

**Figure S1.** System boundary of r-PET insulation sheet and VIP pouch.

**Table S1.** Transportation distance of EPS box.

| Transportation                                | km  | Description  |
|---|-----|--|
| Transport of raw materials                    | 500 | From EPS material supplier to EPS box manufacturing plant  |
| Transport of box                              | 120 | From EPS box manufacturing plant to fresh food manufacturing plant   |
| Transport of box with fresh food and ice pack | 41  | From fresh food manufacturing plants to consumers near the market<br>(average distance according to distribution ratio by distributor) |
| Transport of box for recycling                | 15  | From consumers to EPS box recycling company  |

**Table S2.** Transportation and Reconditioning transportation distance of VIP box.

|                               |   | km   | Description   |
|-------------------------------|---|------|---|
| Transportation                | Transport of r-PET flake                      | 75   | From flake supplier to bale manufacturing plant (average distance)                        |
|                               |   | 5    | From bale manufacturing plant to sheet manufacturing plant                                |
|                               | Transport of VIP film                         | 2838 | From overseas film pouch factory to domestic VIP pouch manufacturing facility             |
|                               | Transport of VIP pouch                        | 4084 | From domestic VIP pouch manufacturing facility to overseas VIP box manufacturing facility |
|                               | Transport of box                              | 3935 | From overseas VIP box manufacturing facility to domestic distribution center              |
|                               | Transport of box for treatment                | 15   | From consumers to box treatment center (average distance)                                 |
| Reconditioning transportation | Transport of box with fresh food              | 44   | From domestic distribution center to sub-terminal (average distance)                      |
|                               | Transport of box with fresh food and ice pack | 8.7  | From domestic sub-terminal to customers (average distance)                                |
|                               | Transport of box for washing                  | 8.7  | From customers to sub-terminal (average distance)   |
|                               | Transport of box for recovery                 | 60   | From customers to domestic recovery center (average distance)                             |
|                               | Transport of box for reuse after recovery     | 65   | From recovery center to domestic fulfillment center (average distance)                    |

**Table S3.** Transportation and Reconditioning transportation distance of EPE box.

|                               |   | km   | Description  |
|-------------------------------|---|------|--|
| Transportation                | Transport of box material and box             | 1798 | From overseas box material manufacturing plant to box manufacturing plant and then to domestic distribution center |
|                               | Transport of box for treatment                | 15   | From consumers to box treatment center (average distance)  |
| Reconditioning transportation | Transport of box with fresh food              | 44   | From domestic distribution center to sub-terminal (average distance)   |
|                               | Transport of box with fresh food and ice pack | 8.7  | From domestic sub-terminal to customers (average distance)   |
|                               | Transport of box for washing                  | 8.7  | From customers to sub-terminal (average distance)  |
|                               | Transport of box for recovery                 | 60   | From customers to domestic recovery center (average distance)  |
|                               | Transport of box for reuse after recovery     | 65   | From recovery center to domestic fulfillment center (average distance)   |

