



European Lime Association Brussels, Belgium

External Critical Review for LCI of Two Lime Products

Review Report

Doc. No. P0006998-1-H2 Rev. 0 - April 2018

Rev.	0
Description	First Issue
Prepared by	C. Strazza
Controlled by	L. Facco
Approved by	C. Mordini
Date	20/04/2018

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1 INTRODUCTION

In the present report the records and the results of the External Critical Review of Life Cycle Inventories of two lime products, commissioned by European Lime Association (EuLA) to RINA Consulting S.p.A., are summarized.

In particular, the independent external critical review has been performed as for compliance with ISO 14040-14044, ILCD entry level and PEF requirements, of two Life Cycle Inventories (LCI) developed by EESAC for the following products:

- ✓ Quicklime;
- ✓ Hydrated Lime.

This final review report is structured as follows:

- ✓ **Section 2** reports the results of the review in terms of quality, methods, nomenclature and documentation used to carry out the Life Cycle Inventories, in consistency with ILCD guidance document for entry-level qualification (and thereby also with ISO 14040 and 14044:2006), with detailed assessment of each of these items;
- ✓ **Section 3** summarizes the findings deriving from the evaluation of additional requirements for compliance with Product Environmental Footprint scope, in particular as concerns data collection and data quality assessment.

2 EVALUATION OF COMPLIANCE WITH ILCD ENTRY LEVEL AND ISO 14040-14044

In the following sub-sections the results of the critical review activity as for compliance with ILCD entry level (and intrinsically with ISO 14040-14044) are summarized, respectively, for the two products: quicklime (2.1) and hydrated lime (2.2).

2.1 QUICKLIME

Here below the general summary of review reporting is depicted in Table 2.1 and Table 2.2. Afterwards, specific/detailed review reporting items for the LCI data set are described in Table 2.3 (quality compliance) and Table 2.4 (nomenclature and documentation).

Table 2.1: Review vs ILCD – Quicklime – General Information

General information:	
Data set name	Quicklime, production at plant
Data set UUID	7c3d4590-c4dc-420b-89d2-7a5f717b1e29
Data set generator/modeller	EESAC: 31c62c64-3993-4cde-8351-a1a094659d4e
Data set owner	EuLA: aa0a2faf-0bcf-428f-9fdf-c74d7e6a5136
Reviewer name(s) and affiliation(s), contact	Carlo STRAZZA RINA Consulting S.p.A. Via Alberto Liri, 8A - 16145 Genova – ITALY +39-010-3628148
Review type applied	Qualified independent external review (Expert judgement)
Date of review completion (DD/MM/YYYY)	20/04/2018
Reviewed against / Compliance system name	ILCD Data Network - Entry-level requirements

Table 2.2: Review vs ILCD – Quicklime – Reviewer Assessment

Reviewer assessment:			
Aspect	Yes	No	Comments
Quality compliance (aspects of ISO 14040 & 14044) fulfilled (see Table 2.3)	✓		Fully compliant
Method compliance (as in ISO 14040 & 14044) fulfilled and documented in data set	✓		Fully compliant


Reviewer assessment:			
Aspect	Yes	No	Comments
Nomenclature compliance (see Table 2.4) fulfilled	✓		Fully compliant
Documentation compliance (see Table 2.4) fulfilled	✓		Fully compliant
Review compliance (Independent external review OR independent internal review + review report) fulfilled	✓		Fully compliant (independent external review)
Overall compliance with ISO 14040 & 14044	✓		Fully compliant
Overall compliance with "ILCD – Entry Level"	✓		Technological representativeness: Very good Time representativeness: Very good Geographical representativeness: Good Completeness: Very good Precision: Very good Methodological appropriateness and consistency: Very good Overall quality: Very good
Date, location, reviewer signature	20 April 2018, Genoa (Italy) 		

Table 2.3: Review vs ILCD – Quicklime - Quality Compliance (ISO 14040 & 14044)

