

Fraunhofer-Institut für Bauphysik IBP

Forschung, Entwicklung,
Demonstration und Beratung auf
den Gebieten der Bauphysik

Zulassung neuer Baustoffe,
Bauteile und Bauarten

Bauaufsichtlich anerkannte Stelle für
Prüfung, Überwachung und Zertifizierung

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Review Report

Critical Review of the Study “Life Cycle Inventory of Quicklime and Hydrated Lime”

on behalf of
IMA-Europe / EuLA

study prepared by
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Stuttgart, 31st August 2011



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1 Summary

The external Critical Review of the study “Life Cycle Inventory of Quicklime and Hydrated Lime”, prepared by EESAC on behalf of IMA-Europe/EuLA, comprises the Critical Review of the report as well as of the findings, their derivation and basis. Conformity to ISO 14040 and ISO 14044 is achieved. The techniques chosen meet the state of scientific and technical knowledge and are explained transparent and critically. Data used, both for the foreground and background system, are consistent and of high quality. Analysis and interpretation of results are according to the goal and scope of the study. The report meets the requirements of ISO 14044.

2 Review – Content

Content of the Critical Review was to check the compliance of the study “Life Cycle Inventory of Quicklime and Hydrated Lime” with ISO 14040 and ISO 14044 and to provide a review report as addendum for the LCA report.

According to ISO 14044 the following points of the study were investigated:

- Review of compliance to standards ISO 14040 and ISO 14044.
- Review of goal and scope, functional unit, system boundaries and other basic information of the study.
- Review of used methodologies, data, models, assumptions and evaluation procedures.
- Review of the study report, its consistency and transparency, the presentation of results and interpretations.

3 Review – Results

The results of the review are presented according to the requirements of the ISO standards. The questions and comments of the reviewer during the review process were clarified; the conceived modifications were implemented and integrated in the report.

Recalculations based on the report and on provided background information as well as comparative calculations based on available literature data supported the presented results.

3.1 Compliance to ISO 14040 and ISO 14044

The study is in accordance with the specifications of the standards ISO 14040 and ISO 14044.

3.2 Goal and scope, functional unit, system boundaries and other basic information

Goal and scope, functional unit and system boundaries are well defined, described and suitable for the intended use. Other information, especially concerning process flows and used questionnaires are presented transparently.

3.3 Methods, data, models, assumptions and evaluation procedures

The used methods represent the state-of-the art of science and technology.

The techniques used meet the state of the scientific and technical knowledge and are documented and referenced traceable.

The data used for both the foreground and background system is consistent, detailed and feasible. Data gaps are identified and closed by suitable procedures. Data quality is good, foreground is based on primary industry data covering the major part of lime production in Europe. Data used are functional and are in accordance with the goal of the study.

The evaluations are in accordance with the state of the scientific and technical knowledge and are conducted according to the goal of the study. Sensitive effects are analysed and documented in a sensitivity analysis.

Interpretation of results is neutral, findings are presented traceable and in accordance with the goal of the study.

3.4 Study report

The format of the study report is in accordance with the specifications of the ISO standards. The report covers the specific fields of the conducted study. Data, methods, assumptions and restrictions are presented appropriately. The report is transparent and coherent.

4 Review – Annotations

Within the critical review process the following points were observed by the reviewer and implemented or further explained by the author of the study. Smaller changes are not mentioned separately but summarised as “editorial comments”. Issues under confidentiality restrictions were solved but not documented here.

Comment by reviewer and proposed change	Comment and explanation by author
1. General comments	
General Aspects about the study are addressed in the introduction chapter --> Renaming of chapter 1 in "introduction and general aspects".	OK, changed according to reviewer's proposal.
As the goal of the study is addressed in chapter 2 please consider a renaming of the chapter to "goal of the study".	OK, changed according to reviewer's proposal.

Comment by reviewer and proposed change	Comment and explanation by author
Chapter 3 addresses the aspects of scope and also the Life Cycle Inventory Analysis. According to ISO 14040/44 two separate chapters are intended, but the chosen presentation is suitable for an understandable report and shows the done working steps --> please consider a renaming of chapter 3 to "scope of the study and Life Cycle Inventory Analysis".	OK, changed according to reviewer's proposal.
The mentioned data categories represent flow categories. Please adapt appropriate.	The section "Data categories" was renamed into flow categories.
In chapter 4 "Results" the inventory results according to the collected, processed and aggregated data are presented in clear tables. The flow nomenclature is not ILCD conform but as this is just an overview a conformity is not necessary. No change proposed.	No comment
2. Specific comments on report	
Editorial comments	Changed according to reviewer's proposal.
p.4 and p.6: Is excluding the explosives ok with the cut-off rules?	Details about the exact composition of the explosives were not provided by the operators as this information is in many cases restricted (for safety reasons). All kind of explosives do represent approximately 0,0025% of the input mass flow, thus being by far below the cut-off rule. Moreover it is worth mentioning that the same methodology was applied by the European Cement industry for the LCI of cement and apparently accepted by PE International (the critical reviewer).
p.5: Which secondary fuels are used? In Fig. 2 and 4 they are named "alternative fuels".	In the lime industry like in the cement industry, secondary fuels and alternative fuels are often mixed. To make the things clear, the name "secondary" was changed in page 5 into "alternative". In practice alternative fuels consist into waste oils, used tyres, used solvents, residues from the municipal waste, etc...

