

TÜV NORD CERT Umweltgutachter GmbH

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TNC Umweltgutachter-H

Critical Review of Life Cycle Assessment

for the

European Paper Packaging Alliance (EPPA)

**SINGLE-USE AND MULTI-USE DISHES SYSTEMS IN QUICK SERVICE
RESTAURANTS**

Region: EU

Report No.: 35280651

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1 General

1.1 Object and Terms of Reference

EPPA (2593 BM 'S-GRAVENHAGE, Netherlands) commissioned Ramboll to draw up a comparative Life Cycle Assessment "**Single-use and multi-use dishes systems in quick service restaurants**".

EPPA, commissioned also TÜV NORD CERT Umweltgutachter GmbH to carry out a critical review of the Life Cycle Assessment as an independent body in accordance with DIN ISO 14040 and DIN ISO14044.

The review was carried out for TÜV NORD Cert Umweltgutachter GmbH (DE-V-0263) by Dr.-Ing. Winfried Hirtz, Environmental Assessor licensed under the Environmental Audit Act, registered number DE-V-0151.

Under the terms of reference, the objective of the critical review was to verify the reliability, transparency, relevance and representative nature of the methods used for Life Cycle Assessment with respect to

- Objective and scope of assessment
- Life Cycle Inventory
- Life Cycle Impact Assessment and
- Evaluation of assessment

1.2 Procedure

Taking into account the general quality criteria (chiefly transparency, reproducibility, quality of the computer programs and data used, and information on the sources of data), the procedure used for the critical review was as follows:

- Review of the objective and scope of the assessment, especially the function and functional equivalence of system boundaries and cut-off criteria (space, time, technology), allocation procedures together with the allocation and distribution rules adopted, and the selection of significant parameters and materials.

- Review of the Life Cycle Inventory drawn up, especially with regard to the input/output analyses (major process chains), the input and output data used and the reliability of such data, the systematic nature, completeness and plausibility of the input/output analysis, the sensitivity analyses and the assessment of errors, where necessary, the plausibility and reliability of computer programs, and the consideration of upstream process chains, by-products and secondary post-use effects
- Review of the Life Cycle Impact Assessment, concentrating on the selection of impact categories (with respect to subject areas and problems) and the concentration of data with reference to impact categories
- Review of the evaluation and the comparative statements made on the basis of the evaluation

System representations, data files and other representative documents were inspected and compared on a random sample basis and some data collection and calculation procedures were reproduced on the computer, in some cases with targeted variation. For example, were viewed all baseline assumptions, the utilisation phase and the end of life. The assessment of the technologies (especially washing and recycling/EoL) under consideration here were performed based on model calculations. Protocols of the model calculations were viewed and inspected. In general, duplication of effort was avoided during the critical review. Relevant literature concerning life cycle assessment techniques was taken into consideration.

2 Result of Critical Review

2.1 Objective of Assessment

The objectives of the Life Cycle Assessment are defined clearly and unambiguously; external and internal target groups for the assessment are also stated. The presentation adopted for the Environmental Commendation provides sufficient appropriate information to make the intended environmentally holistic approach clear and comprehensible.

2.2 Scope of Assessment

The Life Cycle Assessment considers the single-use and multi-use dishes systems in quick service restaurants. Excluded from the study is the take away system. Promo-

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tional units are checked by sensitivity analysis and the amount of units. The baseline of this study is very clear. The Life cycle assessment study refers also to a technology proven for single-use and for multi-use. The technologies refer to the washing systems of the used dishes and also to incineration and recycling at the end-of-life (both referred to existing technologies). Beside of existing technologies there are several variants, the most relevant were considered and directly compared with the baseline system or are checked by sensitivity analyses.

For the comparison of the two different systems in quick service restaurants (QSRs), three scenarios were taken into consideration:

- current system based on single-use and disposable products
- expected (hypothetical) future system in 2023 based on equivalent multiple-use products and respective processes and infrastructure for **in-store** washing operations;
- expected (hypothetical) future system in 2023 based on equivalent multiple-use products and respective processes and infrastructure for **out-store** washing operations.

Despite differences, the chosen systems are equivalent regarding their function. This supposition was intensively investigated as a prerequisite for the study. The scope and system boundaries of the assessment are clearly and unambiguously defined in relation to the entire system with respect to space (EU), time (2023) and technology (processes and necessary infrastructure for 2023). The future systems exist yet today, but are not adapted to QSRs. The boundaries are defined over the whole life cycle. They are compatible with the selected function unit. The assembly has been checked.

Environmental impact is presented and assessed in the categories Climate change (CO₂), depletion of fossils and metals (eq. oil and copper), freshwater consumption (m³), freshwater eutrophication (P), Ionising radiation (Bq CO-60), terrestrial acidification (SO₂), stratospheric ozone depletion (CFC-11), all expressed as equivalent. The choice considers the differences between the systems and allows a well-grounded result.

Within the scope of the assessment, all relevant materials, processes and infrastructure were logged, analysed and finally grouped together for the subsequent Life Cycle Inventory.

The graphs, diagrams and tables in the assessment confirm the systematic nature and completeness of the procedure selected.

The effects and factors considered negligible for the definition of the Life Cycle Assessment system are explained.

In summary it can be stated that all relevant factors have been identified and taken into consideration within the area investigated in accordance with the state of the art of Life Cycle Assessments.

2.3 Life Cycle Inventory

The input/output analyses for the processes mentioned above were carried out and the Life cycle Inventory for the Life Cycle Assessment was documented using a computer system. The calculations themselves were performed using Commercial and own Databases resp. actual data from the industry.