ITEMS	Comments
Time-related coverage/representativeness: “age of data and the minimum length of time over which data should be collected” “qualitative assessment of the degree to which the data set reflects the true population of interest”	Data collection for reference year 2015.
Geographical coverage/representativeness: “geographical area from which data for unit processes should be collected to satisfy the goal of the study” “qualitative assessment of the degree to which the data set reflects the true population of interest”	EU28. Data were collected from a panel of lime plants located in different EU countries, i.e. in 11 EU Member States. EU28 energy mix dataset was used for modeling the flows linked to power generation, and representative LCI datasets were used for secondary data.
Technology coverage/representativeness: “specific technology or technology mix” “qualitative assessment of the degree to which the data set reflects the true population of interest”	Before starting the data collection, a panel of lime plants was selected according to reasonable representativeness criteria. Afterwards, a detailed questionnaire was designed to collect all inputs and outputs related to each elementary process stage, filled by a limited number of companies that

ITEMs	Comments
	finally agreed to submit data. Horizontal weighting and aggregation for each process stage was selected to derive average data.
Precision: "measure of the variability of the data values for each data expressed (e.g. variance)"	The uncertainty calculation was limited to the calcination step, the main contributor to most environmental impact indicators. For each type of kilns modelled, standard deviations for energy consumption and specific CO ₂ emissions were calculated. These statistical values were based on real data submitted by the lime companies.
Completeness: "percentage of flow that is measured or estimated"; assessed on level of process	Cut-off rules are applied to guarantee an excellent level of completeness. Omissions of flows are carried out and justified by considering robustness and relevancy issues.
Consistency: "qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis"	The entire LCI modelling and calculation for this study were governed by the same methodology.
Sources of the data; Appropriateness of use primary/secondary data source	All foreground processes were modelled using primary data collected from production sites as detailed above. Background processes were modelled using secondary data from appropriate sources.
Uncertainty of the information (e.g. data, models and assumptions).	Self-assessment of very good level of precision is declared in the LCI on the basis of low dispersion of specific thermal and electric consumptions of the kilns. Moreover, the performed sensitivity analysis allows to judge a very good level in terms of allocation rules.

Table 2.4: Review vs ILCD – Quicklime - Nomenclature and Documentation

ITEMs	Comments
Correctness and consistency of applied nomenclature (Preferred use of ILCD flows etc.; Correct nomenclature of other flows; Exclusion of not permissible waste flows, sum indicator elementary flows etc.)	In general, applied nomenclature is correct and consistent.
Appropriateness of documentation (see Document "Documentation of LCA data sets")	Documentation is provided accordingly to the ILCD rules set by JRC.
Appropriateness / correctness of documentation form (ILCD Format)	The ILCD format is appropriate and correct.

2.2 HYDRATED LIME

Here below the general summary of review reporting is depicted in Table 2.5 and Table 2.6. Afterwards, specific/detailed review reporting items for the LCI data set are described in Table 2.7 (quality compliance) and Table 2.8 (nomenclature and documentation).

Table 2.5: Review vs ILCD – Hydrated Lime – General Information

REVIEW REPORTING	
General information:	
Data set name	Hydrated Lime, production at plant
Data set UUID	5191d1aa-78e8-42d5-ae18-211a3f5485f3
Data set generator/modeller	EESAC: 31c62c64-3993-4cde-8351-a1a094659d4e
Data set owner	EuLA: aa0a2faf-0bcf-428f-9fdf-c74d7e6a5136
Reviewer name(s) and affiliation(s), contact	Carlo STRAZZA RINA Consulting S.p.A. Via Alberto Liri, 8A - 16145 Genova – ITALY +39-010-3628148
Review type applied	Qualified independent external review (Expert judgement)
Date of review completion (DD/MM/YYYY)	20/04/2018
Reviewed against / Compliance system name	ILCD Data Network - Entry-level requirements