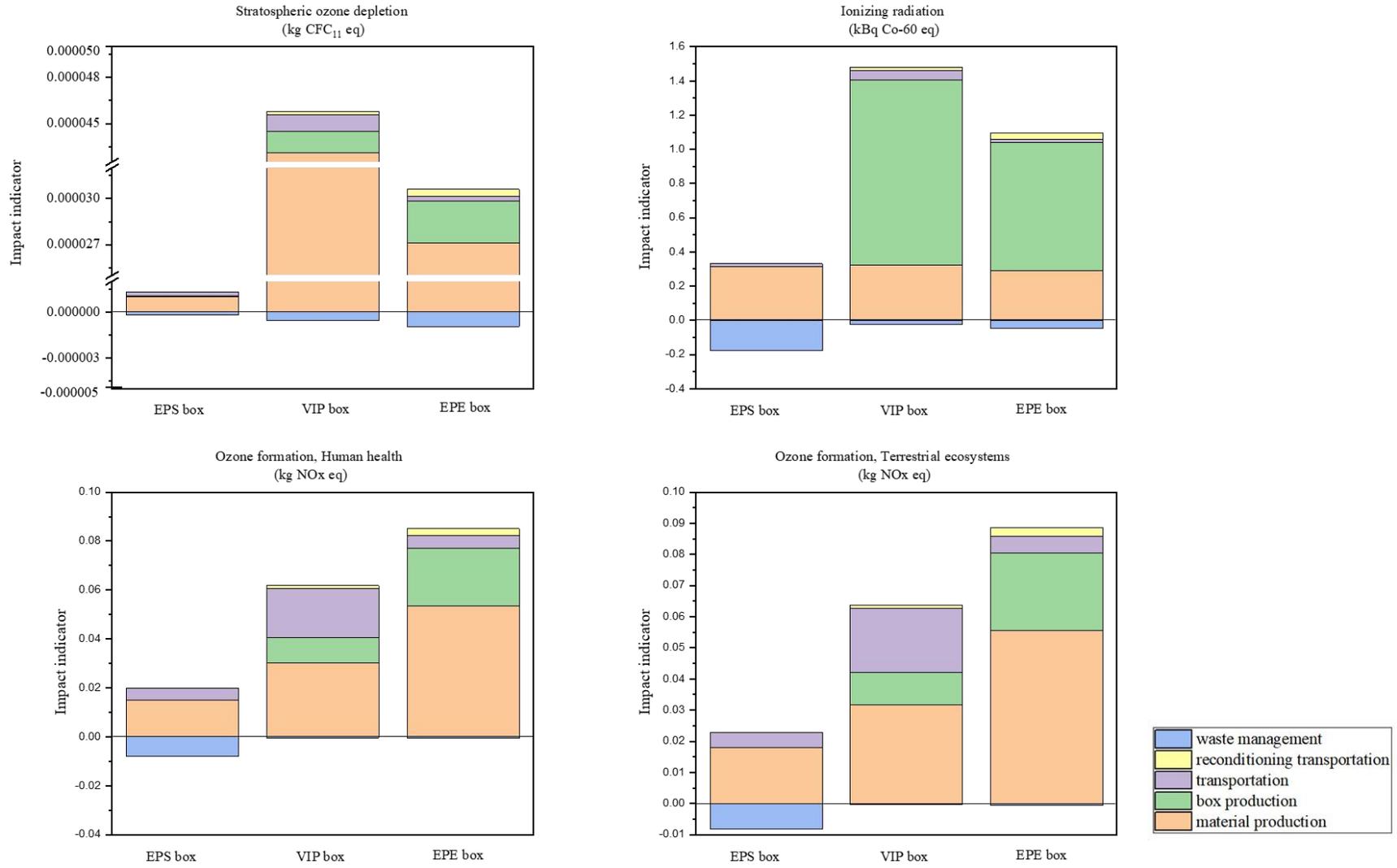


Figure S2. Potential impact results for scenarios 1 (1cycle).

