

## Questions from sessions presented by Green Rose Chemistry

### 1 - Safe and Sustainable by Design (SSbD)

- How does this fit into R&D in drug design? There are already lots of tests to do when looking for leads and new molecules. How much more time and money will this require, particularly if we need to create data sets?

There are some interesting studies cited [here](#) on how the pharmaceutical industry is using elements of the SSbD framework; the concept is not new to them, and they have been working on benign-by-design, safe-by-design, and related concepts for over a decade.

It will require an ongoing, long-term effort, but cost is no reason not to try. The number of novel compounds coming out of the pharmaceutical industry makes it important to include them in SSbD efforts (see slide 14 in SSbD: planetary boundaries concept, which includes a category for novel entities). Right now, SSbD is a voluntary framework, encouraging industry to start implementing where they can.

### 2 - Environmental Footprinting

- Why are the environmental indicators shown as percentages? What does it mean to the consumer? How do we interpret it?

The percentages are more useful to the manufacturer than to the consumer - they allow the internal prioritisation of sustainability R&D efforts. For example, if 60% of impacts come from fossil resource use, then focusing on substituting raw materials with recycled/renewable alternatives might be a good idea.

We agree that it's odd that the percentages are so heavily emphasised in the example Product Environmental Footprint Category Rules (PEFCR - see slide 19 in Environmental Footprinting), while the benchmarking comparison is in a small table. If consumers are the target audience, this could be represented with more clarity.

- How can we include packaging in the EF of the product, as the impact would change according to size?

This is one of the many challenges of simplification and standardisation - the simpler you make the analysis, the more error-prone it is. Benchmark products within PEFCR attempt to capture an "average" product, but what is an average potted plant? Is it a windowsill succulent or a 2m tall tree? PEF of products that are far from the "average" may appear particularly good/bad compared to the PEFCR benchmark. It is necessary to find a balance between simplicity and accuracy, which relies on the judgement of experts who are developing the PEFCRs.

For an individual PEF, packaging is captured as part of the functional unit, and in some

cases (such as food and drink products) is treated as its own stage of the life cycle. In a deeper analysis, for a product with multiple packaging sizes, you can include a sensitivity analysis - this means varying packaging size within your calculations and assessing its impact on the overall EF. It is expected that PEFCR will give guidance on how to handle this for specific products.

- How does recycling a byproduct as a raw material impact the environmental footprint? Where do you draw the boundaries so that it doesn't make the EF 'worse'?

The boundaries are key here – they need to be set firmly, and not changed with addition of a recycling process. If the byproduct is being recycled into a different product (for example, scrap from tyre manufacturing being used to make shoe soles), the EF of the tyres would reflect the recycling as a reduction in waste – essentially, the impact of disposing of those scraps (landfilling, burning, etc.) would be removed from the EF, reducing the overall picture. The impact of processing them into shoe soles would be outside the scope of the tyre EF.

In an EF of the shoe soles, the recycling would be captured as a change in impact of the raw materials – likely a reduction in emissions versus using virgin material (but not always!)

If the process is an internal recycling (for example, scrap from tire manufacturing being put back into the tire manufacturing process), then there would be a reduction in waste and a reduction in virgin raw material used, but an additional impact from any processing needed to make the scraps usable as raw material. All of these would be factored into the EF to get the overall impact, which is why recycling is not always favourable, especially if the processing impact is high.

### 3 - LCAs

- What does “publicly available” mean? If an LCA should be publicly available, how much does it require an organisation to reveal information about their logistics and intellectual property?

A good LCA should be transparent about all assumptions made, data sources referenced, and calculation methods used, to allow proper assessment of the reliability of the LCA. Typically, the individual data points are not revealed.

Paid databases such as Ecoinvent tend to have licensing terms that say you can reveal post-calculation numbers, but not the base data.

### 4 - Approaching substitution

- (Triggered by the thought of regrettable substitutions) Is there any guidance/directive on what materials can't be recycled? What do we know about potential contaminants?

The lack of transparency in the chemical industry makes it very difficult to identify which products contain hazardous chemicals. Policy recommendations mostly centre on reducing the use of hazardous chemicals in the first place, improving transparency/data flow through the supply chain, and restricting presence of hazardous chemicals in end-of-life feedstocks. This broad approach is expected to be more effective than implementing case-by-case restrictions (like not recycling mattresses, or not using recycled materials for children's toys).

Some related reading: <https://eeb.org/library/keeping-it-clean-how-to-protect-the-circular-economy-from-hazardous-substances/>  
<https://www.hbm4eu.eu/wp-content/uploads/2022/07/ChemicalsCircularEconomy.pdf>  
(safe despite the warning)  
<https://chemtrust.org/chemicals-and-the-circular-economy/>

Final note: I hope those answers help, but if you need any further clarification, please don't hesitate to email me.

Also, we're organising more courses like this for industry participants. Is there anything you'd say about this course to help future students decide whether or not to take it? A testimonial we can use on our website would be really helpful!

Please send further questions/testimonials to [anna@greenrosechemistry.com](mailto:anna@greenrosechemistry.com)