02-28217
Name: Remelting of aluminium scrap
Category: Gate to gate
Sector: Materials and components
Function: The inventory data cover remelting of aluminium process scrap, i.e. scrap generated internally, during the production of aluminium semi-finished products. The scrap input for aluminium remelting is clean scrap, i.e. excluding coated scrap, other contaminated scrap (through oil, dirt, etc.) and skimmings, which are processed via the aluminium refiners.

Geographical location:
SiteId (in table JuridicalPerson): cpmcth000-2001-10-17-371
Name: Not specified.
MailAddress: See Geographical boundaries for further information.

Owner:
OwnerId (in table JuridicalPerson): cpmcth000-2001-10-17-370
Name: Not relevant

2. Details on how the data acquisition was performed; The Inventory

Persons and organisations involved with the data acquisition

Practitioner:
PractitionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Reviewer:
ReviewerId (in table JuridicalPerson): cthesa002-2000-08-31-373
Name: Dr. Ian Boustead,
MailAddress: 2 Black Cottages
West Grinstead,
Horsham GB-West Sussex RH13 7BD

Purpose of the data acquisition

Commissioner:
CommissionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Intended User:
LCA-practitioners.
General Purpose:
The European Aluminium Association (EAA) aims to contribute to further environmental improvements in aluminium products in a life cycle concept.
Detailed Purpose:
The purpose with the Environmental Profile Report 2000 is to provide LCA-practitioners with detailed and up-to-date information representing the aluminium industry activities in Europe.

The purposes with formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM) are:

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, regarding LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

Choice of functional unit
Functional Unit: 1000 kg aluminium ingot
Explanation of Functional Unit:
Aluminium rolling or extrusion ingot.

Choice of system boundaries
Nature Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
Cut-off criteria through out this inventory is basically relevance, as checked by the industry expert team monitoring the work and confirmed by reviewer I. Boustead. As a rough guideline ''less than 1% of total mass'' is applied for the inputs, i.e if the input is less than 1% of the total mass, then it is not included in the inventory table. The base for the choices of included inventory parameters is not further described in the EAA report.

Time Boundary:

--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
The data derived from an industry survey from 1998 and includes literature data from reports dated 1998 and 1999.

Geographical Boundary:

--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
It is not always explicit in the report where the different included process steps take place. Data may be acquired from outside of Europe, e.g. regarding ancillary materials. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for further information about the data sources for each process step.

Other Boundaries:
See Nature boundaries for a specification of the cut-off criteria that has been applied.

Description on use of allocation methods; Allocations:
Allocations are not explicitly specified in the Environmental Profile Report 2000.
Systems expansions:
System expansions are not explicitly specified in the Environmental Profile Report 2000.

3. Recommendations on the use of data

Applicability:
--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

RECOMMENDATIONS BY EAA WHEN USING THE DATA

The data provided by the EAA members for their own process steps are the most up-to-date average data available for these processes, and it is recommended that they be used for LCA purposes. Older literature data should be disregarded, as it may no longer be representative due to technological improvements, progress in operating performance, changes with regard to raw materials or waste treatment, etc.

To complete the product system inventory, data
- on the production of consumer products, from semi-fabricated aluminium,
- on the performance of consumer products in the use phase, and
- on the recovery of scrap prior to remelting at the end of the product's useful life

should be acquired.

EAA recommend that these data be used in LCA studies in accordance with methodologies within the framework of the international standards in the ISO 14040-series.

RELATED DATA SETS IN SPINE DATA FORMAT

The data presented in the Environmental Profile Report is reformatted in to the SPINE format and structured according to the SPINE concept in as many separate activities (sub-systems) as possible. The system scope for the study as a whole is primary aluminium production, semi-finished aluminium production, and recycling. The SPINE formatting resulted in 7 activities. These activities are all published in the SPINE@CPM database.

The production and recycling step are intended to be used together. For example, to obtain a cradle to gate-system for rolled aluminium sheet, the activity Primary aluminium production should be connected to the activity Production of rolled aluminium sheet. A recycling step

(Aluminium recycling by refiners) could also be connected to such a system, depending on the scope.