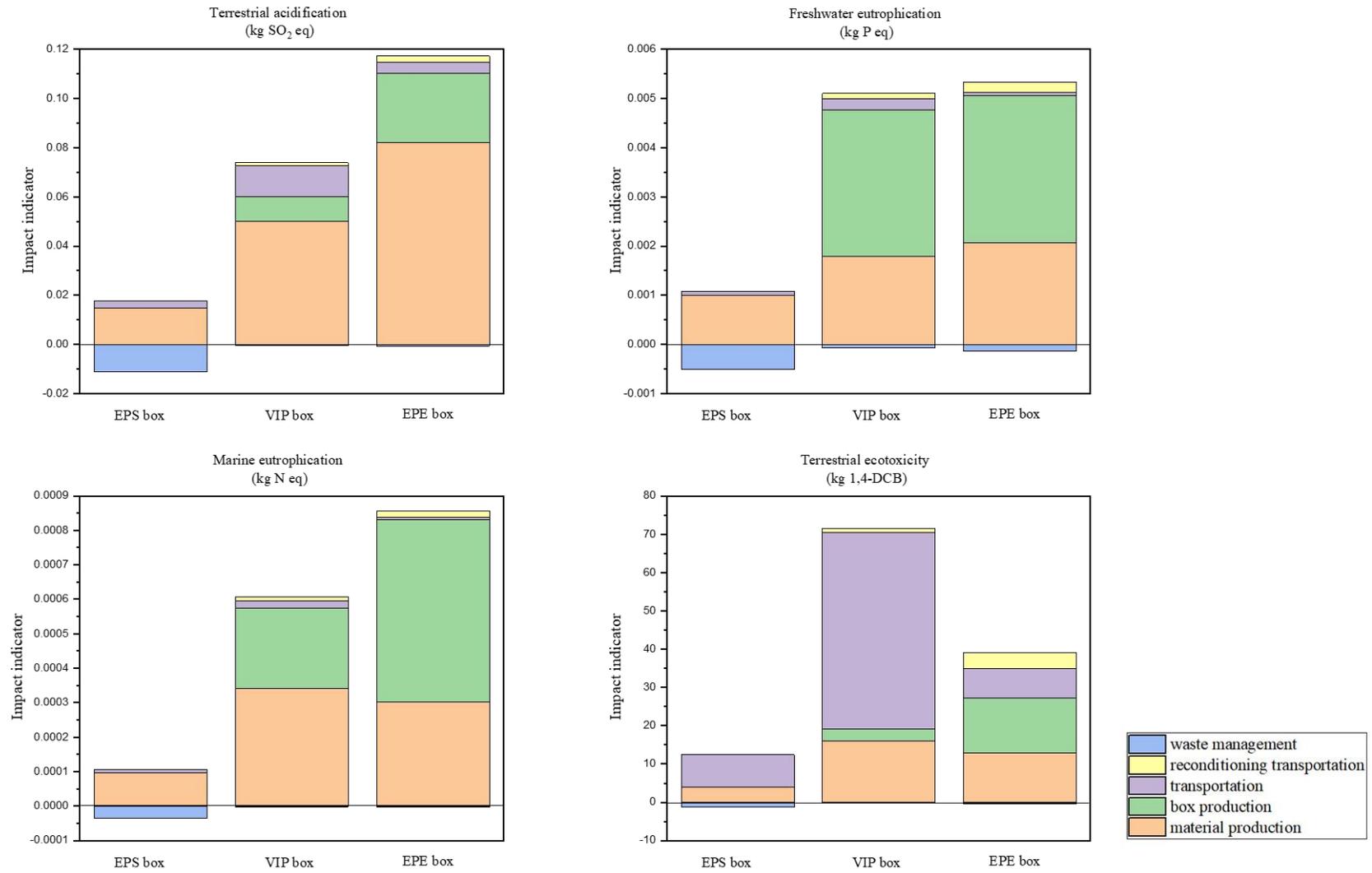


Figure S3. Potential impact results for scenarios 2 (1 cycle).

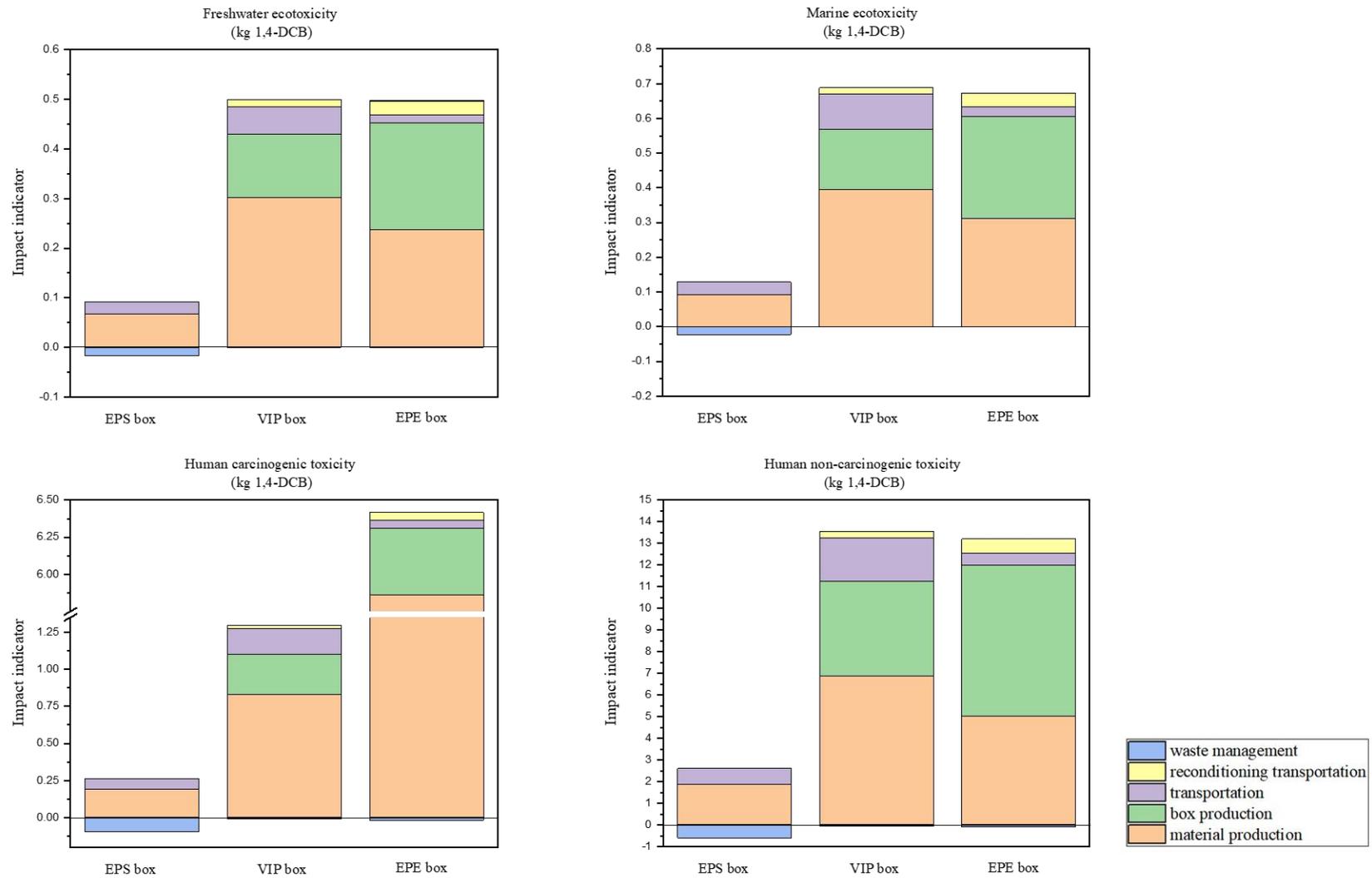


Figure S4. Potential impact results for scenarios 3 (1 cycle).

