



Welcome to the 5th NanoSustain Newsletter

Dear Reader,

For most scientists, engineers, businessmen and regulators engaged in nanosafety issues, it has become increasingly evident that we need strong transnational coordination and integration of current research and funding activities to adequately tackle the novelty and opportunities, but also the complexity and possible risks, associated with nanotechnology based industries. A huge amount of time and money are being invested in finding ways to safeguard the rapidly growing commercialisation of resulting new nanomaterials. This investment will be only returned if the resulting products and applications are truly safe and sustainable, and if benefits are not neutralised by adverse effects that have been overlooked due to the lack of a comprehensive understanding of the true nature of engineered nanomaterials.

To develop reliable, economic and socially acceptable nanotechnologies for industrial and consumer applications requires: (1) a scientifically sound knowledge of the mechanisms and factors that steer the interaction between nanoparticles (NP) and biological components (bio-molecules, cells, tissues, organisms, ecosystems); (2) a hazard classification system based on material properties that determine their biological impact; (3) reproducible measurement metrics, detection devices and testing protocols to understand and eliminate sources of variability; (4) the build-up of a comprehensive exposure database including occupational, consumer and environmental situations occurring along the whole life cycle of NP; and (5) the tailor-made design of safe NP based on material properties that help to minimize their hazard and possible risks.

NanoSustain is addressing all these questions from an end-of-life-cycle perspective.

This 5th Newsletter indicates the midterm of the project and the time to assess the progress of the work done during the first 18 months.

For this reason, the consortium will meet on the 23rd-25th November 2011 in Venice, Italy, to discuss results achieved so far, and their dissemination and compliance with what we expected.

This Newsletter will also start to successively introduce our expert team and the individual project members, and the work they do, starting with our 2 Finnish partners UPM and VTT (see page 2-3).

On page 4-5 main achievements obtained within the different work packages (WP1-6) are summarised and more detailed information will be soon available through a new specific "results" link created on our website (www.nanosustain.eu) for the more interested reader.

Further news concerning dissemination of obtained results and from the Nanosafety cluster can be found on page 6-7.

I hope you will find this Newsletter informative and inspiring for your own work!

Best wishes

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NanoSustain coordinator

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UPM leads the integration of bio and forest industries into a new, sustainable and innovation-driven future. Their products are made of renewable raw materials and are recyclable. UPM consists of three Business Groups; Energy and pulp, Paper, and Engineered materials; employing around 24 500 people with production plants in 16 countries. UPM's annual sales exceed EUR 10 billion and their shares are listed on the Helsinki stock exchange. UPM – The Biofore Company – www.upm.com

Within the NanoSustain project, UPM is responsible for producing nanocellulose based materials and associated end-products for characterisation, biodegradability, toxicity and eco-toxicity experiments to be carried out by the other project partners with Senior Researcher, Päivi Korhonen, acting as project manager.



Figure 1: VTT and UPM researchers working on the NanoSustain project. From left to right: Minna Vikman, Anu Kapanen, Ulrika Backman, Päivi Korhonen and Jari Vartiainen.



VTT Technical Research Centre of Finland is a globally networked multi-technological contract research organization providing high-end technology solutions and innovation services. We enhance our customers' competitiveness, creating prerequisites for society's sustainable development, employment, and wellbeing.

At VTT Senior Scientist Ulrika Backman acts as the project manager, she is also the work package leader of work package 5 of the NanoSustain project.

The main tasks of VTT in the NanoSustain-project are:

Nanocellulose: Nanocellulose is one of the most promising innovations for forest sector. In this task VTT does conducts nanocellulose characterisation in close cooperation with UPM. First results suggest that nanocellulose is non-toxic and does not cause any harm to environment. Senior Scientist Jari Vartiainen is responsible for this work.



Landfill conditions: Test methods for estimating the release potential of nanoparticles from nanotechnology-based products under conditions mimicking landfill conditions will be developed. The first stage is to map suitable methods for measuring nanoparticles in the water phase and to evaluate the reliability of the measurement for release studies. In the second stage the critical test conditions will be identified in order to develop a scientifically sound test method for measurement of the release of nanoparticles. Senior Scientist Margareta Wahlström is responsible for this work.



Figure 2: More VTT researchers working on the NanoSustain project: Research scientist Jouni Hokkinen (left) and Senior scientist Jussi Lyyräinen

Ecotoxicity: In this task the suitability of existing *in vitro* ecotoxicity tests for environmental risk assessment for different nanomaterials is evaluated. *Vibrio fischeri* kinetic luminescence test is being carried out with microfibrillated cellulose, CNT, ZnO and TiO₂. Especially the effect of test environment on nanoparticle behaviour during the biological tests is studied. Recently a poster “Toxicity and characteristics of microfibrillated cellulose in kinetic luminescent bacteria test environment” was presented at International Conference on the Environmental effects of Nanoparticles and Nanomaterials, London. Senior scientist Anu Kapanen is responsible for ecotoxicity testing.