-- List of activities formatted in the SPINE-format, published in SPINE@CPM --

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

Please note: The recycling process 6. Re-melting of aluminium scrap is included in the semi-finished aluminium product fabrication, i.e. activities 2-5. When designing a product system with the activities above where recycled aluminium is regarded, the activity Aluminium recycling by refiners should be used. The Re-melting of aluminium activity is only a specification if the user is specifically interested in this process step.

RECYCLING RATES FOR ALUMINIUM PRODUCTS AFTER USE

After use, aluminium products are a valuable re-usable resource. The European recycling rates for end products are currently around 95% for the automotive sector and 85% for the building sector.

IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE OF ALUMINIUM PRODUCTS AND PROCESSES OVER THE PAST FEW YEARS

Over the past few years EAA has achieved major improvements in the environmental performance of its production processes by means of the following:
- improvement on existing technology
- development and introduction of new technology and operations
- increased recycling of all materials in the production process.

Examples of major environmental improvements in aluminium products achieved over the past few years include:
- weight reduction by downgauging in the packaging sector
- energy savings through weight reduction and subsequent fuel reduction in the transport sector
- reduction of maintenance in the building sector

The previous Ecological Profile Report from EAA was published in 1996.

About Data:
--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

PRECISION

According to EAA, the environmental data figures in the inventory table are usually accurate

to a precision of 5%.

DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION

The electricity supply systems and fuel production and use (transport energy and emission data) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

All emissions connected with total fuel consumption (i.e. production and combustion of oil, gas or coal) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250', table 16.9. Emissions from combustion only, i.e. excluding the contribution of the production of the fuel, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of production and combustion of fuels in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, in view of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.

REVIEW OUTSPOKE

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, April 2000, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. Ian Bousteds' review comments on the Environmental Profile Report for the European Aluminium Industry, April 2000:

''...I have received the detailed calculations on which this present environmental report is based. All of the queries that I raised after working through these reports were answered satisfactory.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Good-quality data were supplied by the EAA member companies, and the number of companies participating provides good coverage of the various processes, meaning that the results can be regarded as representative of the industryas a whole for the production of primary aluminium and subsequent conversion processes.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Because of the very fragmented nature of the recycling industry and wide variations in practices, it is recognised that the data presented for this sector of the industry can only be regarded as indicative. Nevertheless it is helpful to have such information from an authorative source.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

Notes:

REVIEWER

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. See AboutData for review comments.

Administrative and general information on the dataset

Copyright:
EAA
Availability: Public
Publication:
Environmental Profile Report for the European Aluminium Industry, European Aluminium Association, April 2000
Date Completed: 2002-05-07

4. Flow table (the inventory table is excluded from the presentation in this report).

5. Description of methods used to obtain the data; Flow Meta Data

For the entire data set; General Flow Meta Data

Meta Data Id: CPMXFRTOOL2001-02-28869
Time period during which the data was acquired; Date Conceived: 1998 - 1999
Type of method used to obtain the data; Data Type: Derived, unspecified

Description of Method:
REMELTING OF ALUMINIUM SCRAP
Data were obtained from aluminium-integrated cast house operations, i.e. cast houses associated with semi-finished aluminium production. The 1998 survey on semi-finished aluminium products also encompassed aluminium-integrated cast houses, with 37% coverage for the recycling of process scrap.

TRANSPORTS
Transport energy and air emission data have been taken from SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9

ELECTRICITY
For all manufacturing operations, the consumption of fossil fuels and emissions linked to electricity production was calculated according to the UCTPE 94 electrical energy model as described in BUWAL 250.

Emissions from combustion only, i.e. without the precombustion contribution, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of precombustion and combustion in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the industry survey reporting, data calculated from BUWAL 250 were always used, inview of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.
Represents:
Not relevant.
Literature reference:
---Recycling
- Aluminium scrap terms and definitions: pr EN 12258-3
- Aluminium BREF note: document prepared for the EU Comission, 1999

---Transport energy, electricity, and air emission

- SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9
- EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

Notes:

In this inventory profile it is possible to identify if the emission derives from the process or the energy use, see Note-field for each specific flow.