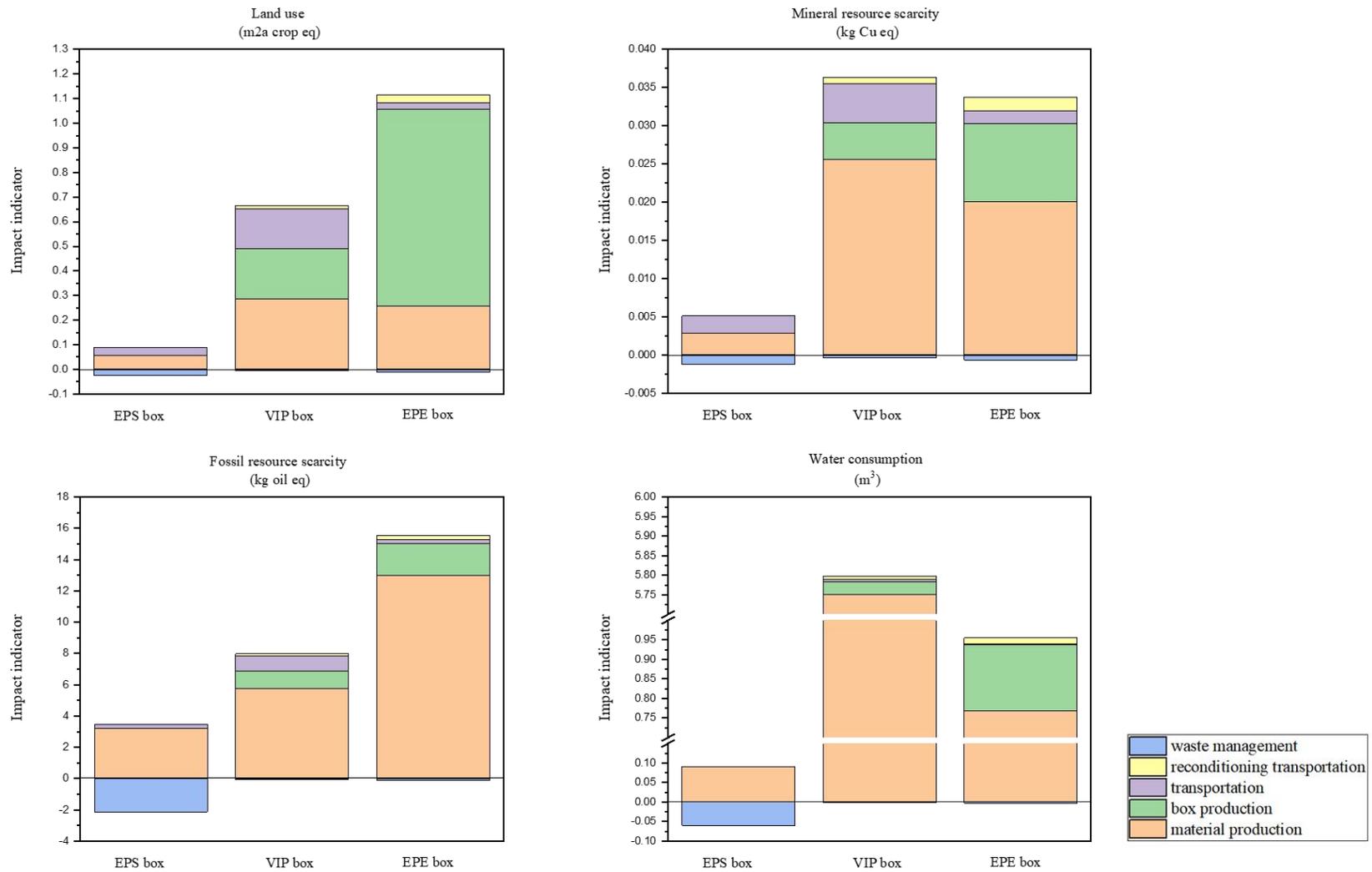


Figure S5. Potential impact results for scenarios 4 (1cycle).