Biodegradability: In this task the suitability of nanocellulose materials for composting, that is organic recycling, will be explored. As biodegradability is a prerequisite for composting, appropriate tests are being performed. The small scale tests in liquid environment are in progress and tests in compost environment are to start during autumn/winter 2011. The structure of microfibrillous cellulose is different compared to nanoparticle-like structures resulting in challenging behaviour in test environments. Senior scientists Minna Vikman and Anu Kapanen are responsible for this part of the research which is closely connected to ecotoxicity studies.

Recycling of glass: The aim of this research is to find out if nanoparticles are emitted during recycling of window glass coated with pro.Glass Barrier 401. The glass is supplied by Nanogate. The heating and melting of the glass is done with an induction furnace and the particles are detected with standard aerosol equipment and analysed with electron microscope. The experimental work is ongoing. The researchers mainly performing this work are Senior Scientist Jussi Lyyräinen and Research Scientist Jouni Hokkinen.

Incineration of CNT-containing epoxy: Emissions to air during incineration of CNT-containing epoxy will be studied at laboratory scale. The incineration experiments will be carried out (sub-contracting) at University of Eastern Finland, where Prof. Jorma Jokiniemi is specialised in emissions from incineration processes to air. So far preparations have been made and the experiments are to be carried out during the end of this year. The researchers mainly performing this work are Senior Scientist Jussi Lyyräinen and Research Scientist Jouni Hokkinen.

The latest results from WP5 are summarised for your information on p4



WP1: Project management

NanoSustain has reached the mid-term point of its three year duration. A great deal of experiments, measurements, and tests have been launched and are currently underway, or in the preparation phase, with first results obtained (see WP2-5). The consortium will discuss these interim results, and further steps, during the next 4th regular project meeting in Venice, Italy, from 23rd-25th November 2011, with a particular focus on the preparation of the first Periodic Report.

WP2: Data gathering, generation, evaluation, and validation

As scientific literature on nanomaterials is rapidly evolving, the NanoSustain Literature Database has now selected, compiled, and critically reviewed more than 120 scientific papers and made them available for project partners. The statistical analysis of the analysed papers is still ongoing to identify main trends in the physicochemical characterisation and the use of the various endpoints for hazard identification, as shown for ZnO in **Figure 1**).

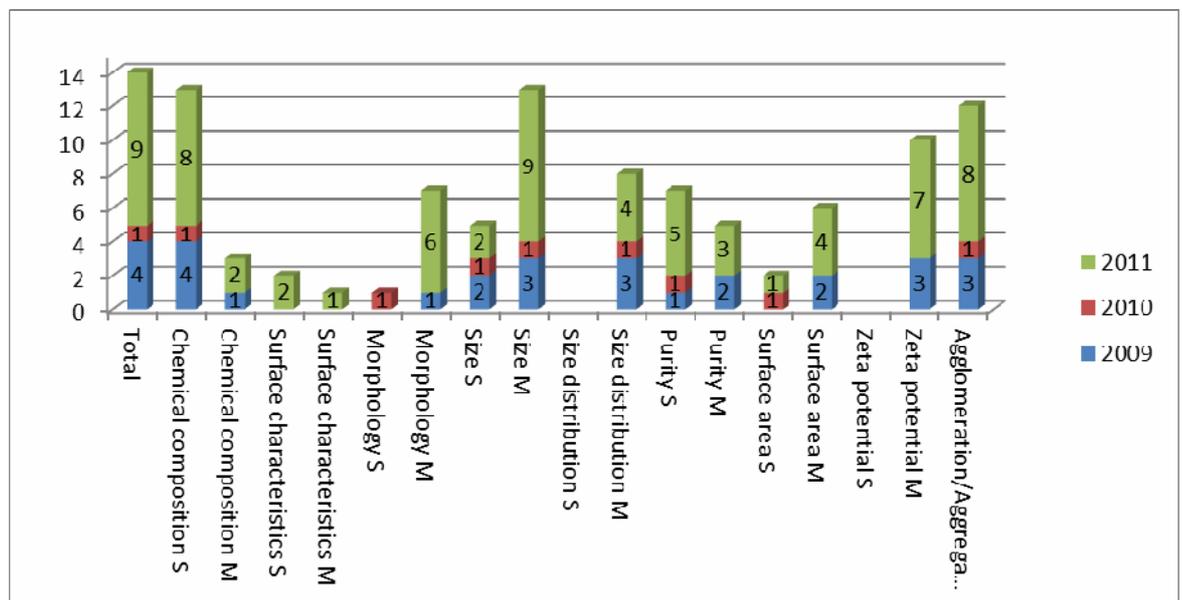


Figure 1: Total number of papers collected and the frequency of physicochemical properties reported for ZnO per year and regarding ecotoxicological studies. S = Supplier, and M = Measured. Agglomeration/Aggregation is always measured in the exposure media.

NanoSustain has also started to establish and organise the framework necessary for the validation of the scientific data, including the procedure and implementation of the inter-laboratory comparison of results, so that only validated data will finally enter the material database. This database will be designed in a way that makes it easy to become harmonised with and integrated into the database of other collaborating projects in particular into the central database planned within the EU nanosafety cluster.

