A Promising Approach Towards Responsible and Safe Nano-Innovations

Susanne Resch¹, Christa Schimpel¹, Andreas Falk*¹
¹BioNanoNet Forschungsgesellschaft mbH (BNN), Steyrergasse 17, Graz, Austria

1. INTRODUCTION & MOTIVATION

With large amounts of nanotoxicology studies delivering contradicting results and an unstable, moving regulatory framework, potential risks surrounding nanotechnology appear complex and confusing. The European chemical regulation, REACH, is trying to adapt its annexes to fit nanomaterials [1], however, this is not a process achieved swiftly. In order to develop safe and legally compliant products, we focused on the development of a safety concept implementable in real-life innovation processes [2], which may help to plot a sensible path through the nano-risk landscape, without stifling innovation.

2. AIMS

Presently, the concept is used in an ongoing H2020 pilot line project that develops ESJET printing technologies for nano-copper inks/pastes, and encompasses six pillars (see Figure 1) aiming to:

- create a real-life relevant risk profile for a given nanomaterial,
- reduce uncertainties related to nanomaterial hazard,
- analyse occupational and environmental exposure,
- optimise production processes and related parameters, and
- maximise safety along the entire value chain of the used nanomaterial [3].

3. METHODS & TOOLS

The approach provides a hazard-, exposure- and risk profile for a given nanomaterial, including:

- identification of potential exposure scenarios,
- use of qualitative and semi-quantitative tools to prioritize them,
- measurement of occupational exposure, both at lab and pilot scale, and
- introduction of the Safe-by-Design concept in the innovation and development phases of the pilot plant.

With the proposed concept, concrete and practical guidance to industry on how to deal with environmental health and safety (EHS) issues of manufactured nanomaterials and nano-enabled products along their life-cycle is provided, including, as appropriate, legislation/sector specific issues. The proposed approach aims to be universally applicable for various nano-related innovations and thus bringing them closer to the market.

REFERENCES


Figure 1: Overview of the different phases of the suggested nanosafety approach

4. RESULTS

The initial assessment involved identifying potential source(s) of nanomaterial emissions by reviewing the type of process, process flow, material inputs and discharges, and work practices. Due to latest findings, occupational release/risk is not expected since tasks are performed under safeguarded conditions (e.g., risk is controlled using appropriate safety measures like LEV, PPE, waste management measures).

Results from the exposure monitoring at lab scale indicated no nanocopper release into the workplace environment during ESJET printing processes. Measurements under real work conditions using SMPS 3938 (Scanning Mobility Particle Sizer, TSI) with a measurement range of median particle diameters from 14.9 - 697.8 nm showed that no aerosols are released during ESJET printing processes (188 N/cm³ background aerosols vs. aerosols released during ESJET printing 143 N/cm³).

5. CONCLUSION

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