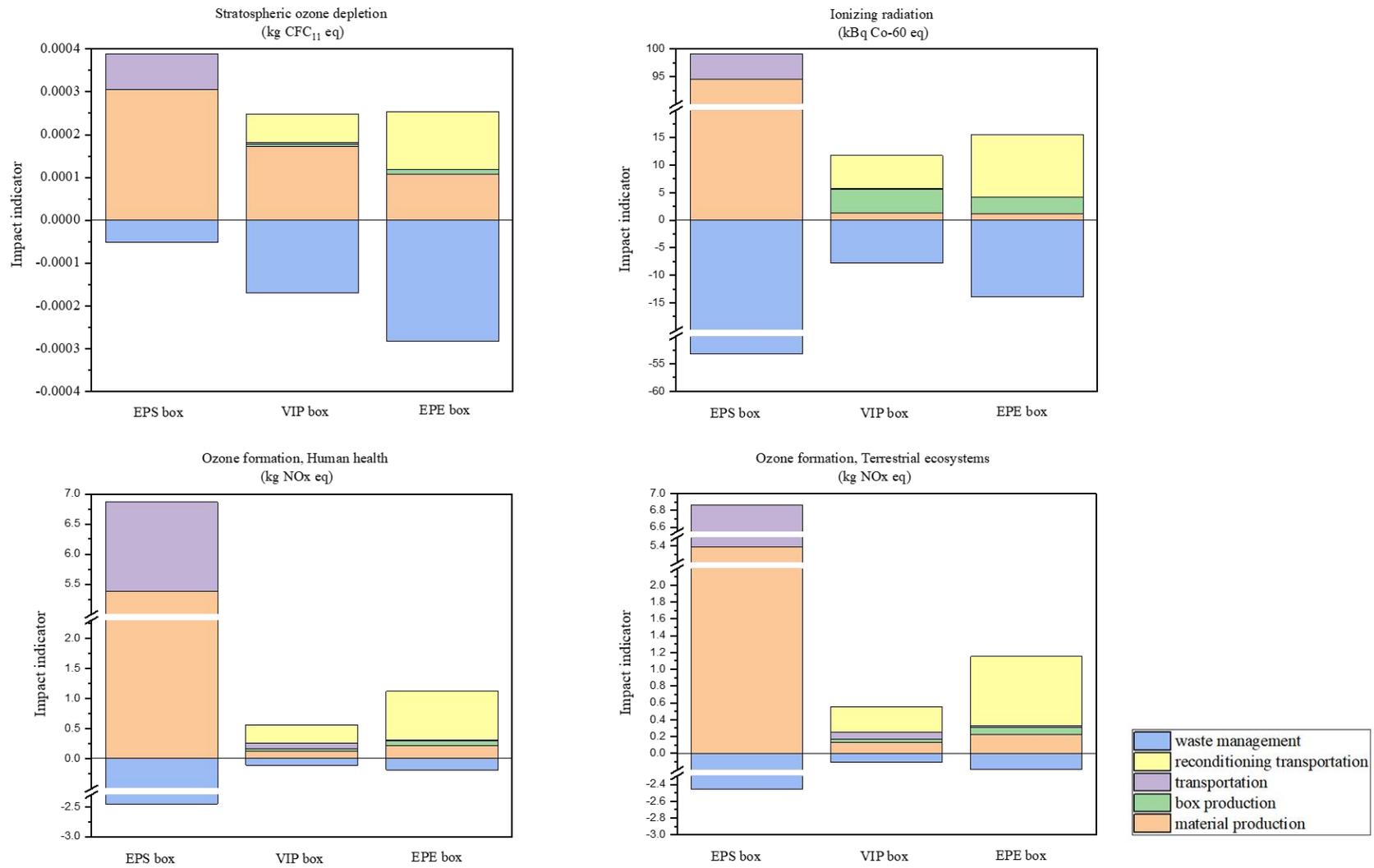


Figure S6. Potential impact results for scenarios 1 (300 cycle).

