



# Do end-users matter?



# The context

The LIFE ChemBee project addresses a central and increasingly urgent question in environmental health policy: to what extent can end-users contribute to reducing exposure to hazardous substances in everyday life? The project was built around the recognition that chemical substances are present in a very wide range of products used daily, from food packaging, cosmetics and cleaning products to furniture, textiles, flooring and other household materials. As a result, exposure does not occur through a single source or isolated behaviour, but through a combination of routines, products, domestic environments and lifestyle choices. These exposures may contribute to a complex “chemical cocktail” in the environment and in the human body, with potential health implications, particularly where substances have endocrine-disrupting, carcinogenic, persistent or bioaccumulative properties.

In this context, the title of the report “Do end- users matter?” is deliberately framed as a question. LIFE ChemBee sought to test whether informed and empowered consumers can reduce exposure-related behaviours when they are provided with accessible knowledge, practical tools and feasible alternatives. More specifically, the project explored whether capacitating people to identify where hazardous substances may be found in daily life can lead to concrete changes in consumption patterns, household practices and risk awareness. The project therefore moves beyond traditional awareness-raising: it examines whether information, self-assessment and practical recommendations can become drivers of behavioural change.

This approach is highly relevant within the framework of the European Union’s LIFE Programme. LIFE projects are expected not only to communicate environmental problems, but also to test, demonstrate and support the implementation of practical solutions that can inform policy, replication and systemic change. LIFE ChemBee fits into this logic by **translating the complex scientific and regulatory issue of hazardous chemicals in everyday products, into practical end-user action**. At the same time, the project also provides evidence on the **limits of relying on consumers alone**. This dual perspective is one of the most important contributions of the project: it shows that **end users can act**, but also that **many exposure pathways are shaped by systems over which individual citizens have limited control**.

## The source

The results are based on exposure-related indicators and self-reported behaviours, not on biomonitoring. Changes between the first and second assessment may partly reflect improved understanding of the questionnaire, more accurate reporting, missing data patterns or the fact that more motivated users were more likely to complete the follow-up. This is why the interpretation of the results should combine statistical significance with practical relevance.

# The profile of project participants

Many of the ambassadors and active users involved in LIFE ChemBee were already relatively aware, motivated and knowledgeable before participating. In other words, the project often worked with people who were already predisposed to act (the “believers”). This has two implications:

1. It may explain why some reductions in exposure-related scores were not more expressive: **some participants may already have changed the easiest behaviours before joining the project.**
2. It highlights a major challenge for future replication. **If even motivated and well-informed citizens find it difficult to change certain behaviours or household conditions, the barriers will be even greater for people with lower chemical literacy, lower income, less time, fewer alternatives or more pressing daily concerns.**

This is particularly relevant when considering **equity**. Chemical exposure prevention cannot depend only on the ability of individuals to search for information, understand labels, identify safer products, afford alternatives or replace household materials. Such an approach risks placing the greatest burden on those least able to respond. **LIFE ChemBee therefore reinforces an important environmental justice message: empowering consumers is necessary, but it must be accompanied by upstream measures that protect everyone, including those who are less aware, less informed or less able to act.** Safer products, better labelling, stronger substitution policies, accessible alternatives and regulatory action are essential to avoid making chemical safety a matter of individual privilege.

## The main results

The results of the project indicate that end users do matter. When **people are given clear information and practical tools, they are able to recognise relevant exposure sources and change some behaviours.** The most visible improvements were observed in **behaviours that are concrete, easy to understand and relatively easy to replace**, especially those related to food contact with plastic. Reducing the consumption of food in plastic packaging, avoiding plastic lunchboxes or limiting plastic contact with hot food are examples of actions that can be understood quickly and incorporated into daily routines with comparatively low effort.

However, the analysis also shows that **behavioural change is not uniform across all exposure pathways.** Some behaviours changed significantly, while others remained stable or changed only modestly. This is not a failure of the project; rather, it is an important and realistic finding. **Different groups of substances may be associated with different domestic contexts, product uses and lifestyle patterns.** Therefore, a single generic message is unlikely to be effective. **Prevention tools need to be substance-aware and context-aware**, helping users distinguish between what they can change immediately, what may require more time, and what depends on broader market or regulatory conditions.

One relevant finding concerns the **cumulative nature of behavioural change.** Even **when individual behaviours do not show strong statistical changes, small adjustments across several routines may together contribute to a measurable reduction in exposure-related scores.** This is particularly relevant for BPA and, to a lesser extent, phthalates. Users may not radically transform their lifestyles after one intervention, but they may introduce several small modifications: replacing some plastic containers, avoiding plastic in contact with hot food, changing food-storage routines, choosing different bottles, reducing specific packaged products or becoming more attentive to product composition. Each individual change may be modest, but their combined effect can be meaningful. This supports the value of repeated self-assessment and feedback as tools for gradual behavioural change.

## Gender-related patterns

**Men** appeared to show **higher exposure scores** in several key endocrine-disrupting chemical groups, suggesting that sex-specific routines, product handling, occupational contacts, dietary patterns or consumption habits may influence exposure. At the same time, **women appear to be particularly important as lifestyle changemakers**. This is a relevant implementation finding. It suggests that women may play a central role in initiating changes in household practices, product choices and family routines. However, this should not lead to an unfair transfer of responsibility to women. Instead, **communication strategies should recognise household decision-making dynamics and design messages that engage all users, while also acknowledging the practical role women often play in consumer and domestic choices**.

## Age-related differences

**Younger participants may be more exposed through lifestyle mediated sources**, such as packaged foods and drinks, personal-care products, plastic food-contact materials and consumption related with convenience. These are typical of modern consumer routines and may respond well to targeted communication, especially when alternatives are simple and attractive.

