# - Supporting Information -

# Redefining environmental nanomaterial flows: Consequences of the regulatory nanomaterial definition on the results of environmental exposure models

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**Table S1. Assumed transfer coefficients for the product categories for each compartment.**

| **Substance form (main application according to Glauser et al (2014)[1]** | **Transfer coefficients** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Precipitated silica** | **Waste-water** | **WIP** | **Landfill** | **Air** | **Soil** | **Surface water** | **Cement kiln** | **Recycling / WMS** | **Export** | **Bio-waste** | **Reference** | **Remark** |
| Elastomeres (green tires filler as reinforcing agent) | 0.0748 | 0.036 | 0.016 | 0.01497 | 0.0604 | | 0.36476 | 0.31895 | 0.07193 | | End-of-life: (ETRMA 2015) [2] Air: (Harrison et al. 2012) [3] | silica is used as a substitute for carbon black, wear of tires is 10-20%; (Milani et al. 2004) [4] silica is used 5-15 % (Wik and Dave 2009) [5] unknown fraction mentioned in ETRMA (2015) [2] was distributed equally between the compartments considered. |
| Detergents and Cosmetics (e.g. as powder agent) | 0.8 | 0.15 | 0.03 | 0.02 | | | | | | | (Wang et al. 2016) [6] adapted from categories "Cosmetics, personal care" with Kumar (2005) [7] | No sun lotion -> no direct entry to surface waters |
| Carrier materials (agricultural and animal feeds | | | | | 1 | | | | | | own assumption Function: anti-caking -> fertilizer or soil application | nano-$SiO_2$ is not bioaccumulated and released accordingly. |
| Polymers and Plastics (Plastics: battery plates, PVC flooring, fillers in plastics, Anticaking) | | 0.32 | 0.68 | | | | | | | | (Wang et al. 2016) [6] category polymers | |
| Sealants | 0.015 | 0.9 | 0.085 | | | | | | | | (Wang et al. 2016) [6] category "Adhesive + sealants" Tolls et al., 2016 [8] | |
| Paints, coatings and ink | 0.05 | | 0.2 | | 0.1 | 0.05 | | 0.6 | | | (Wang et al. 2016) [6] category Paints coatings inks and toners | Disposed as aggregates with construction and demolition waste |
| Other (sealants, paints, coatings, inks and miscellaneous uses) | 0.2 | 0.75 | 0.025 | | | 0.025 | | | | | (Wang et al. 2016) [6] | |

**Table S1 continued.**

| **Colloidal silica** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Refractory Binders (ceramics) | 0.01 | 0.15 | 0.25 | | | | | 0.59 | | | (Wang et al. 2016) [6] category: stone, cement, glass, putties, modeling clay | |
| Investment casting (ceramics) | | 0.32 | 0.67 | 0.01 | | | | | | | (Wang et al. 2016) [6] category composite and alloys | |
| Pulp and paper (anti-slip / less sticking) | | 0.03 | 0.07 | | | | | 0.7 | 0.2 | | (Sun et al. 2016) [9] | |
| Electronics (wafer polishing) | 0.05 | | 0.95 | | | | | | | | (Wang et al 2016) [6] (Electrical / electronic products -> slurry/paste, industrial use) | microfiltration on site |
| Beverage clarification (own: flocculation agent) | 0.01 | | | | | | | | | 0.99 | Own assumption, see beer fining category | |
| Textile processing | 0.99 | | | 0.01 | | | | | | | (Wang et al. 2016) [6] | |
| Other (batteries (electrolyte), catalysts, concrete, cosmetics, leather treatment, pigment formulations, plastic additive, refractory, adhesives, cleaning products, other (paint, epoxy resin) | 0.2 | 0.75 | 0.025 | | | 0.025 | | | | | (Wang et al. 2016) [6] category adhesive and sealants | simplified assumption due to use in many different product categories |

**Table S1 continued.**

| **Silica gel** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Beer fining | 0.01 | | | | | | | | | 0.99 | own assumption based on (Leiper et al. 2002) [10] | |
| Other food | 0.9 | 0.05 | 0.05 | | | | | | | | (Wang et al. 2016) [6] category Food products | |
| Adsorbents and Desiccants (Compete with molecular sieves) | | 0.5 | 0.5 | | | | | | | | Own assumption | |
| Paints and coatings (Flattening agents) | 0.05 | | 0.2 | 0.1 | 0.05 | | | 0.6 | | | (Wang et al. 2016) [6] category paints and coatings | |
| Plastics and textiles | 0.02-0.32-0.65 | Rest*0.4 | Rest*0.1 | | | | | Rest*0.1 | Rest*0.4 | | (Wang et al. 2016) [6] category clothes, shoes, polymers | |
| Pharmaceutical tableting (Additive) | 0.9 | 0.05 | 0.05 | | | | | | | | (Wang et al. 2016) [6] category article for health services | |
| Dentrifices (Toothpastes) | 0.9 | 0.05 | 0.05 | | | | | | | | (Wang et al. 2016)[6] category article for health services of (down the drain product) | |
| Other (catalysts, specialty paper, high-pressure chromatography) | 0.05 | | | | | | | 0.95 | | | (Wang et al. 2016) [6] category catalysts | |

**Table S1 continued.**

| **Fumed silica** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Silicone elastomers | 0.015 | 0.9 | 0.085 | | | | | | | | Based on (Wang et al. 2016) [6] category sealants (Tolls et al 2016) [8] | Silicone elastomers are mainly used in machinery, automotive, construction |
| other silicones (own: silica gel, fluids, resins) | | 0.2 | | | | | | 0.8 | | | (Wang et al. 2016) [6] category Lubricants | |
| Paints and coatings | 0.05 | | 0.2 | | 0.1 | 0.05 | | 0.6 | | | (Wang et al. 2016) [6] category paints and coatings | Disposed as aggregates with construction and demolition waste |
| Polyester resins | | 0.75 | 0.25 | | | | | | | | Eurostat, 2013 [11] | average distribution of waste in the EU; |
| Adhesives and sealants | 0.015 | 0.9 | 0.085 | | | | | | | | Based on (Wang et al. 2016) [6] category sealants (Tolls et al. 2016) [8] | |
| Epoxy resins (own: coatings, adhesives, electronics | 0.015 | 0.9 | 0.085 | | | | | | | | Based on (Wang et al. 2016) [6] category sealants (Tolls et al. 2016)[8] | many different industries |
| Industrial inks | 0.015 | 0.735 | 0.25 | | | | | | | | Eurostat 2013 [11] own assumption based on (Tolls et al. 2016) [8] | average distribution of waste in the EU; wastewater: worst-case for dispersive use cf. (Tolls et al. 2016) [8] |
| Other (planarization of metals and dielectric films) | | 0.05 | 0.1 | | | | | 0.65 | 0.2 | | (Wang et al 2016) [6] electronic products | |

## References


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