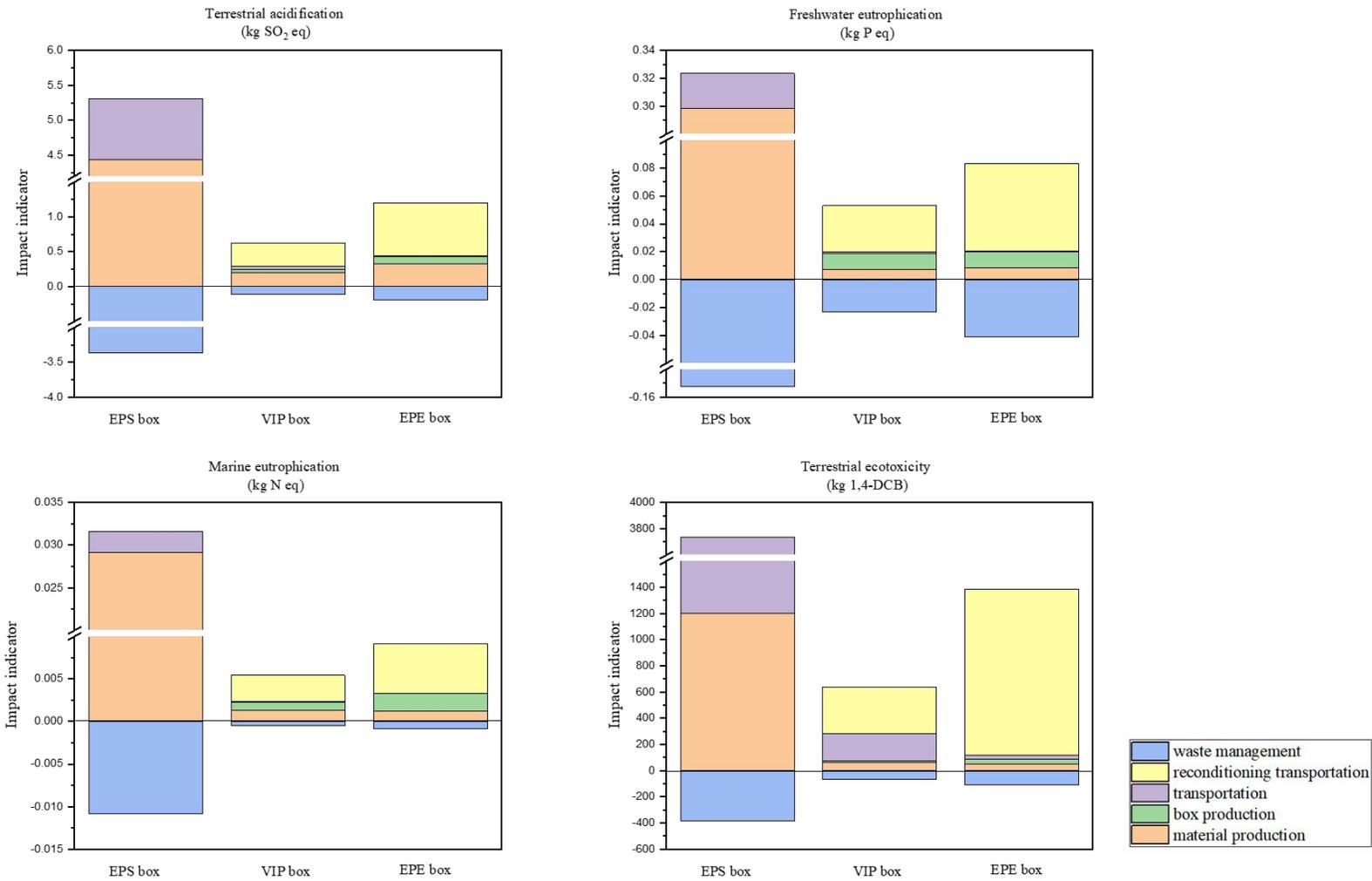


Figure S7. Potential impact results for scenarios 2 (300 cycle).