Table 2.6: Review vs ILCD – Hydrated Lime – Reviewer Assessment

Reviewer assessment:			
Aspect	Yes	No	Comments
Quality compliance (aspects of ISO 14040 & 14044) fulfilled (see Table 2.7)	✓		Fully compliant
Method compliance (as in ISO 14040 & 14044) fulfilled and documented in data set	✓		Fully compliant
Nomenclature compliance (see Table 2.8) fulfilled	✓		Fully compliant
Documentation compliance (see Table 2.8) fulfilled	✓		Fully compliant
Review compliance (Independent external review OR independent internal review + review report) fulfilled	✓		Fully compliant (independent external review)


Reviewer assessment:			
Aspect	Yes	No	Comments
Overall compliance with ISO 14040 & 14044	✓		Fully compliant
Overall compliance with "ILCD – Entry Level"	✓		Technological representativeness: Very good Time representativeness: Very good Geographical representativeness: Good Completeness: Very good Precision: Very good Methodological appropriateness and consistency: Very good Overall quality: Very good
Date, location, reviewer signature	20 April 2018, Genoa (Italy) 		

Table 2.7: Review vs ILCD – Hydrated Lime – Quality compliance (ISO 14040 & 14044)

ITEMs	Comments
Time-related coverage/representativeness: “age of data and the minimum length of time over which data should be collected” “qualitative assessment of the degree to which the data set reflects the true population of interest”	Data collection for reference year 2015.
Geographical coverage/representativeness: “geographical area from which data for unit processes should be collected to satisfy the goal of the study” “qualitative assessment of the degree to which the data set reflects the true population of interest”	EU28. Data were collected from a panel of lime plants located in different EU countries, i.e. in 11 EU Member States. EU28 energy mix dataset was used for modeling the flows linked to power generation, and representative LCI datasets were used for secondary data.
Technology coverage/representativeness: “specific technology or technology mix” “qualitative assessment of the degree to which the data set reflects the true population of interest”	Before starting the data collection, a panel of lime plants was selected according to reasonable representativeness criteria. Afterwards, a detailed questionnaire was designed to collect all inputs and outputs related to each elementary process stage, filled by a limited number of companies that finally agreed to submit data. Horizontal weighting and aggregation for each process stage was selected to derive average data.
Precision: “measure of the variability of the data values for each data expressed (e.g. variance)”	The uncertainty calculation was limited to the calcination step, the main contributor to most environmental impact indicators. For each type of

ITEMs	Comments
	kilns modelled, standard deviations for energy consumption and specific CO ₂ emissions were calculated. These statistical values were based on real data submitted by the lime companies.
Completeness: “percentage of flow that is measured or estimated”; assessed on level of process	Cut-off rules are applied to guarantee an excellent level of completeness. Omissions of flows are carried out and justified by considering robustness and relevancy issues.
Consistency: “qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis”	The entire LCI modelling and calculation for this study were governed by the same methodology.
Sources of the data; Appropriateness of use primary/secondary data source	All foreground processes were modelled using primary data collected from production sites as detailed above. Background processes were modelled using secondary data from appropriate sources.
Uncertainty of the information (e.g. data, models and assumptions).	Self-assessment of very good level of precision is declared in the LCI on the basis of low dispersion of specific thermal and electric consumptions of the kilns. Moreover, the performed sensitivity analysis allows to judge a very good level in terms of allocation rules.

Table 2.8: Review vs ILCD – Quicklime - Nomenclature and Documentation

ITEMs	Comments
Correctness and consistency of applied nomenclature (Preferred use of ILCD flows etc.; Correct nomenclature of other flows; Exclusion of not permissible waste flows, sum indicator elementary flows etc.)	In general, applied nomenclature is correct and consistent.
Appropriateness of documentation (see Document “Documentation of LCA data sets”)	Documentation is provided accordingly to the ILCD rules set by JRC.
Appropriateness / correctness of documentation form (ILCD Format)	The ILCD format is appropriate and correct.

3 EVALUATION OF ASPECTS RELATED TO PEF

A basic requirement of the PEF methods is that data shall be compliant with the entry level requirements of the ILCD. Nevertheless, some of the EF requirements provide further specifications to ILCD entry-level.

For the scope of this review, only aspects about data collection and data quality assessment are analysed with respect to the PEF requirements. Hence, the data quality criteria and scores are assessed on the basis of Data Quality Ranking, DQR, with reference to PEF Guidance Version 5.2.