2.3.1 Data sources

The main processes in the individual areas were modelled realistically. The data sources are based on generally accepted files or are primary data from the industry, e.g. paper producer or washing machines, they are comprehensible and representative as regards this Life Cycle Assessment. The data basis is extremely comprehensive. The data can be understood and traced. There is a difference between primary and secondary data sources. This could have an effect on data symmetry that is relevant for some of the hypothetical multi-use variants. Therefore the importance of sensitivity analyses is high (see 2.3.5). The assumptions for the variants for the near future are realistic and refer to existing technologies. This is the case especially for washing systems.

2.3.2 Plausibility and completeness review

The computer system reflects the system boundaries systematically and is consistent with the assessment area defined. Boundaries were drawn at points where no (significant) impact on the results of the individual areas or the overall assessment is ex-

pected (see also the sensitivity analyses conducted). The data are of high quality and are highly symmetrical under consideration of available primary and secondary data (see also chapter 2.3.1). The data used were drawn from databases. The available information regards the individual components and parts lists (set menu) which are used. This information was verified by means of information requested from QSR operators including the material composition.

The correctness and plausibility of the calculations and the results were verified by reviewing selected parameters. In this way, the links between the various areas and the hierarchy of data used for the assessment calculations were verified with respect to the process plans (also checked), the inclusion of partial assessments (where more detailed information are available) and the data basis.

In order to ensure that the data used could be traced back to the original data sources, both the calculations and the documentation were investigated and found to be very clear and transparent.

All significant parameters are available and representative and have been systematically derived and duly assessed. All type approvals have been checked. The assessments and the underlying data collection and calculation procedures are transparent and traceable.

2.3.3 Allocations

Allocations arise in connection with basic data; they are included in a database and it was possible to represent them appropriately. They are represented in the computer system completely, clearly and plausibly.

To the extent that allocations are imported to the process plan from databases, the data basis is adequate. Allocations from the databases have already been taken into consideration in the process plan.

Further allocations were performed e.g. for the part incineration and for the recycling of sorted paperboard and coated paper.

2.3.4 Error assessments/Uncertainty

Separate error assessments were not drawn up. In view of the numeric stability and proven quality of the data used, there is no need to include the separate error assessments (see also 2.3.5). The prediction of future handling for the reuse is not submitted to error assessments but considered in sensitivity analyses.

2.3.5 Sensitivity Analysis

Numerous sensitivity analyses are carried out. Seven are referred in the study. In order to verify the possible predictions, calculations regarding sensitivities and the associated parametering were performed at the client's premises. There were no indications that further sensitivity calculations were needed at the moment.

2.4. Life Cycle Impact Assessment

The Life Cycle Impact Assessment was based on the results of the Life Cycle Inventory and is an integral part of the process plans.

In order to carry out a Life Cycle Impact Assessment on the basis of data and information derived from the Life Cycle Inventory, it is necessary to compress the data for defined impact categories.

Taking into consideration the objectives of the assessment, the functional unit selected and the (standard) technologies used in the assessment area, the impact categories were well defined.

The impact categories were selected in accordance with the objectives and scope of the Life Cycle Assessment.

These quantifiable impact categories represent the system assessed and the technologies used in terms of key local, regional and global categories.

The calculations were checked. The factors stored in the computer program are internationally recognized. With reference to the objectives of the assessment, other impact categories are of secondary importance.

Data compression within these categories has been carried out on the basis of generally accepted equivalence factors in a way which is clear, reliable and easy to follow.

2.5 Evaluation

The evaluation section of the Life Cycle Assessment includes specific conclusions and recommendations.

The evaluation of the results of the Life Cycle Inventory and Life Cycle Impact Assessment which was submitted is based consistently and appropriately on the objectives defined for the Life Cycle Assessment.

Further statements and recommendations are strictly separated from the Life Cycle Assessment itself.

2.6 General conclusion

This study is valid for the systems described. The results may change when the assumptions change. Other studies refer more to products. Therefore a comparison with existing studies is not always correct. The use of primary data shows the actual state-of-the art of the industry. Secondary data are mostly relevant for the multi-use alternatives and cannot always show the same actuality. But it has to be considered that the multiple-use systems present a hypothetical future scenario for which no primary data are available. Also all secondary data are as actual as possible and are updated regularly. It is recommended to include always the results of the sensitivity analyses when checking the environmental assessment of possible alternatives.

3 Summary of the critical review

The critical review of the Life Cycle Assessment "Single-use and multi-use dishes systems in quick service restaurants" conducted by the undersigned in accordance with the requirements of international standards DIN EN ISO 14040:2009 and DIN EN ISO 14044:2018 may be summarised as follows:

- The methods used for drawing up the Life Cycle Assessment are in accordance with the requirements of DIN EN ISO 14040:2009 / DIN EN ISO 14044:2018. The

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methods are scientifically well-founded and are in accordance with the state of the art of Life Cycle Assessments.

- The data used are adequate, appropriate and well-founded with reference to the objective of the assessment.
- The evaluations take into consideration the objective of the assessment and the limitations which were identified.
- The Life Cycle Assessment is consistent and transparent.

A certificate of validity has been issued concerning the critical review which was conducted. The report of the critical review will become part of the detailed version of the Life Cycle Assessment.

No remarks are finally found.

A handwritten signature in black ink, appearing to read 'Dr. Hirtz', with a long, sweeping underline stroke extending to the right.

Dr. Winfried Hirtz
Environmental Verifier
DE-V-0151