Specific for each flow; Specific Flow Meta Data (the description of methods used to obtain each figure in the table is excluded from the presentation in this report).

:END DATA SET DOCUMENTATION

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

7.4.2 Preliminary SPINE Data Set: Aluminium Recycling by Refiners

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

SPINE@CPM Data Tool 3.3
Transparent LCI Data Documentation and Reporting

START DATA SET DOCUMENTATION:

1. Description of the technical system; The Object of Study

ActivityId: CPMXFRTOOL2001-02-21834
ObjectOfStudyId: CPMXFRTOOL2001-02-21217
Name: Aluminium recycling by refiners
Category: Gate to gate
Sector: Materials and components
Function: This inventory data represents the model of used aluminium recycling practice in Europe, as operated by the aluminium refiners in an average recycling situation. The refining includes:
- Scrap preparation
- Melting and alloying

Production of electricity is included in the system.

The mix of technologies included is presented below, under the headline ''Scrap preparation'' and ''Melting and alloying''.

The aluminium refiners recycle old aluminium scrap, their typical material input comprising one-third aluminium scrap from end-of-life aluminium products, the rest is new scrap i.e turnings, skimmings and dross, and aluminium metallics.

Several melting processes are used. The choice of process depends upon a number of variables. These include the composition of the scrap, the process available within the given plant, and economic and scheduling priorities. A breakdown of the common melting technologies is given below, under the headline ''Information regarding secondary smelting

furnances''.

Molten metal fluxing (to treat the molten metal: chemical adjustment, cleaning, yield maximisation, degassing, etc.) and filtration technology (to remove any unwanted materials prior to casting) has been developed to produce aluminium alloys of the correct quality without undue environmental impact.

----------Scrap preparation----------
The scrap is sorted in the following categories:
1. shredder sheet scrap (4%)
2. shredder cast scrap (6%)
3. sink and float (9%)
4. baling (15%)
5. skimmings treatment (16%)
6. turnings treatment (50%)

--- Specification of the scrap ---

OLD SCRAP
Old scrap is the aluminium material which is recovered after an aluminium article has been produced, used and finally collected for recycling. Old scrap could be a used aluminium bevarage can, a car cylinder head, window frames, or electrical conductor cable.

Old aluminium scrap comes into the secondary industry via a very diversified and efficient network of metal merchants and waste management companies which have the technology to recover aluminium from vehicles, household goods, etc. This is often done using heavy equipment such as shredders, thogether with magnetic separators to remove iron, sink-and-float installations, or by the use of eddy current installations to separate aluminium from other metals.

NEW SCRAP
New scrap is surplus material that arises during the production and fabrication of aluminium products up to the point where they are sold to the final customer. Thus extrusion discards, sheet edge trim, turnings, millings and drosses could all be described as new scrap.

Most new aluminium scrap comes into the secondary industry directly from the fabricators. It is therefore of known quality and alloy, and is often uncoated. It can then be melted with little preparation, apart perhaps from baling.

Some new scrap that arises during semi-finishing processes may be coated with paints, ink, or plastics. This scrap can be decoated by passing scrap through an oven or a mesh conveyer whilst hot gases are circulated through the mesh to volatilise or burn off the coating.

----------Melting and alloying----------

The scrap is melted in a secondary smelting furnace. Different furnaces are used for European aluminium scrap refining:
1. Rotary furnance
2. Sloping hearth furnance
3. Open well reverberatory furnance
4. Electric furnance

and goes further to the process steps:

5. Holding furnance
6. Casting.

Further details on the rotary furnace process step:
Coated aluminium scrap is typically processed by aluminium refiners using a rotary furnance with a salt flux, yielding salt slag as a by-product. The reprocessing of salt slags to recover salt flux and aluminium oxide is part of the aluminium refiners' operations as it is carried out either by the refiner himself or by an independent reprocessing specialist.

