

FitforREACH in Brief – Project impacts

1 Aim of the work

- Identify to which extent the selected alternatives demonstrated lower risk levels and lifecycle impacts than the substituted substances.
- Evaluate the project's effect on reducing risk from hazardous chemicals.
- Describe the project's environmental and societal impacts.

2 What was done and how?

Detailed assessments were made for the cases with the six partner companies. The assessments made use of the LIFE programme indicators to measure the substituted amounts of substances and change in emissions, while using the own indicator set to evaluate the change in risk characterisation ratio (RCR) and change in values of lifecycle categories.

- Use of the RCR identified the extent to which the original risk to human health and the environment had been reduced. The RCRs were derived using [ECETOC TRA](#).
- A lifecycle assessment (LCA) was conducted to measure the overall impact of a substitution on the environment. The software [SimaPro](#) with Ecoinvent database was used for calculations. The methodology is described in the [Indicator concept](#).
- For a selected set of small scale substitution cases, which were initiated and finalised during the project, the IT tool [SubSelect](#) was used to create a qualitative picture of the impacts.

3 A few findings...

The development of specific indicators to measure activity and project success proved to be cumbersome when gathering specific data on processes or products of a company. Frequently, hazard and exposure data, needed to develop risk characterisation ratios or LCAs, were unavailable or non-comparable. These challenges were in addition to the following issues in measuring the success of substitution:

- Hazard data on chemicals, in particular on DNELs and PNECs, was either not available, or were available based on different effects and/or for different exposure pathways and durations.
- RCRs for substances of very high concern were often not established (no threshold value, no DNEL/PNEC available), which distorted assessment results.
- ECETOC TRA, although comparatively simple to use and based on limited data needs, was not suitable to derive RCRs that could be communicated to a wider public. This is partly due to the conservatism of the emission and exposure models used, intransparent exposure calculations for workers and consumers, and a low degree of differentiation between substances resulting in unrealistic and questionable RCRs.¹
- LCAs on chemicals are frequently not possible due to a lack of information on individual substances in the LCA databases. It is unclear to which extent it is suitable to use data of similar substances.
- The SubSelect integrates hazard and sustainability considerations but does not account for risks, as the exposure is only very roughly considered by the substance mobility. No particular challenges were observed in using the tool for the cases, except the absence of information on lifecycle impacts (cf. above).

¹ However, as the same method was applied to measure RCRs before and after substitution, the same „mistakes“ and worst case assumptions existed and comparing the two values was still possible. Only the low degree of differentiation and the inability to consider specificities of some substances were challenges remaining in the exposure calculations

4 Achievements

- For nine substitution cases in the partner companies, RCR calculations were possible for at least one human health and/or one environmental endpoint.
- Nine LCAs were calculated for cases in the partner companies.
- Eight substitution cases in SME companies were assessed regarding the change of RCRs or using SubSelect.

	Attempts	Successes	Comments
ΔRCR	11	10	- One case (a substance to a mixture with one hazardous component) could not be calculated as no DNELs, PNECs, and physical-chemical data were available - All other cases were calculated with some assumptions
LCA	11	9	- One case was calculated without problems - Two cases (substitution of a substance to a substance) could not be calculated as no data in Ecoinvent were available - All other cases were calculated with some assumptions

An example of how impacts are illustrated in the evaluation report is shown in the case of Marijampolės Pieno Konservai substituting BPA, where the substance was included in the coating of pre-fabricated lids and metal sheets used to form milk cans.

