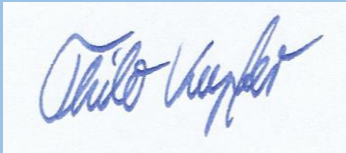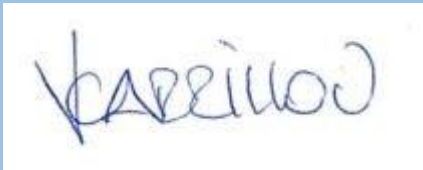# LCI Review report (reviewed against "ILCD Data Network - entry-level requirements")

C10-13 Linear alkylbenzene sulphonic acid (HLAS) (petro based) (No 2 - Matrix)

Table 1:   **General review reporting items**

REVIEW REPORTING	
General information	
Data set name	C10-13 Linear alkylbenzene sulphonic acid (HLAS) (petro based) (No 2 - Matrix, ELCD)
Data set UUID and version number	{7148C7FE-F957-48DA-BBCB-ADDFE444E86F} V1.0
Data set locator (e.g. Permanent URI, URL, contact point, or database name and version, etc.)	ERASM (www.erasm.org) Data sets will be made available via http://eplca.jrc.ec.europa.eu/ELCD3 Based on GaBi 7, DB version 6.115, SP 29
Data set owner	ERASM: Environmental & Health Risk Assessment and Management of Surfactants, a research partnership of the European Detergents and Surfactants Industries: A.I.S.E., the International Association for Soaps, Detergents and Maintenance Products, and CESIO, the European Committee of Organic Surfactants and their Intermediates (www.erasm.org)
Review commissioner(s)	ERASM
Reviewer name(s) and affiliation(s), contact	Dr. Thilo Kupfer and Viviana Carillo, thinkstep AG, Hauptstr. 111-113, 70771 Leinfelden-Echterdingen
Review type applied	Data set review against ILCD Data Network - Entry-level requirements
Date of review completion (DD/MM/YYYY)	21/04/2016
Reviewed against / Compliance system name	ILCD Data Network - Entry-level requirements

Reviewer assessment:			
Aspect	**Yes**	**No**	**Comments**
Quality compliance (aspects of ISO 14040 & 14044) fulfilled (see table 2)	x		See table 2
Method compliance (as in ISO 14040 & 14044) fulfilled and documented in data set	x		See table 2
Nomenclature compliance (see table 3) fulfilled	x		See table 3
Documentation compliance (see table 3) fulfilled	x		See table 3
Review compliance (Independent external review OR independent internal review + review report) fulfilled	x		Independent internal review + review report
Overall compliance with ISO 14040 & 14044	x		Data set reviewed by two independent experts against ISO 14040 & ISO 14044
Overall compliance with "Compliance system"	x		Relates to ILCD Data Network - Entry-level requirements
Date, location, reviewer signature	21/04/2016, Leinfelden-Echterdingen Dr. Thilo Kupfer Viviana Carrillo		

Table 2: Specific/detailed review reporting items for LCI data set: Quality compliance (ISO 14040 & 14044). Please note that for aggregated LCI result data sets, this includes key processes in the background system.

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"	Very good. Reference year: 2011 Production data was collected as annual average of the production year 2011. The data set is representative for the state of technology in 2011 and considered to be valid for ten (10) years or until substantial technological changes in the production chain occur.
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"	Very good. Primary production data for HLAS production is from five different suppliers in Europe representing HLAS production in Europe (DE, ES, FR, GB, IT).
Technology coverage/representativeness: "specific technology or technology mix" "qualitative assessment of the degree to which the data set reflects the true population of interest"	Good. Foreground system: HLAS is produced by sulphonation of LAB (linear alkylbenzene). The sulphonation of LAB is commonly accomplished with SO_3 as sulphonation agent using two different types of reactors, cascade and falling film. In the sulphonation reaction, an SO_3 (sulphonic) group is introduced in the 4-position ("para") of the aromatic ring of the LAB molecule giving the corresponding sulphonic acid. The reaction is exothermic and it requires a careful control of the temperature to avoid undesired side reactions. Conversion to sulphonic acid is very high with minor quantities of unsulphonated matter (free-oil) in the reaction product. The processes using SO_3 (gas) comprise several steps, namely: • Sulphur treatment • Process air drying • Sulphur burning to SO_2 • Conversion of SO_2 to SO_3 • Sulphonation • Digestion and hydrolysis • Exhaust gas cleaning

