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ABSTRACTS

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How to manage nanomaterials safety in research environment?

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At the moment, there is not enough information on nano toxicology or studies on exposure to nanomaterials, making difficult a rigorous risk assessment.

However, since preliminary scientific evaluations indicate that there are reasonable suspicions that activities involving nanomaterials might have damaging effects on human health; public and private institutions as well as industries have to adopt preventive and protective measures proportionate to the risk intensity and the desired level of protection.

In this work, we present a practical procedure for a university-wide safety and health management of nanomaterials, developed as a multi-stakeholder effort (government, accident insurance, researchers and experts for occupational safety and health).

The process starts using a schematic decision tree that allows classifying the nano laboratory into three **hazard** classes similar to a control banding approach (from Nano 3 - highest hazard to Nano1 - lowest hazard).

Classifying laboratories into **risk** classes would require considering actual or potential exposure to the nanomaterial as well as statistical data on health effects of exposure. Due to the fact that these data (as well as exposure limits for each individual material) are not available yet, risk classes could not be determined.

The main occupational exposure routes are the respiration tract and the skin. Consequently, the first differentiation in the decision tree for **hazard** class determination regards the environment, whether the process is carried out in a closed (complete process confinement) or open system. In case the process is not fully enclosed (glove box or completely sealed environment), different types of activities with nanomaterials are correspondingly discussed:

- Activity with nanofibers
- Activity with nanoobjects in powder
- Activity with nanoobjects in suspension
- Activity with nanoobjects in solid matrix

Inside these categories, hazard classification is based on the quantity of nanomaterial as well as on the aggregation/agglomeration state (for activities with nanopowders).

For nanopowders we also distinguish *production* and *handling*. Very often, particles are supplied by other laboratories or external suppliers, where occupational safety and health team cannot control the process as well as for home-made particles. Furthermore, users manipulate such particles more often in confined spaces. Limits for hazards classes' determination in case of *handling* are therefore lower than those for *production*.

The hazards related to nanomaterials suspension is not only influenced by the nature of particles but also by the dispersant. The decision tree is organized accordingly: For manipulated quantities superior to 1 liter the nature of the used dispersant (flammable, toxic etc.) is considered.

The preparation of composites is either treated as "Activity with nanoobjects in suspension" or "Activity with nanoobjects in powder" when performed in solution or in dry conditions, respectively. The laboratory is treated as Nano 1 if material characterization and post-preparation processing activities do not include any mechanical or thermal treatment. If dust can be released during the manipulation or if composites are friable, laboratory is treated as "Activity with nanoobjects in powder".

For each determined hazard level we then provide a list of required risk mitigation measures (technical, organizational and personal).

The target 'users' of this safety and health methodology are researchers and safety officers. They can rapidly access the precautionary hazard class of their activities and the corresponding adequate safety and health measures. The proposed methodology and protective measures are provisional in nature pending the availability of more reliable scientific data.

This methodology is being implemented at EPFL for research labs dealing with nanomaterials. It is our opinion that it would be useful to other research and academia institutions as well.

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