Comment by reviewer and proposed change	Comment and explanation by author
p.8: How many of the European lime producers were included in the study?	The percentage of lime producers is not representative for this type of study as there are broad differences in the production structure. As mentioned in § 3.2, the study covers 73% of the European lime production.
p.12: What is the share of the 10 selected quarries due to absolute amount (mass) compared to the production in Europe?	The percentage of limestone extracted in the 10 quarries does represent approximately 25% of the limestone extracted in Europe for the production of lime. This percentage is not believed to be of importance for the outcome of the LCI as the extraction process in limestone quarries is basically always the same. The single differences between quarries are linked to the morphology of the quarry (quarries of type 1 require less transportation energy than quarries of type 2 and 3) and the presence of groundwater (quarries of type 3 need more electricity for the dewatering than quarries of types 1 and 2). Therefore it was believed that it is more important to select quarries that do correctly represent these different natural conditions than cover a high percentage of production with a uncontrolled distribution of quarry types.
p.13: What is the impact of the higher amount of groundwater abstracted on the overall results?	The amounts of water extracted and discharged in the surface water are overestimated but since both flows are equal, the "water consumption" as explained on page 10 is equal to zero. The electricity consumed for dewatering the quarry is therefore in principle overestimated. However as can be seen in chapter 5, the total contribution of the whole mining activities (incl. the quarry dewatering) is always rather small (few percentages). Thus the overestimation of the electricity consumption for the dewatering of the quarries is believed to be very small. In any case, it is on the safe side since the emissions and consumptions are not underestimated.

Comment by reviewer and proposed change	Comment and explanation by author
p.16: What about deliberately grown biofuels? If a high amount of biofuels is used excluding them might result in too optimistic results.	In 2007, 1,74% of the energy consumed by the European lime industry was provided by "bio-fuels". None of these bio-fuels are grown bio-fuels. In fact, all of them are wastes generated by another industrial process.
p.17: Is there really no water used? In some quarries water is used for washing.	For the production of kiln feed, the limestone is indeed sometimes washed. However this case occurs only in the Northern part of Europe. In these cases, the water from the washing installation is discharged in settlement ponds (usually former quarries). The particles settle and the "clean" water is immediately reused for the washing installation. Investigations made in different installations have shown that there is globally no water consumption. For the calcination step, no water is consumed. Lime producers avoid as much as possible any contact between the lime and water in order to avoid any hydration of the products.
p.20-23: LCI results for quicklime are higher than for hydrated lime (per 1000 kg of product) – this is related to the effect, that one kg of hydrated lime includes less calcium than one kg of quicklime. As this could lead on the first view to questions, this characteristic could be explained.	The analysis / comment is fully correct. However it seems to the practitioner better to remain as neutral as possible for the presentation of the results and not to give the impression to the reader that LCI results for hydrated lime are simply proportional to those of quicklime. Moreover, similar comments do not exist in other LCI report (e.g. EcoInvent).
p.21/23: single flows for particles to air are mentioned but the value is aggregated to the total amount of particles.	There was a big debate within EuLA about this topic since the results from the different particle sizes were extremely scattered. For example the percentage of PM10 to the total particulates emissions was varying between 10% and 95%. No technical consensus could be found among the lime experts about these emissions. It was finally agreed that the presented results represent a consensus and that more detailed investigations shall be made for the revision of this LCI.
3. Comments on LCI datasets for Quicklime and Hydrated Lime	
Editorial comments	Changed according to reviewer's proposal.
Final check of (administrative) entries to be done by EuLA.	Final entries will be done by EuLA.

5 Review – Signature

Herewith I confirm as external critical reviewer that the study “Life Cycle Inventory of Quicklime and Hydrated Lime”, prepared by EESAC on behalf of IMA-Europe/EuLA, is compliant to ISO 14040/44 and carried out according to the state-of-the art of science and technology.

Name	Dipl.-Ing. Matthias Fischer
Role	Reviewer, Independent External LCA Expert
Institution	Fraunhofer IBP Department Life Cycle Engineering
Place and Date	Stuttgart, 31 st August 2011

Signature

A handwritten signature in blue ink, appearing to read 'M. Fischer', with a long horizontal flourish extending to the right.