ITEMs	Comments
	Sulphonation is carried out at a molar ratio of SO_3/LAB slightly higher than stoichiometric to achieve full conversion of LAB (>99%).
	In the cascade process, the SO3 gas is mixed with liquid LAB in several reactors in series (cascade) in order to complete the reaction. The residence time (contact time) of the or-ganic matter is relatively high and therefore this process is not suitable to sulphate com-pounds such as alcohols and alcohol ethoxylates which require shorter reaction time to avoid undesirable side reactions.
	In the film reactors, the organic matter is injected into the reactor tubes using different methods. All have in common the formation of a very thin liquid layer inside the tubes in order to facilitate the contact with SO3 and produce an almost instantaneous reaction keeping the residence time in the reactor very short. This process is very flexible and it allows LAB sulphonation, and numerous other sulphonation/sulphation reactions to prepare other surfactants like alkyl sulphates (AS), alcohol ethoxysulphates (AES), alpha olefin sulphonate (AOS), methyl ester sulphonate (MES), etc.
	The foreground system can be rated "very good" as precursor data of LAB were not published, due to confidentiality concerns. Hence, the dataset for HLAS is rated rather conservative with the rating "good" for technology coverage/representativeness.
Precision/ Uncertainty of the information (e.g. data, models and assumptions): "measure of the variability of the data values for each data expressed (e.g. variance)"	Good. Based on various precision and uncertainty checks the likelihood of systematic errors in the dataset is low. - Check for plausibility of data sampling - Check of mass and energy balances - Cross-checks with other data sources and available data sets (LCIs)
Completeness: "percentage of flow that is measured or estimated"; assessed on level of process	Good. Cut-off rules for each unit process: Coverage of at least 95% of mass and energy of the input and output flows, and 98% of their environmental relevance (according to expert judgment). Excluded from the analysis are: - The construction of major capital equipment (infrastructure) - Maintenance and operation of sup-port equipment - Human labor and employee transport and - Packaging of final products In addition, all 15 LCIA methods recommended by the Product Environmental Footprint (PEF Guide 4.0) can be evaluated.
Consistency:	Very Good

ITEMs	Comments
"qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis"	Foreground and background model are compliant with GaBi modelling principles and ISO 14040/14044, hence a consistent modelling approach is applied.
Sources of the data; Appropriateness of use primary/secondary data source	ERASM Surfactant Life Cycle and Ecofootprinting (SLE) Project GaBi databases The data set covers all relevant process steps / technologies over the supply chain of the represented cradle to gate inventory with a very good overall data quality. It represents a production average based on the year 2011. The inventory is mainly based on industry data and is completed, where necessary, by secondary data. This data set is based on primary data from European adopted production processes, connected with regional precursor chains. The data set is based on primary production data for HLAS production is from five different suppliers, either Spain, Germany, United Kingdom, France or Italy representing the imported and produced HLAS in Europe. Transportation was considered for the main materials (covers about 90% of the mass of all inputs), other transportation was not considered.
Overall data quality rating according to PEF evaluation scheme.	Very good. Overall quality according to PEF validation scheme results in 1,6; interpreted into "very good overall quality" in the PEF quality validation scheme.
Others	None.

Table 3: **Specific/detailed** review reporting items for LCI data set: Nomenclature and Documentation

ITEMs	Comments
Nomenclature	
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.)	Nomenclature of elementary flows is correct according to the flow check tool 1.2.1; no issues detected Elementary flows are compliant to ILCD nomenclature Product flows / correctness of product flows not verifiable as not standardized, Except of four (4) radioactive waste flows, all waste flows are modelled to the end of waste status Unspecific elementary flows are not used (e.g. VOC (air emission), heavy metals (unspecific emissions in water))
Documentation	
Appropriateness of	Documentation check tool applied, no issues detected.

ITEMs	Comments
documentation (see Document "Documentation of LCA data sets")	All mandatory and some optional documentation fields do contain supportive meta data about the setup of the LCI data set.
Appropriateness / correctness of documentation form (ILCD Format)	Documentation of the dataset uses ILCD format provided by GaBi LCA software export