PROJECT FINAL REPORT

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Project acronym: MARINA

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4.1. Final publishable summary report

4.1.1. Executive summary

Nanotechnology promises new materials for industrial applications by having new or enhanced physico-chemical properties that are different in comparison to their micron-sized counterparts. However, as in all industrial applications, the potential exposure of humans and the environment to these materials is inevitable. As these new materials go through their life-cycle – from development, to manufacture, to consumer usage, to final disposal – different human groups (workers, consumers), environmental compartments (e.g. air, soil, etc…) and species (e.g. worm, fish, etc…) will be exposed to these materials. Emerging data have shown a range of toxic effects from engineered nanoparticles, suggesting that combined with the potential exposure these nanoparticles may result in a risk to human health or the environment. While standard methods exist for hazard and risk analysis of conventional chemicals, these tools need to be modified and verified before applied to nanomaterials. Similarly, current standard approaches to risk management, control and reduction need to be rendered relevant for nanomaterials. Thus, the development of nanotechnology-based products must be complemented with appropriate methods to assess, monitor, manage and reduce the potential risks of engineered nanomaterials (ENM) to human health and the environment. Not only good management tools are important, but public awareness is also important for industrial development and acceptance. Public mistrust of any new technology is often high, and demonstrating 'safe' products of nanotechnology will enhance public confidence. Hence, efficient communication strategies to the public and stakeholders, of significant progress are of high importance. The methods must be integrated in an overarching, coherent strategy for regulators and industry. Thus, a safe and environmentally responsible nanotechnology will safeguard current and future global investments and will be the key to the sustainability of this industry. While there are standard procedures for the material identification, exposure, hazard, and risk assessment for traditional chemicals, it is not yet clear how these procedures need to be modified to address all the novel properties of ENM. Thus, there is a need to evaluate and develop specific reference methods for all the fundamental steps in managing the potential risk of ENM. **The aim of MARINA (MAnaging the RIsks of NAnomaterials) is to develop the Risk Management Methods for Nanomaterials** by addressing the four central themes for the Risk Assessment and Management of Nanomaterials: *Materials, Exposure, Hazard, and Risk*. In MARINA we developed referential tools from each of these themes and integrate them into a Risk Management Toolbox and Strategy for both human and environmental health. These tools were also demonstrated by means of case studies. The fundamental achievements of MARINA are:

i. A well tested set of reference nano**materials** with throroughly validated referential characterisation methods.
ii. The methods to further understand the properties, interaction, **exposure,** and fate of ENM in relation to human health and the quality of the environment.
iii. The harmonised, and standardised reference methods for **hazard** assessment for both human and environmental health and an integrated/intelligent testing strategy.
iv. The **risk** assessment tools by combining elements of (i), (ii) and (iii); strategies for monitoring ENM exposure for human health and environment (including accidental massive release, e.g. explosion or environmental spillage).
v. The MARINA database of experimental results to be shared with the Nanosafety Cluster and ongoing or future projects.
vi. Over 80 scientific papers published in peer-reviewed-journals.