It is important to note that the rationale behind DQR for PEF compliance is to consider data quality both as the quality of the dataset as documented and the dataset's appropriateness and accuracy for the process/product it is intended to represent in the specific case.

In the version dated 22 March 2018 of the methodology report of the Updated LCI of quicklime and hydrated lime¹, the PEF method in assessing DQR makes reference to PEF guide dated 17/02/2012², and it is coherent with the "Commission Recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (2013/179/EU).

According to this approach, the semi-quantitative assessment of the quality criteria of a dataset is based on six characteristics: i.e. five relating to the data (Technological representativeness, Geographical representativeness, Time-related representativeness, Completeness, Parameter uncertainty) and one to the method (Methodological Appropriateness and Consistency). The adopted formula is the following one:

$$DQR = \frac{TeR + GR + TiR + C + P + M}{6}$$

By using the same formula, no deviations are retrievable in terms of critical review with respect to the self-assessment already carried out and declared.

It is also important to note that the data quality criterion of "methodological appropriateness and consistency", was defined in PEF Guide 2012 but it is not encompassed in the recent "Guidance for the implementation of the EU PEF during the EF pilot phase" (latest version nr. 5.2 – February 2016)³. In that Guidance, the following formula is required to re-calculate DQR within the scope of specific PEFCRs:

$$DQR = \frac{TiR + TeR + GR + C + P + EoL}{6}$$

With respect to the DQR calculation developed according the PEF Guide, the only difference for the objective of re-calculation for PEFCR is the replacement of a generic parameter related to the method (M) with a parameter related to End Of Life Formula (EoL). Nevertheless, in this specific case the potential development of PEFCR for the considered products will be tailored to exclude the end-of-life-stage from the system boundaries, regarding the case of intermediate products (i.e. cradle-to-gate, excluding use and end-of-life stage). Furthermore, the mining and processing steps do not include recycling processes, hence the application of the default PEF recycling EoL formula (compliant to Recommendation 2013/179/EU - April 2013) is not foreseen in this case.

Besides, it should be noted that it will eventually be the specific PEFCRs' role to provide further guidance on data quality assessment scoring for the considered product category with respect to time, geographical and technological representativeness.

On the basis of the available information for the scope of this review, including the declared assessment of variability in the LCI report, the results of the re-calculation of DQR are provided in the following Table 3.1 and

¹ Report LCI lime v2018#03#22 (full).pdf

² Ref. Ares(2012)873782 - 17/07/2012

³ http://ec.europa.eu/environment/eussd/smgp/pdf/Guidance_products.pdf

Table 3.2. The overall data quality level can be therefore evaluated as “excellent quality” for each product under review.

Table 3.1: PEF Data Quality Requirements - Quicklime

Data Quality Criteria	Assessment	Rating	Comment
Technological Representativeness [TeR]	Very good	1	Completely context specific (technological characteristics, including operating conditions)
Geographical Representativeness [GR]	Good	2	Not complete coverage of countries within the region owing to limited number of selected sites
Time-related Representativeness [Tir]	Very good	1	All data collected for unique year of reference: 2015
Completeness [C]	Very good	1	≥ 90%
Parameter Uncertainty [P]	Very good	1	Qualitative expert judgement
End-of-Life [EoL]	Very good	1	Full compliance (no recycling to be included)

Table 3.2: PEF Data Quality Requirements - Hydrated Lime

Data Quality Criteria	Assessment	Rating	Comment
Technological Representativeness [TeR]	Very good	1	Completely context specific (technological characteristics, including operating conditions)
Geographical Representativeness [GR]	Good	2	Not complete coverage of countries within the region owing to limited number of selected sites
Time-related Representativeness [Tir]	Very good	1	All data collected for unique year of reference: 2015
Completeness [C]	Very good	1	≥ 90%
Parameter Uncertainty [P]	Very good	1	Qualitative expert judgement
End-of-Life [EoL]	Very good	1	Full compliance (no recycling to be included)



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