

EXPOSURE SCENARIO LIBRARIES AS A TOOL FOR EXPOSURE ASSESSMENT

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Abstract. The development of nanotechnology has reached a point where it is being widely applied, and numerous nanomaterials and nano-enabled products are handled across a broad range of industrial sectors. Exposure extends beyond occupational settings as products containing nanomaterials are used by different consumer groups.

Despite the knowledge on their toxic effects is growing there is still not OEL for most NMS and therefore the precautionary approach is still used where levels are kept as low as possible. Therefore there is a need to assess workers and consumers exposure.

1 Occupational exposure assessment to nanomaterials

There are several measurement strategies for nanomaterials.

NanoGEM approach, developed by a group of German institutes, structured in three tiers, where tier one is information gathering, tier two involves a basic campaign and tier three a detailed in-depth measurement survey

The French approach is structured in five tiers, and also included off-line analysis as dustiness test. NIOSH has prepared specific guidance on the assessment of CNT and CNF And also for TiO₂. There is also a general approach the Nanoparticle Emission Assessment Technique, There are differences in the details of the approaches, the instrument used and assessment of the background but all follow a tiered approach where:

- Tier one consist of information gathering and assessment of potential release scenarios
- Tier two release and potential exposure is confirmed for which a basic campaign is required
- Tier three, detailed exposure concentrations are measured

The difference between tier 2 and 3 can be just the use of a couple more instruments. And longer measurement periods.

The move from tier 1 to tier 2 is more substantial, tier one is a desk-base exercise whereas tier two involves a visit to the industrial site in the case of an occupational scenario and the use of instruments, personnel who knows how to use the equipment, and all of that has financial implications. So, the decision has to be well informed. And whatever method you use it has to be a systematic.



2 Tier one tools

Control banding tools; like nanosafer, stoffemanager nano and the nanocontrol banding tool for occupational exposure and nanoriskcat for consumers. These tools provide a hazard and an exposure band and an estimation of the risk. However, the hazard information is not always available, they do not cover all the domains, and what is more important they have not been validated with measurement data.

Hristozov developed a model base on weight of evidence. The model covers occupational exposure and it overestimates the exposure.

In short this consists of defining lines of evidence and assigning a weight to estimate an overall Or one can also use a read-across approach.

Read-across is a technique for data-gap filling where endpoint information from one chemical is used to predict the same endpoint for another chemical which is considered to be similar in some important aspect relating to that endpoint. Read-across may be for a qualitative or quantitative result.

Read-across exposure

Use of measurement data from analogous scenario in a conclusion on release/exposure or risk assessment.

What are exposure scenario libraries?

Collection of exposure scenarios with summaries of measurement data where scenarios can be searched using different descriptors and the user can find a match for the scenario of interest and read-across from the scenario library. I have to say all data is anonymised so companies cannot be identified. There are several projects developing or using data libraries.

3 MARINA Library

In the project MARINA, which stands for Managing the Risks of Nanomaterials we have developed the exposure library further. The template for data collection is more detailed and information is coded to facilitate the search.

This is an example: it includes information on the substance, the activity, the room conditions, other factors affecting the release and the exposure. The measurement data consists of summary statistics for the different instruments used and also descriptive information of SEM, TEM analysis if that is available. The library will be available online. It allows to search using the type of scenario, occupational, consumers or service life, CES name, name of the material, the life cycle and operating procedure. At the moment it has data on 11 NMs and most of the scenarios are for occupational exposure.

Limitations

- Quality of the exposure scenario information
- Quality check: completeness & transparency,
 - representativeness of the measurements
- Measurements are not collected in a harmonised way
- Might lead to different outcomes if reading from two different ES
- Uncertainty can be described but not quantified
- Criteria to read-across

This method of reading approach exposure information is being developed further in other projects.
In the Guidenano

1. Further population of the library with more ES
2. Algorithm to measure the similarity of the studied ES and the library ES
3. Library will be used as a tier one method in the Exposure Assessment module of the GuideNano tool.

As part of SUN (Sustainable nanotechnologies) work is being done on dermal exposure and this will also be put into a Library which will include dermal transfer efficiencies from surface to hand and hand to mouth.

4 Conclusion

- Exposure assessment is an essential part in risk assessment/management
- Need to be done in an intelligent, tiered approach
- Systematic approach to move to tier two to carry out a monitoring survey
- ES libraries are a useful tool for this process