

NANO SUSTAIN

AT A GLANCE

Title: Development of sustainable solutions for nanotechnology-based products based on hazard characterization and LCA

Instrument: Small or medium-scale focused research project, FP7

Total Cost: 3.225.429 €

EC Contribution: 2.475.054 €

Duration: 36 months

Start Date: 1 May 2010

Consortium: 12 partners from 8 countries

Project Coordinator: NordMiljö AB – NOMI, Sweden

Project Web Site: <http://www.nanosustain.eu>

Key Words: nanoproducts, nanomaterials, nanotoxicology, toxicology, ecotoxicology, hazard, impact, exposure, precaution, transport, transformation, fate, LCA, sustainability, use, re-use, recycling, treatment, disposal

THE CHALLENGE

The behaviour and properties of nanomaterials can be quite different to macro-materials; a fact that drives considerable international research and development activities towards exploitation and commercial application, with a corresponding increase in the number of products reaching the end of their life-cycle. At the same time, there is increasing concern that the beneficial properties of nanoscale particles and associated materials and products might also have negative impacts on human and environmental health. However, we still do not know how exactly different nanoparticles (inter)act in the human body or the environment, to what extent these materials may be released or leach from products, or how they are transported, transformed, emitted and accumulate in living organisms or in the environment, e.g. when used directly, or after consumption, reuse, final treatment and disposal.

More reliable scientific data is needed on properties, toxicokinetics, exposure to and degradability of nanoparticles to better understand where, in which form, and to what extent nanoparticles will end up in the environment, to develop more accurate impact, exposure and risk assessment models; and to find efficient solutions for product design that in turn may favour their possible reuse and/or safe disposal. Current analytical and test methods are often not appropriate to generate the data we need to reliably characterize and assess their risk and hazard. As a result, there is an urgent need for preliminary assessment at an early stage of innovation and to validate and further develop these methods to accurately detect nanoparticles in various compartments and to measure their physico-chemical properties in air, water, soil, and products, the media in which men and ecosystems are exposed to, as well as in cells, body fluids or tissues.



PROJECT OBJECTIVES

NANOSUSTAIN's primary goal is to develop new technical solutions for the sustainable design and use, for recycling and final treatment of selected nanotechnology-based products.

Specific objectives are: 1) to assess the hazard of selected nanomaterials based on a comprehensive data survey on their properties (physico-chemical characteristics, exposure probabilities, etc.) and the adaptation, evaluation, validation and use of existing analytical, testing and LCA methods; 2) to assess selected products using LCA (in relation to material and energy flows); 3) to assess the impact of these materials in relation to toxicology, ecotoxicology, exposure, environmental and biological fate, transport, transformation, and destiny; and 4) to explore the feasibility and sustainability of new technical solutions for end-of-life processes, such as reuse/recycling, final treatment or disposal.

METHODOLOGY

NANOSUSTAIN will integrate, validate and apply a variety of advanced analytical and toxicity test methods, including molecular biology and biochemistry, to deepen our present understanding of the impact that follows after possible release and intake of nanoparticles, and identify possible health risks. Various laboratory and modelling approaches will be used to assess hazardous properties of selected products and materials, to improve existing monitoring systems to control distribution, transport and final destiny of nanomaterials, and to develop and explore appropriate solutions for their safe use, handling and recycling, and final treatment.

NANOSUSTAIN will in particular develop the assessment of specific areas that may be relevant for the selection of appropriate endpoints, such as exposure to nanoparticles in test systems or their aggregation and solubility in relation to abiotic factors. Different test strategies and in vitro tests will be examined, to assess possible effects under real conditions, but also to reduce the amount of animal testing. Results will be used to build up a project-specific material database, to further develop and validate preliminary and established risk assessment methods, and to allow for a more careful design and use of products, and of technical solutions for recycling and final treatment.

To identify potential environment impacts from production and application/use to final recycling, existing LCA-methods and exposure models for LCIA will be used and further developed to generate data on prospective environmental concentrations and to define criteria and guidelines for a more precautionary design and improved recyclability of selected nanomaterials.

RESULTS

NANOSUSTAIN will help improve our (presently insufficient) knowledge on the hazard, impact and sustainability of nanomaterials and products, in particular in relation to their use, recycling and final treatment. It will contribute to the update and validation of existing databases and methodologies and hence make current LCA and risk assessment more accurate and reliable. Very little is known about the release and fate of used nanomaterials during end-of-life processes; so the project will generate scientific data on potential risks and their probability of occurring during recycling, final treatment and disposal. For the first time new and innovative solutions will be explored and developed on a lab scale for: 1) recycling of nanomaterials from waste products, 2) composting of nanotechnology-based products, 3) incineration of nanowaste as safe final treatment, and 4) final land-filling of nanoparticle containing products. This will bring about a real step change in the control of this unresolved and major barrier towards the sustainable development of nanomaterials, which in turn will significantly improve the environmental performance of existing and future products and applications.



PROJECT PARTNERS	
Nordmiljö AB, SE (project coordinator)	Kaunas University of Technology, LT
The Institute of Nanotechnology, UK	National Institute for R&D in Microtechnologies, RO
National Research Centre for the Working Environment, DK	Nanologica AB, SE
Technical Research Centre of Finland, FI	Nanogate AG, DE
University of Bremen, DE	UPM Kymmene, FI
Veneto Nanotach, IT	European Commission Joint Research Centre, BE