The temperature of the molten metal is adjusted and alloying additions may be made with a combination of primary metals, recovered metals and master alloys to ensure the correct chemical composition of the melt.

Geographical location:

SiteId (in table JuridicalPerson): cpmcth000-2001-10-17-371
Name: Not specified.
MailAddress: See Geographical boundaries for further information.

Owner:

OwnerId (in table JuridicalPerson): cpmcth000-2001-10-17-370
Name: Not relevant

2. Details on how the data acquisition was performed; The Inventory

Persons and organisations involved with the data acquisition

Practitioner:
PractitionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels
Telephone: +32 2 775 63 63
Fax: +32 2 779 05 31
EMailAddress: +32 2 779 05 31
EMailAddress: eaa@eaa.be

Reviewer:

ReviewerId (in table JuridicalPerson): cthesa002-2000-08-31-373
Name: Dr. Ian Boustead,
MailAddress: 2 Black Cottages
West Grinstead,
Horsham GB-West Sussex RH13 7BD

Purpose of the data acquisition

Commissioner:
CommissionerId (in table JuridicalPerson): cthesa002-2000-08-31-371
MailAddress: EAA (European Aluminium Association)
12 Av. de Broqueville
B-1150 Brussels

Telephone: +32 2 775 63 63
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EMailAddress: eaa@eaa.be

Intended User:
LCA-practitioners.
General Purpose:
The European Aluminium Association (EAA) aims to contribute to further environmental improvements in aluminium products in a life cycle concept.
Detailed Purpose:
The purpose with the Environmental Profile Report 2000 is to provide LCA-practitioners with detailed and up-to-date information representing the aluminium industry activities in Europe. The purposes with formatting the Environmental Profile Report 2000 for the European Aluminium Industry to the data documentation format SPINE, according to the data documentation criteria applied at Centre for environmental assessment of Product and Material systems (CPM) are:

- CPM and European Aluminium Association (EAA) are anxious to provide life cycle assessment (LCA) practitioners with accurate and up to date environmental data for aluminium production.

- EAA is interested in the SPINE formatting procedure and result, as the format is a base for (and therefor somewhat similar to) the new Technical Specification in ISO, ISO 14048, regarding LCA data documentation format.

- EAA is interested in the CPM data quality control and documentation criteria.

Choice of functional unit
Functional Unit: 1000 kg aluminium ingot
Explanation of Functional Unit:
Aluminium rolling or extrusion ingot

Choice of system boundaries
Nature Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
Cut-off criteria through out this inventory is basically relevance, as checked by the industry expert team monitoring the work and confirmed by reviewer I. Boustead. As a rough guideline ''less than 1% of total mass'' is applied for the inputs, i.e if the input is less than 1% of the total mass, then it is not included in the inventory table. The base for the choices of included inventory parameters is not further described in the EAA report.

Time Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
The data derived from an industry survey from 1998 and includes literature data from reports dated 1998 and 1999.
Geographical Boundary:
--- BOUNDARIES VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---
It is not always explicit in the report where the different included process steps take place.

Data may be acquired from outside of Europe, e.g. regarding ancillary materials. See litterature references (LitteratureRef) next to the flow table (FlowMetaData) for further information about the data sources for each process step.
Other Boundaries:
See Nature boundaries for a specification of the cut-off criteria that has been applied.

Description on use of allocation methods; Allocations:
Allocations are not explicitly specified in the Environmental Profile Report 2000.
Systems expansions:
System expansions are not explicitly specified in the Environmental Profile Report 2000.

3. Recommendations on the use of data

Applicability:
--- SPECIFIC INFORMATION FOR THIS DATA SET ---

RECYCLING OF USED ALUMINIUM

This recycling model has has been prepared through a survey of aluminium refiners carried out in 1998, with an estimated coverage of 53%. The survey specifically covered secondary refiners of various sizes, ranging in output from <5 000 tpa to major facilities with production in excess of 50 000 tpa. The survey took into account the process technology, feedstock and products, along with the input and output of the various processes. Due to the individual nature of most secondary refining plants it is not possible to publish process-specific data without the risk of exposing commercially sensitive information, because a given site usually has a unique mix of feedstock, products and process technology.

