caLIBRAte
nano risk governance

Fact Sheet

Improving suitable existing environmental hazard, exposure and risk assessment models

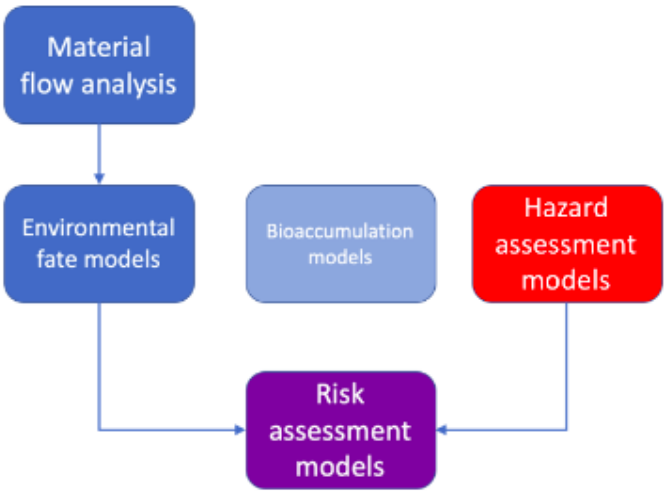
To support efficient environmental risk assessment of nanomaterials, a suite of modelling tools is needed including hazard, exposure and risk assessment tools. caLIBRAte aimed at improving suitable existing environmental models selected in the project. Some of the models were further developed and new functionalities were added. For other models the work performed in caLIBRAte centered primarily on improving the input to the models rather than making changes to the core models.

Models included

The models included in this work were:

- Material flow analysis models
- Fate and transport models
- Hazard assessment models
- Bioavailability and bioaccumulation modelling
- Environmental risk assessment models.

The caLIBRAte risk governance framework



Background

Many environmental risk assessment models are flexible enough that input parameters can be varied in a way for improvements in the modelling to be achieved. This is especially true for material flow analysis models where they present a framework for modelling with significant flexibility in the way the model is built. New knowledge that affects the input parameters or inclusions of new processes can therefore easily be included in the existing models. These adaptations can profoundly affect the results obtained from the models. This is also true for hazard or risk assessment models that all have a built-in flexibility and rely to a large extent on well curated data sets.

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Improvements achieved

The main improvements made to the different models were:

- Material flow analysis (1): Imrpoved quantification of production amounts of nanomaterials, the most important input parameter for material flow models. This value is strongly affected by the definition for nanomaterials.
- Material flow analysis (2): Grouping of nanomaterials for material flow modeling based on the form of the nanomaterials (e.g. crystal phase) to separate the flows for a single nanomaterial into its different forms to be used in different applications.
- Fate modeling: Introducing more specific atmospheric modeling into an environmental fate model for nanomaterials (SimpleBox4Nano) to improve the description of dispersion from a local source in air.
- Hazard assessment (1): Improvement of a probabilistic species sensitivity distribution model (SSD) by better considering the parameter uncertainty, particularly the assessment factors
- Hazard assessment (2): Comparison between three different species sensitivity distribution models based on a harmonized and well curated data set.
- Environmental risk assessment: Using the improved material flow and hazard assessment tools to obtain a form-specific environmental risk assessment of nanomaterials.

The work lead so far to three published papers:

- Wigger, H.; Wohlleben, W.; Nowack, B. (2018) Redefining environmental nanomaterial flows: Consequences of the regulatory nanomaterial definition on the results of environmental exposure models. Environ. Sci. Nano 5: 1372-1385.
- Wigger, H.; Nowack, B. (2019) Grouping by material-specific properties applied to a combined environmental exposure and hazard assessment of engineered nanomaterials. Nanotoxicology 13: 623-643.
- Cai, Y.; Wigger, H.; Nowack, B. Identifying ecotoxicological descriptors to enable predictive hazard assessments of nanomaterials in a meta-analysis of ecotoxicological data. NanoImpact 15: 100-180.

This fact sheet is based on caLIBRAte Deliverable 3.3: *Report on improvements of environmental risks assessment models* produced as a result of collaboration between Swiss Federal Laboratories for Material Science and Technology (CH) and National Research Centre for the Working Environment (DK).

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