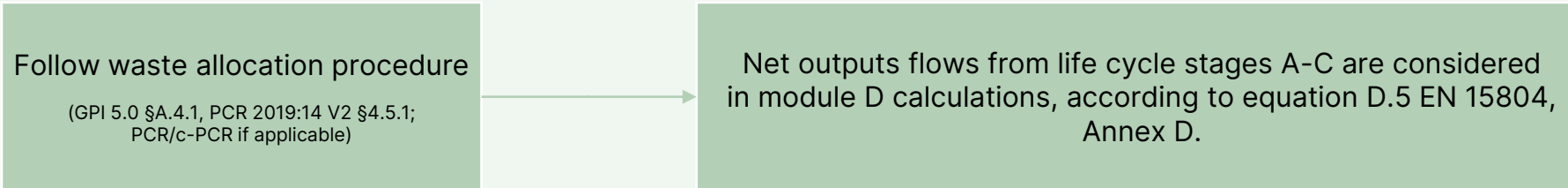


Module D calculations for flows that ceased to be waste



Scenario 1: **Positive** net output flow

Occurs when a product system generates more recycled/recovered material used in the next product system than secondary material consumed, avoiding the use of virgin materials beyond the system boundary:

- 1000 kg steel beam (40% recycled content).
- 95% of the beam is collected and recycled according to the scenario used in module C1-C4.
- Net output flow: $950 \text{ kg} - 400 \text{ kg} = +550 \text{ kg}$
- If primary steel production emits 2.0 kg CO₂eq/kg and the recycling process emits 0.5 kg CO₂ eq/kg, the net benefit is -1.5 kg CO₂ eq/kg
- The environmental benefit related to net output of secondary materials, substituting primary material, is -825 kg CO₂ eq in module D.

Scenario 2: **Negative** net output flow

Occurs when a product system consumes more secondary material than it generates, requiring the use of virgin materials beyond the system boundary:

- 1 kg aluminum (50% recycled content).
- 30% is collected and recycled according to the scenario used in module C1-C4.
- Net output flow: $0.3 \text{ kg} - 0.5 \text{ kg} = -0.2 \text{ kg}$
- If primary aluminum production emits 20 kg CO₂eq/kg and the recycling process emits 2.0 kg CO₂ eq/kg, the net benefit is -18 kg CO₂ eq/kg.
- The environmental burden related to net output of secondary materials is +3.6 kg CO₂ eq in module D.

Scenario 3: **Zero** net output flow

Occurs when a product is made of recycled content equal to how much is recycled/recovered at the end-of-life:

- 1000 kg of glass bottles (100% recycled content).
- 100% of the bottles are collected and recycled.
- Net output flow: $1000 \text{ kg} - 1000 \text{ kg} = 0 \text{ kg}$
- Even though the product is highly circular, it provides no net addition to the global secondary material pool.
- The environmental benefit and burdens related to net output of secondary materials is zero in module D.