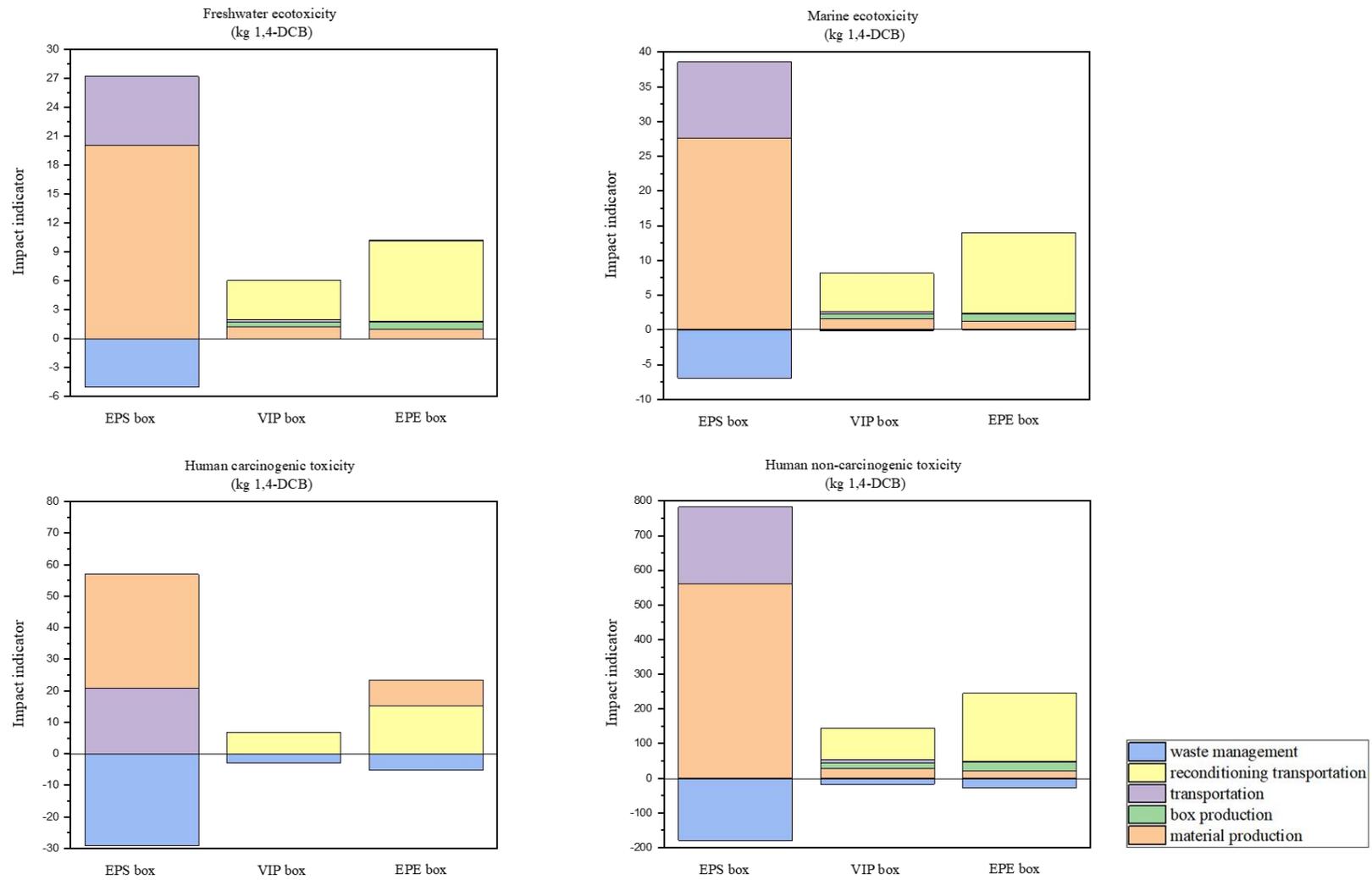


Figure S8. Potential impact results for scenarios 3 (300 cycle).