**Older participants**, by contrast, may show more **stable background exposure linked to long-standing household characteristics**, food-storage practices, furnishings, domestic materials or indoor dust. This suggests that prevention messages should be adapted to life stage and context. Younger users may benefit from communication focused on plastics, cosmetics, takeaway food and convenience products. Older users may require more support to identify less visible and more structural sources in the home.

## Pregnancy and other biologically sensitive windows

The absence of clear differences among pregnant users should not be interpreted as evidence that this group is not vulnerable. Rather, it suggests that **vulnerability does not automatically translate into lower exposure related behaviour**. Awareness does not arise naturally simply because a person belongs to a sensitive group. This is a crucial lesson for prevention policy: **vulnerable groups require active, targeted and accessible support**. Communication should be clear, non-alarmist and practical, helping people identify priority actions without creating guilt or unrealistic expectations.

## Body mass index (BMI) relations

Although correlations were not strong, they clearly suggest that **individuals with higher BMI may carry a higher estimated everyday exposure burden**. From a clinical and public health perspective, this finding supports the relevance of exposure-informed counselling within metabolic risk assessment. It indicates that **BMI may help identify groups** that could particularly **benefit from preventive guidance** aimed at reducing exposure to endocrine-disrupting chemicals in daily life.

## The limits of individual action

The project found that ordering food in plastic packaging was close to conventional statistical significance but did not show a clearly favourable shift. This is highly informative from an implementation perspective. Consumers may wish to avoid plastic packaging in general, but when using **take-away food services** their ability to do so depends on the choices made by restaurants, delivery platforms, suppliers and local service systems. This illustrates that some exposure pathways can be influenced by individual behaviour, while others require changes in product systems, business models, procurement practices or regulation. **The consumer can create demand for safer alternatives but cannot redesign the market alone.**

**Structural household sources** are another area where **individual change is particularly difficult**. Materials such as flooring, furniture, wall coverings, ceilings, insulation, coated surfaces or long-lasting household equipment may contribute to exposure, but they cannot be easily identified, removed or replaced. These **changes often involve cost, technical knowledge, disruption and long decision cycles**. The fact that structural household indicators did not improve substantially, and in some cases may even have increased, can plausibly be explained by improved user understanding between the first and second assessments. As participants became more aware of relevant materials, they may have answered more accurately during the second check. This means that an apparent increase in risk-related scores may partly reflect better recognition rather than a real worsening of household conditions.

## Cleaning practices

**Indoor dust emerged as an important exposure pathway.** The results suggest that more thorough cleaning routines, such as vacuuming, dust wiping and floor mopping, are commonly performed weekly or less often by many users. Since indoor dust can act as a reservoir for endocrine-disrupting chemicals and other substances released from plastics, textiles, furnishings and household materials, this represents a potentially modifiable pathway. **Promoting regular dust removal and adequate ventilation can therefore be part of a practical prevention strategy.** Nevertheless, these recommendations should be framed carefully. Cleaning can reduce exposure, but it does not eliminate the source of hazardous substances. Once again, the downstream action of the user must be complemented by upstream product safety.

## LIFE ChemBee and the hierarchy of action

The LIFE ChemBee experience points to a **hierarchy of possible action**. Some measures are **immediately actionable by consumers**, such as avoiding plastic food contact where feasible, replacing plastic lunchboxes, not heating food in plastic, improving dust removal and paying attention to product choices. Other measures are **partially actionable** but depend on availability and affordability, such as choosing safer cosmetics, alternative cookware, lower-emission household products or non-plastic packaging. A third group of measures is largely **systemic**, including the reformulation of products, substitution of hazardous substances, better labelling, safer design of household materials, regulation of food-contact materials and changes in takeaway and retail packaging systems. Effective prevention requires all three levels, but the greatest long-term impact depends on systemic change.

This leads to the central conclusion of the report: yes, end-users matter, but end-users should not be left alone with the responsibility for chemical exposure prevention. LIFE ChemBee shows that empowered consumers can understand complex information, change some practices and become agents of demand for safer products. It also shows that **many barriers are structural, economic or regulatory**. Behavioural **change is most likely when recommendations are feasible, prioritised and linked to daily routines**. It is less likely when action requires major household changes, market alternatives that do not exist or are not easy to access, or decisions controlled by third parties.

From a **LIFE perspective**, this is a strong and policy-relevant outcome. The **project demonstrates the value of participatory tools, citizen engagement and practical environmental health literacy**. It also **generates evidence** that can support **better policy design**. **End-user empowerment** can help identify exposure pathways, test communication approaches, reveal implementation barriers and **create social demand** for safer products. However, LIFE projects should not be interpreted as a substitute for regulation. Their role is to demonstrate what works, where barriers remain and what needs to change at the system level.

In conclusion, LIFE ChemBee confirms that prevention of hazardous chemical exposure must combine individual empowerment with systemic transformation. Citizens can make meaningful changes, especially when actions are visible, practical and affordable. Women and motivated users may play an important role as early changemakers. Repeated self-assessment can support learning and gradual behavioural shifts. But the **project also makes clear that a toxic-free environment cannot depend on individual vigilance alone, nor is it a fair option considering social justice issues**. The safer choice must become the easier, affordable and default choice. This is the broader lesson of LIFE ChemBee: **end-users matter, but safer systems matter even more**.

**Disclaimer: The project LIFE ChemBee (No. LIFE21/GIE/DE/101074245) is co-funded by the LIFE Programme of the European Union.** Views and opinions expressed are however, those of the project LIFE ChemBee only and not necessarily reflect those of the European Union or the LIFE Programme. Neither the European Union nor the granting authority can be held responsible for them.

