caLIBRAte nano risk governance

Fact Sheet

Exposure scenarios and data for performance testing of human and environmental risk assessment tools: Inventory and analysis of existing case studies

Selected human and environmental risk analysis tools were performance tested before acceptance to the Nano Risk Governance Portal (NRGP). Value-chain case studies with high quality information were needed for testing and demonstrating of the modelling tools.

Data quantifying the nanomaterial release, transformation, exposure and fate were necessary for performance testing, calibration and demonstration of exposure assessment models used in the NRGP. Existing case studies were comprehensively inventoried, the quality of their data was examined, the missing information (data gaps) identified and completed when applicable data was available. The results of this analysis were used to select the most relevant case-studies for performance testing of the models and for demonstration of the NRGP.

Inventory

A complete map of existing value-chain case-studies for nanomaterial and nanomaterial enabled products, their production, downstream use and waste handling was created. The case studies from earlier or soon ending EU projects were catalogued. Totally 55 nanosafety-related EU and national projects were contacted and asked to deliver possible case-studies suitable for exposure model testing. The projects reported 139 different case studies. This basic set of case studies were expanded with the data from recent scientific literature and existing exposure databases (GUIDEnano and NECID).

Categorization

The inventoried case studies were grouped according to the focus of the study; 1) case studies focusing on release or emission from the product, 2) case studies focusing on exposure measurement and 3) case-studies evaluated on environmental fate or mass flow models.

From each case study, caLIBRAte reported the type of nanomaterial and/or nanomaterial-enabled product, life-cycle stage, as well as data availability, description of the case study and results from human exposure and/or environmental exposure assessment.

Identifying knowledge gaps and missing data

Following inventory and categorisation of the case studies, knowledge gaps and missing data on human exposure and environmental release and fate were identified. Gap analysis was focused on TiO_2, SiO_2, Ag and Cu-based nanomaterials.

Exposure scenarios were assessed for those missing parameters required in the selected models. When data/parameters were not present, sources of information were identified or data were generated (i.e. dustiness of NM, release rate, etc.).

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The outcome of this analysis enabled caLIBRAte to know which amount and type of information/ data is currently available, and to evaluate which parameters are lacking in each case study according to the mandatory parameters identified in HRA and ERA models.

Life Cycle stages	Synthesis	Manufacturing	Use	End-of-life
Potential Exposure Scenarios	Weighing, Flame pyrolysis, Chemical vapour deposition, Wet synthesis, Milling, ...	Spraying, Extrusion, Cutting, Drilling, Formulation, Handling, ...	Weathering, Abrasion, Sanding, Washing, Wearing, ...	Landfilling, Incineration, Filtration, Waste water treatment plant, Recycling, ...
Worker exposure	Data available	Data available	Not relevant	Data gap
Consumer exposure	Not relevant	Not relevant	Data gap	Not relevant
Environmental exposure	Data gap	Data gap	Data available	Data available

Available exposure scenarios and data gap identified along the Life cycle stages of NM and/or NM-enabled product.

Summary

From the gap analysis it could be concluded that the NMs with the largest number of human exposure studies available are TiO_2, followed by SiO_2, Ag and Cu-based NMs. These exposure studies correspond to activities performed during the synthesis (e.g. handling of powders) and manufacturing stages (e.g. ceramic processing), with few scenarios corresponding to professional use. A clear gap has been found in the end-of-life stage of all NMs.

For environmental exposure and fate data, information from synthesis and manufacturing phases are missing for all selected nanomaterials. The most sensitive input parameters for environmental models were found for TiO_2, SiO_2 and Ag nanomaterials, while some were missing for Cu-based nanomaterials. Substantial information on nanomaterial release from nano-enabled products were found for TiO_2 (29 studies), SiO_2 (18 studies), Ag (15 studies), but less so for Cu-based products (4 studies). The polymeric materials were the most investigated product category, followed by textiles, paints, surface coatings and additives. The studies were mainly performed in lab-scale and simulated the use of nano-enabled products (e.g. weathering, washing, sanding).

This fact sheet is based on caLIBRAte Deliverable 6.1*: Inventory of existing value-chain case-studies* & Deliverable 6.2: *Report on gap analysis* as the result of a collaboration between Leitat (ES); Finnish Institute of Occupational Health (FI); National Research Centre for the Working Environment (DK); UK Research and Innovation (UK) & Nederlandse Organisatie voor toegepast-natuurwetenschappelijk Onderzoek (NL).

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