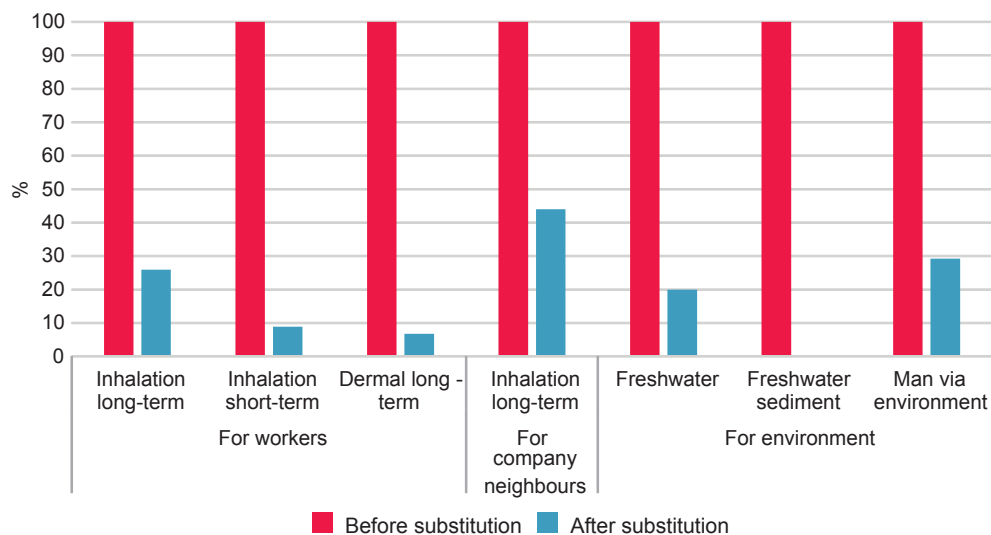


Figure 1. Change in risk characterization ratios for BPA in food cans

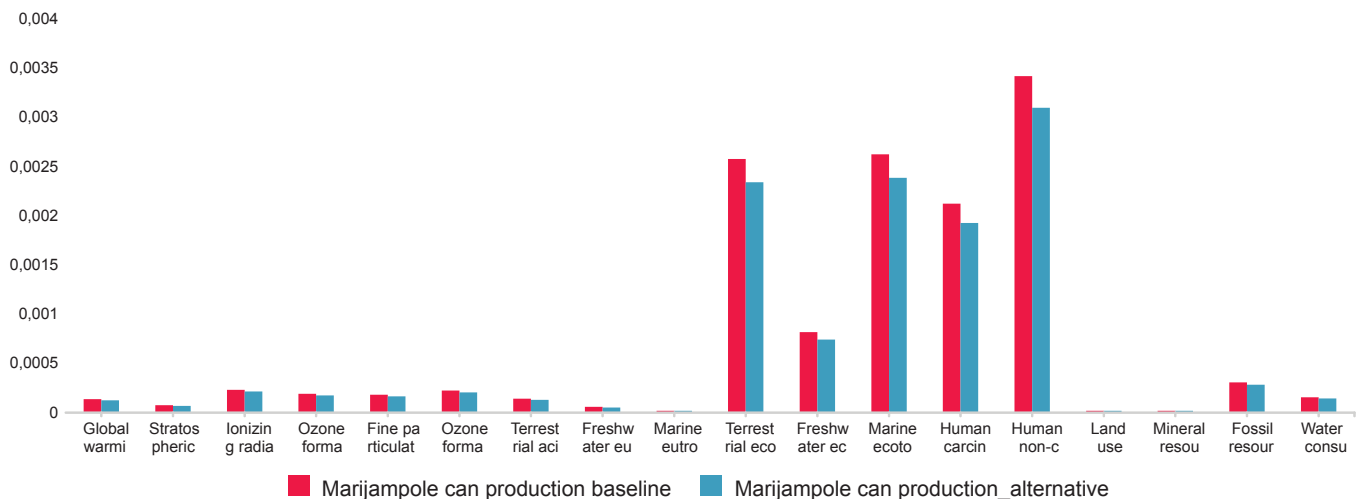


Figure 2. Normalized results of lifecycle assessment showing change in and importance of impact categories

Due to the challenges mentioned above, some uncertainty remains in the case evaluations. The majority of partner cases achieved successful substitution with regard to the change in risk. One case was evaluated as “neutral” as the substituted substance is currently not classified. Another case, however, has substituted a substance for one that is more hazardous.

Company	Substance / case	Δ RCR	LCA	Overall evaluation
Mariampolės pieno konservai	BPA in can coatings	Workers ↓ Consumers ↓ Neighbours ↓ Env ↓	All categories ↓	Unambiguous: successful
Mariampolės pieno konservai	Disinfection (efficiency)	Not applicable, no substitution	All categories ↓ except 1	Unambiguous: successful
Vakaru metalgama	Xylene in thinners	Workers ↓ Neighbours ↓ Env ↓↑	Nearly all categories ↓	Unambiguous: successful
Tenachem	DINP in sealant	Workers ↓↑ No data for other	No data for LCA	Only assessed regarding workers health, where result is positive
Tenachem	Dibutyltin dilaurate in sealant	No DNEL for target effect, ⇒ RCR not relevant	No data for LCA	Qualitative: rather successful as repro 1 replaced by repro 2
Epokate	Nonylphenol in epoxy resin	Workers ↓↑ Consumers ↓ Neighbours ↓ Env ↓↑	All categories ↑ but data set was incomplete	Qualitative: rather successful as SVHC is phased out; more detailed assessment necessary
Epokate	Benzyl alcohol in epoxy resin	Workers ↓↑ Consumers ↓ Neighbours ↓ Env ↓↑	All categories ↓ but data set was incomplete	Rather successful
Henkel Balti	Methylen chloride as cleaner	Workers ↓↑ Neighbours ↓ Env ↓↑	Categories ↓↑ but most relevant ones ↓	Success: RCR /LCA category increases for less severe hazards than decreases
Henkel Balti	Resource efficiency through quality control	Not relevant, no substitution	All categories ↓	Unambiguous success
Mayeri	Sodium perborate in bleacher	Workers - not possible due to incomparability; Env ↓↑ (freshwater↑)	Categories ↓↑	Qualitative: successful, as SVHC is replaced by safer alternative; freshwater impact may be overestimated ²
Mayeri	Sodium percarbonate in bleacher	Workers ↑ Consumers ↑ Env ↓↑	Categories ↓↑, freshwater very relevant ↑	Qualitative: questionable as new hazards are introduced; however, control is ensured

5 Conclusions

- The assessed substitution and use reduction cases contributed to the reduction of overall risks to the environment, workers, and consumers.
- The chosen methodology allows evaluating substitution cases only to a certain extent. Additional information and qualitative assessments lead to an overall and qualitative conclusion for most cases.
- Impact assessment is challenging for substitution, in particular if it is not 1:1. It is not yet clear how DU companies can either do it themselves or be guided to do so, particularly for mixtures.
- Data availability is critical to any methodology, even if it is as simple as ECETOC TRA.
- If risk characterisation ratios are used in an alternatives assessment, it is most likely that scientific knowledge is necessary to derive missing DNELs and PNECs for the relevant endpoints, while using higher tier exposure models to derive more specific exposure levels. If this is not available, companies should stick to comparing hazards, and qualitatively evaluate exposures and risks with the “fuzzy logics” of common sense.
- Data necessary for the LCAs of individual substances are often not available. This methodology is best suited to assess impacts from substitution induced changes rather than for chemical-to-chemical substitutions.

² Alternatives are enzymes, the activity of which decreases significantly after the washing process; this is thought not sufficiently in the standard models