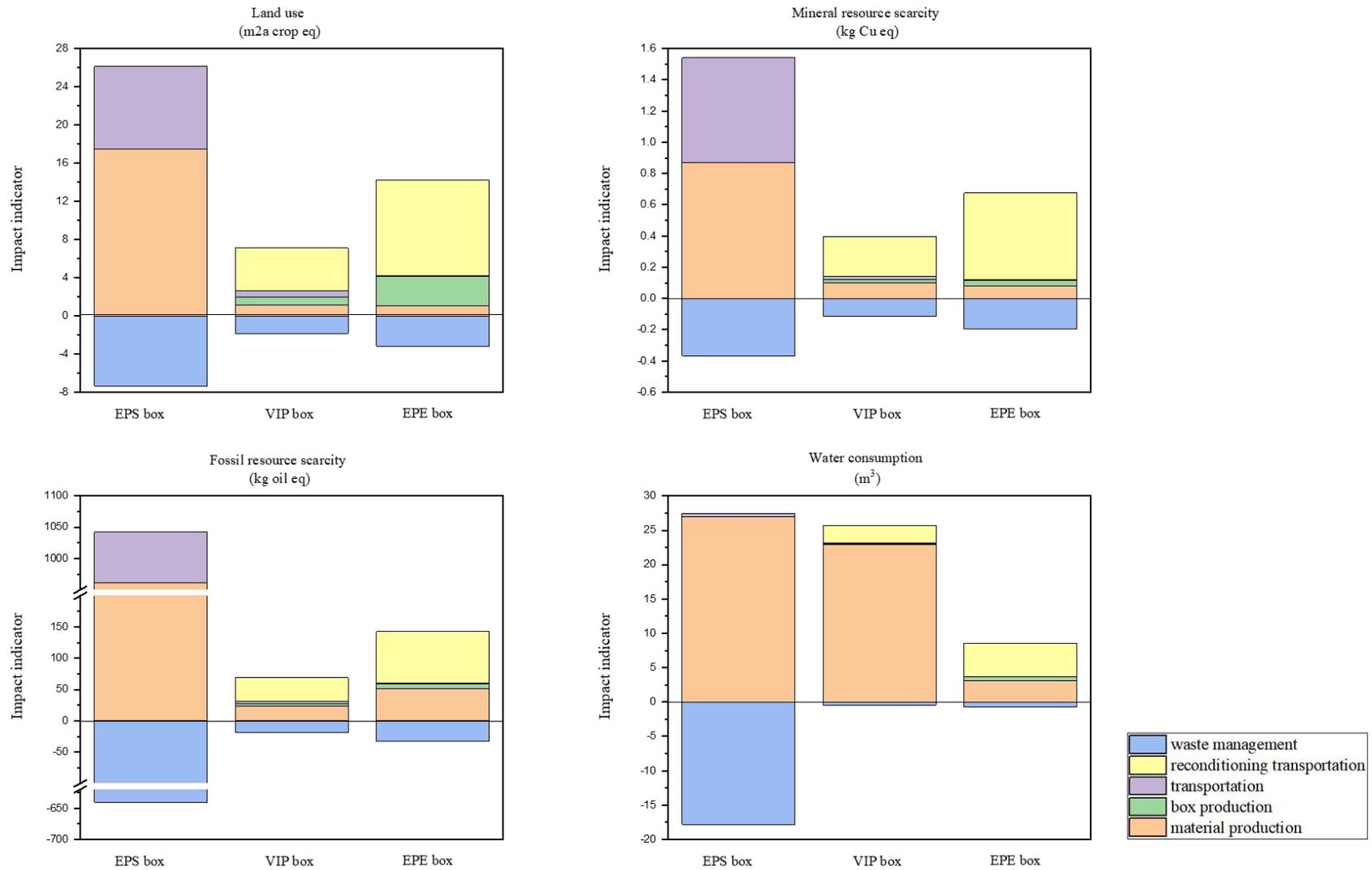


Figure S9. Potential impact results for scenarios 4 (300 cycle).

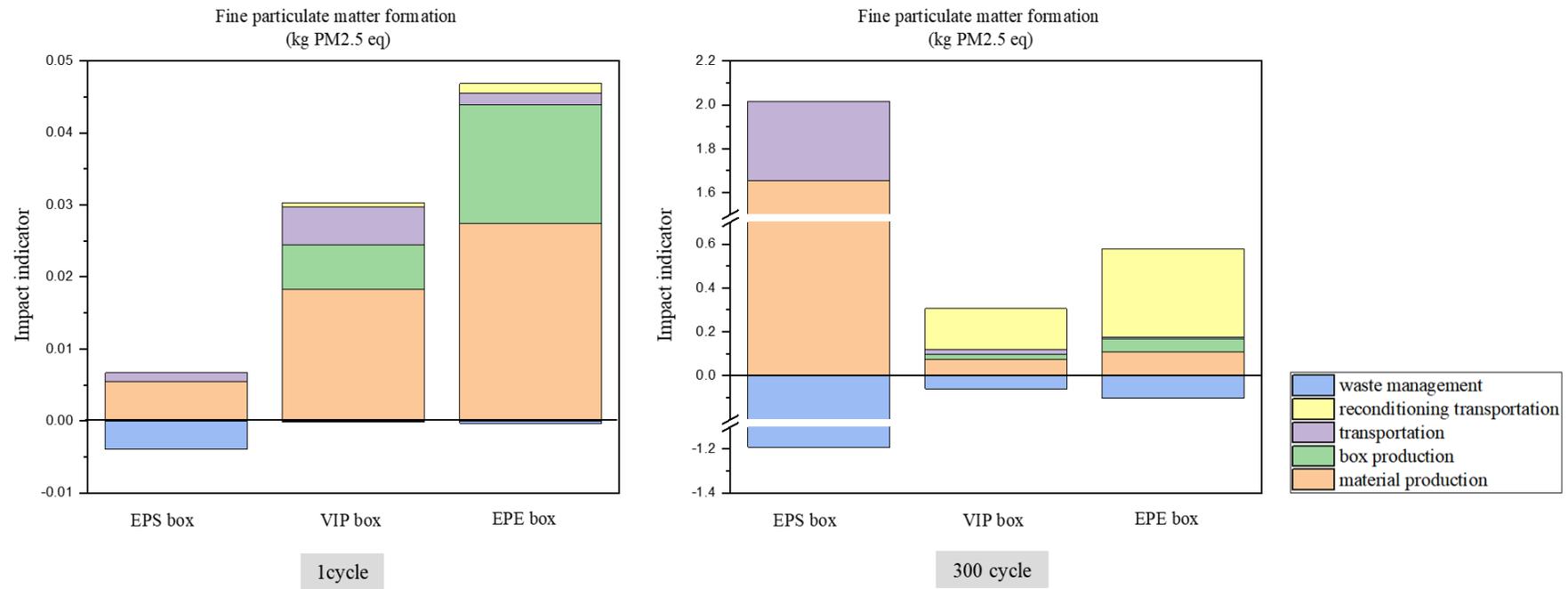


Figure S10. Fine particulate matter formation results for scenarios.