For most scrap types there are several viable processing routes, which may be taken in order to meet specific company requirements. For a given scrap, each process route will have advantages and disadvantages. For example, one process route may produce higher metal yields, but at the cost of reduced flexibility, e.g. in the range of feedstock that could be used, higher investment in equipment or additional environmental controls.

The aluminium refiners therefore actually make a case-by-case selection, depending on the type of scrap, through a range of pre-treatment, preparation and melting technologies, in order to maximise the metal value and to optimise the environmental aspects.

As a result of this inherent variability in scrap processing for recycling, the aluminium recycling model developed here is only indicative, and this should be borne in mind if it is used to describe the recycling of any particular product. Any LCA-study on aluminium recycling would need to check carefully how well this fits with the particular aluminium product or process involved, in order to avoid misinterpretations or incorrect conclusions.

ALUMINIUM RE-MELTING VERSUS PRIMARY ALUMINIUM PRODUCTION

Aluminium re-melting requires much less energy than the primary aluminium production from its ore. A clear-cut comparision is not possible because the energy used in re-melting is predominantly thermal while being electrical in the electrolysis. However, aluminium re-melting saves raw materials and energy, and also reduces demands on landfill sites.

--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

RECOMMENDATIONS BY EAA WHEN USING THE DATA

The data provided by the EAA members for their own process steps are the most up-to-date average data available for these processes, and it is recommended that they be used for LCA purposes. Older literature data should be disregarded, as it may no longer be representative due to technological improvements, progress in operating performance, changes with regard to raw materials or waste treatment, etc.

To complete the product system inventory, data
- on the production of consumer products, from semi-fabricated aluminium,
- on the performance of consumer products in the use phase, and
- on the recovery of scrap prior to remelting at the end of the product's useful life

should be acquired.

EAA recommend that these data be used in LCA studies in accordance with methodologies within the framework of the international standards in the ISO 14040-series.

RELATED DATA SETS IN SPINE DATA FORMAT

The data presented in the Environmental Profile Report is reformatted in to the SPINE format and structured according to the SPINE concept in as many separate activities (sub-systems) as possible. The system scope for the study as a whole is primary aluminium production, semi-finished aluminium production, and recycling. The SPINE formatting resulted in 7 activities. These activities are all published in the SPINE@CPM database.

The production and recycling step are intended to be used together. For example, to obtain a cradle to gate-system for rolled aluminium sheet, the activity Primary aluminium production should be connected to the activity Production of rolled aluminium sheet. A recycling step (Aluminium recycling by refiners) could also be connected to such a system, depending on the scope.

-- List of activities formatted in the SPINE-format, published in SPINE@CPM --

Primary aluminium production
1. Primary aluminium production

Semi-finished aluminium product fabrication
2. Production of rolled aluminium sheet
3. Production of extruded aluminium profiles
4. Production of 0,02-0,2 mm single-rolled aluminium foil
5. Production of 0,005-0,02 mm double-rolled aluminium foil

Recycling
6. Re-melting of aluminium scrap
7. Aluminium recycling by refiners

Please note: The recycling process 6. Re-melting of aluminium scrap is included in the semi-finished aluminium product fabrication, i.e. activities 2-5. When designing a product system with the activities above where recycled aluminium is regarded, the activity Aluminium recycling by refiners should be used. The Re-melting of aluminium activity is only a specification if the user is specifically interested in this process step.

RECYCLING RATES FOR ALUMINIUM PRODUCTS AFTER USE

After use, aluminium products are a valuable re-usable resource. The European recycling rates for end products are currently around 95% for the automotive sector and 85% for the

building sector.

IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE OF ALUMINIUM PRODUCTS AND PROCESSES OVER THE PAST FEW YEARS

Over the past few years EAA has achieved major improvements in the environmental performance of its production processes by means of the following:
- improvement on existing technology
- development and introduction of new technology and operations
- increased recycling of all materials in the production process.

