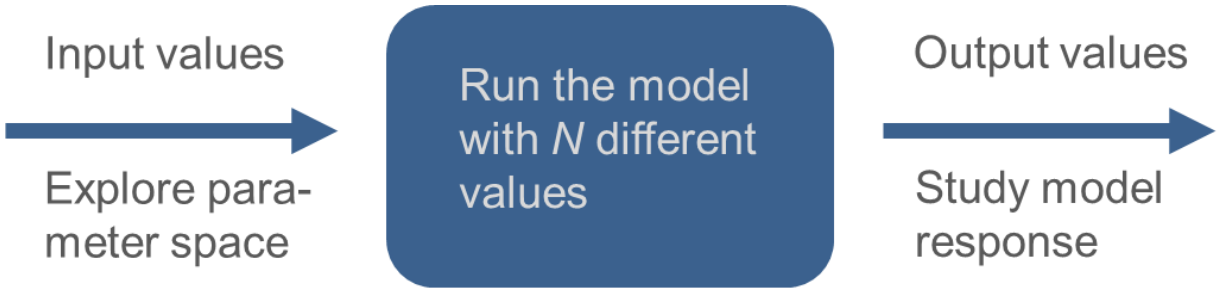
caLIBRAte
nano risk governance

Fact Sheet

Input value sensitivity of Nanomaterial risk, exposure and hazard assessment tools

Establishment of a web-based nano-risk governance portal with well-documented tools and guidance is one of the key products of the caLIBRAte project. An important part of this work is the testing and calibration of the nanomaterial (NM) risk assessment tools and models. This includes sensitivity analysis on 11 nanomaterial risk, exposure and hazard assessment models.

The testing methods included One-at-a-time (OAT), Monte-Carlo, and tailored regression analysis and diagnostic methods. The aim of the testing was to find the input parameters that show no, lowest or highest sensitivity. Furthermore, the aim was to find if there is any unexpected behavior of the models.



Sensitivity analysis is defined as a study on model output value variation, when model input values are

The most and least sensitive inputs parameters differ between the models

A total number of 64 input parameters were classified as most sensitive, which of most were physical-chemical or exposure parameters and only a few hazard parameters. Common most sensitive parameters between models were the presence of nanomaterials in the production, release rate/ concentration, duration of cycle/process, weight fraction of nanomaterial in product, redox/ catalytic/ROS/inflammation potential and stability/ half-life of the nanoparticles.

A number of 43 input parameters were classified as least sensitive. Common least sensitive parameters in multiple models were duration of handling/ duration of activity in work cycle, ventilation rate, room volume, origin of nanomaterial / product type, ENP / Primary particle diameter and activity level/handling activity.

Some parameters showed high sensitivity in some models whereas low sensitivity in others. These parameters are dustiness, room volume, room ventilation rate, duration of handling/work cycle, limit values, R-phrases / -classification and dissolution rate/solubility.

Sensitivity analysis of the models served as the basis for the full performance testing of caLIBRAte models.

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Unexpected behavior of risk assessment models

A number of eight models were found to have non-sensitive parameters, which was the most common unexpected behaviour in the models. Two of the models had non-linear output when linear behaviour was expected. One of the models had outliers in the output values and three of the models had sudden jumps in the output data. No model crashes or fails were encountered during the models runs, but three of the models had some other unexpected behaviour, namely, a higher variability in the output ranges has been expected for some of the input parameters than was observed; a higher probability was discovered to increase the hazard band by two bands instead of one band, which does not intuitively make sense and the third model was found to have some programming errors. The model owners were advised of these and some are being corrected by the model developers.

Nanosafer CB

Control banding nanotool

BAUA Sprayexpo 2.3

ConsExpo nano

SimpleBox4Nano

ANSES

LICARA nanoscan

Swiss Precautionary Matrix

SUN DS

ISO/TS 12901-2:2014

Stoffenmanager Nano

Implications of sensitive parameters

The results, especially the most and least sensitive input parameters, serve as a guidance for data collection needs. The highly sensitive parameters identified here serve as an indication that high-quality data of these is key in obtaining better risk estimates, and in reducing uncertainty. Hence, data collection for these parameters has a high likelihood of having a high value.

In contrast, the need for collecting large amount of data on the parameters that have low sensitivity is not as high, as it is not as likely that better data substantially improves the risk estimates. Therefore, the users are suggested to put more emphasis on the most sensitive parameters, since they affect the model outcome the most.

This fact sheet is based on caLIBRAte Deliverable 7.2: *Report on results of the first performance test of caLIBRAte tools* as a result of collaboration between Tampere University (FI), National Research Centre for the Working Environment (DK), the Netherlands Organisation for applied scientific research (NL), National Institute for Public Health and the Environment (NL), GreenDecision (IT), Ca' Foscari University of Venice (IT) and Swiss Federal Laboratories for Materials Science and Technology (CH).

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