Examples of major environmental improvements in aluminium products achieved over the past few years include:
- weight reduction by downgauging in the packaging sector
- energy savings through weight reduction and subsequent fuel reduction in the transport sector
- reduction of maintenance in the building sector

The previous Ecological Profile Report from EAA was published in 1996.

A**bout Data:**
--- GENERAL INFORMATION VALID FOR ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

PRECISION

According to EAA, the environmental data figures in the inventory table are usually accurate to a precision of 5%.

DATA SOURCES FOR FUELS/ENERGY PRODUCTION AND COMBUSTION

The electricity supply systems and fuel production and use (transport energy and emission data) have been taken from SAEFL Environmental Series 250 (1998) 'Buwal 250' and EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

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REVIEW OUTSPOKE

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''...I have received the detailed calculations on which this present environmental report is based. All of the queries that I raised after working through these reports were answered

satisfactory.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Good-quality data were supplied by the EAA member companies, and the number of companies participating provides good coverage of the various processes, meaning that the results can be regarded as representative of the industryas a whole for the production of primary aluminium and subsequent conversion processes.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

''Because of the very fragmented nature of the recycling industry and wide variations in practices, it is recognised that the data presented for this sector of the industry can only be regarded as indicative. Nevertheless it is helpful to have such information from an authorative source.'' Ian Bousted, Environmental Profile Report for the European Aluminium Industry, April 2000

Notes:

REVIEWER

Ian Boustead has reviewed and commented on the Environmental Profile Report for the European Aluminium Industry, which is a revision of the first Ecological Profile Report from EAA that were published in 1996. See AboutData for review comments.

GENERAL TECHNICAL INFORMATION ABOUT SECONDARY SMELTING FURNANCES
Below some further information about the different types of furnaces and areas of application for secondary smelting furnances used in aluminium recycling.

Furnance type: REVERBERATORY
Variations: Standard, Side Well and Sloping Hearth

STANDARD
Principal application: Melting larger volumes of clean scrap and primary feedstock
Advantages: Large metal capacity (<=100t), Few restriction on feedstock sizes, Lower salt slag use
Disadvantages: Lower thermal efficiency, Restricted feedstock types
Comments: High yields due to quality of feedstock, Molten metal pumps sometimes used

SIDE WELL
Principal application: Melting larger volumes of clean scrap and primary feedstock, Enables efficient recovery of some finer feedstocks
Advantages: Large metal capacity, Wider range on feedstock possible, Normally no salt slag
Disadvantages: Lower thermal efficiency
Comments: High yields due to quality of feedstock, Molten metal pumps sometimes used

SLOPING HEARTH
Principal application: Separation of aluminium from higher melting point metal contamination (i.e. iron/steel)
Advantages: Very efficient at removing high melting point contaminants
Disadvantages: Lower thermal efficiency
Comments: Sometimes incorporated into other furnance types, Yield dependent on level of contamination

Furnance type: ROTARY
Variations: Fixed Axis, Tilting

FIXED AXIS
Principal application: Recycling a wide range of feedstocks
Advantages: No feedstock restrictions, Good thermal efficiency, Efficient de-magging, No skimmings produced, Large chargevolumes possible (<50t)
Disadvantages: Relatively high usage of salt flux, Feedstock size may be restricted
Comments: Resultant salt slags can be reprocessed

TILTING
Principal application: Recycling a wide range of feedstocks
Advantages: No feedstock restrictions, Good thermal efficiency, Efficient de-magging, No skimmings produced, Large chargevolumes possible (<50t) and lower use of salt flux than ''Fixed Axis''
Disadvantages: Feedstock size may be restricted
Comments: Tends to be used for lower scrap grades

Furnance type: INDUCTION
Variations: Coreless, Channel

CORELESS
Principal application: Melting of cleaner scrap or primary feedstock
Advantages: High yields obtained, No combustion gases, No salt flux required, Flexible use (batch and continous processing possible)
Disadvantages: Relatively small load (<10t), Restricted feedstock type, Feedstock size may be restricted
Comments: -

CHANNEL
Principal application: Melting of cleaner scrap or primary feedstock
Advantages: High yields obtained, No combustion gases, No salt flux required
Disadvantages: Relatively small load (<20-25t), Restricted feedstock type, Feedstock size may be restricted
Comments: -

Administrative and general information on the dataset

C**opyright:**
EAA
A**vailability:** Public
P**ublication:**
Environmental Profile Report for the European Aluminium Industry, European Aluminium Association, April 2000
D**ate Completed:** 2002-05-07

4. Flow table (the inventory table is excluded from the presentation in this report).

5. Description of methods used to obtain the data; Flow Meta Data

For the entire data set; General Flow Meta Data

Meta Data Id: CPMXFRTOOL2001-02-21872
Time period during which the data was acquired; Date Conceived: 1998 - 1999
Type of method used to obtain the data; Data Type: Derived, unspecified

Description of Method:
RECYCLING OF USED ALUMINIUM
This recycling model has has been prepared through a survey of aluminium refiners carried out in 1998, with an estimated coverage of 53%. The survey specifically covered secondary refiners of various sizes, ranging in output from <5 000 tpa to major facilities with production in excess of 50 000 tpa. The survey took into account the process technology, feedstock and products, along with the input and output of the various processes. Due to the individual nature of most secondary refining plants it is not possible to publish process-specific data without the risk of exposing commercially sensitive information, because a given site usually has a unique mix of feedstock, products and process technology.

See Applicability for further information.

--- GENERAL INFORMATION REGARDING ALL DATA SETS FROM THE ENVIRONMENTAL PROFILE REPORT 2000 ---

TRANSPORTS
Transport energy and air emission data have been taken from SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9

ELECTRICITY
For all manufacturing operations, the consumption of fossil fuels and emissions linked to electricity production was calculated according to the UCTPE 94 electrical energy model as described in BUWAL 250.

Emissions from combustion only, i.e. excluding the production of the fuel, have been considered where appropriate in order to make a direct comparision with the corresponding process emissions. Emission data for combustion came from a report prepared by EMPA for EEA (13 December 1997), showing the respective contributions of production and combustion of the fuels in 'BUWAL 250, table 16.9'. Although emissions from fuel combustion were often covered in the reporting from the industry survey, data calculated from BUWAL 250 were always used, in view of the fact that the survey results were not sufficiently reliable due to inconsistent use of conversion factors.

Represents:
Not relevant.
Literature reference:
---Recycling
- Aluminium scrap terms and definitions: pr EN 12258-3
- Aluminium BREF note: document prepared for the EU Commission, 1999

---Transport energy, and electricity use, and air emissions
- SAEFL Environmental Series 250 (1998) ''BUWAL 250'', table 16.9
- EMPA report for EAA dated 27 April 1998, derived from Buwal 250 for national grid systems.

Notes:

In this inventory profile it is possible to identify if the emission derives from the process or the energy use, see Note-field for each specific flow.

Specific for each flow; Specific Flow Meta Data (the description of methods used to obtain each figure in the table is excluded from the presentation in this report).

:END DATA SET DOCUMENTATION

SPINE@CPM Report generator 3.3, by Raul Carlson, A-C Pålsson, Chalmers University of Technology, 2001

7.4.3 Questions and Comments during Formatting (Memorandum)

The questions and comments noted below arose when working with the re-formatting of data from the Environmental Profile Report to the SPINE format. They are not rewritten for this report. The questions and comments were currently discussed throughout the project, in a personal contact with a representative of EAA. The result of the discussions can be studied in the final SPINE data set.

Re-melting of aluminium scrap

1. Should all input substances (flows in the table 4.4.) be regarded as refined resources, except for the energy resource gas (there are also heavy and light fuel)?

Aluminium recycling by refiners

1. How is the energy input presented in table 4.5.3 (risk for double counting)? What is to be regarded as refined and natural resources (also for the other substances)?
2. What activities are included in the inventory table for "scrap preparation" (7.4. and 4.5.1) and "melting and alloying" (7.5 and 4.5.2), respectively (see chapter 4).