WP3: Hazard characterisation and impact assessment

During the last 3 months the following work has been ongoing within WP3:

- Physical-chemical characterization of particles;
- The generation of sanding dust from life-cycle materials has been performed;
- RNA purification from tissues from mice exposed to pure nanoparticles from the first animal experiment has been performed and RT-PCR on selected genes is ongoing;
- Determination of DNA strand breaks in bronchoalveolar cells from the mice exposed to nanoparticles is almost finished;
- Acute toxicity of nanocellulose and modified nanocelluloses has been tested with *Vibrio fischeri* Kinetic luminescent bacteria test (ISO 21338);



Figure 2: Equipment used for generation of sanding dust at NRCWE.



- Method based on optical microscopy for evaluation of NFC characteristics in test media has been developed;
- TiO₂, ZnO and CNT are currently tested for acute toxicity and size distribution in kinetic luminescent bacteria test environment;
- In collaboration with Flügger and NanoHouse, the weathering testing of glass sheets coated with and without a ZnO-containing coating is ongoing at GFC Chimira, Italy; and
- A collaboration between Health Canada and NanoSustain has been initiated. Researchers at health Canada are going to perform microarray analysis on tissues from mice exposed to TiO₂.



Figure 2: NRCWE scientist conducting sanding experiments.

WP4: Life cycle assessment and prospective technological assessment

On the basis of an evaluation of the published literature process models for the production phase, use phase, end-of-life and recycling phases (re-use, recycling and/or final treatment and disposal) has been developed in the LCA-Softwaretool Umberto. This life cycle models are included all relevant material flows of the selected nanomaterials and their applications:

- Nanocellulose as paper additive, industrial thickener, rheology modifier;
- Nano-TiO₂ paint application;
- Nano-ZnO glass coating as UV-Barrier; and
- MWCNT in epoxy plates.

During the last three months work in WP4 has been focused on the detailed information collection for the process models. On the basis of a literature search of exposure approaches in the field of nanotechnology we are now also working on the development of exposure models of the selected nanomaterials and their applications.

To encourage international exchange of experience we organised a training workshop on LCA of manufactured nanomaterials and nanotechnology based applications in Bremen on 26th & 27th September 2011.

WP5: Development of innovative solutions for recycling and final treatment

Based on the evaluation of the published literature, process models for the production phase, use phase, end-of-life and recycling phases (re-use, recycling and/or final treatment and disposal) have been developed by using the LCA-Softwaretool Umberto. These life cycle models include all relevant material flows of the selected nanomaterials and applications:

- Nanocellulose as paper additive, industrial thickener, rheology modifier;
- Nano-TiO₂ in paint applications;
- Nano-ZnO glass coating as UV-Barrier; and
- MWCNT in epoxy plates.

During the last three months work in WP4 has focused on a detailed information collection for these process models. By evaluating the relevant literature on exposure approaches in the field of nanotechnology, we are now working on the development of appropriate exposure models for the selected nanomaterials and their applications. To discuss results and exchange experience with other LCA experts, a training workshop on LCA of manufactured nanomaterials was organized in Bremen on 26-27 September 2011.

WP6: Dissemination and exploitation of results

During the last three months there have been further improvements to the website to make it more dynamic and user friendly. Shortly details of the latest results will be available for all visitors to the website to allow them to keep up to date with the most exciting developments within the project.

On the 26th & 27th September 2011 NanoSustain held a LCA Training Workshop at the University of Bremen, organised by our WP4 leader, Michael Steinfeldt. This event was a great success; the output from the workshop and the next steps will be available on the website in the coming weeks.



NanoSustain Life Cycle Assessment (LCA) of Nanomaterials Workshop 26th & 27th September, University of Bremen

WP4 leaders, Michael Steinfeldt and Arnim von Gleich, organised this successful workshop where around 30 European experts from the fields of Life Cycle Assessment, Risk Assessment, and Toxicology were in attendance.

The workshop aim was to provide an overview of current R&D activities in Europe in this particular field in light of the latest findings, and to introduce relevant tools to assess the life cycle impact of nanomaterials. The programme of the workshop consisted of several lectures, group discussions, and a final plenary session. The presentations and discussions indicated that a large number of uncertainties and data gaps remain to be addressed, in particular regarding the LCA of nanoproducs.. On the other hand many researchers work on a combination of LCA and Risk Assessment to fully assess potential risks and environmental impacts of nanoproducs and nanomaterials. The assessment of nanospecific toxicological impacts in the context of the LCA necessity was controversially discussed against it. The workshop presentations can be accessed by registered users at www.nanosustain.eu

25th November 2011, 16:30-18:30, NH Hotel Laguna Palace Conference Centre

NanoSustain Stakeholder Workshop - new research to support the design and development of sustainable nanomaterials

NanoSustain is organising a Stakeholder Workshop on the 25th November 2011, within the NanotechItaly 2011 Conference in Venice, Italy (see www.nanotechitaly.it). Representatives from relevant stakeholder groups, such as regulatory and standardisation bodies, policy makers, academia, SMEs, industry, consumer organisations, general public and the media, are warmly invited to come and discuss with us the research we do in the light of their needs, concerns and expectations. For more information please contact Rudolf.reuther@enas-online.com or Eleanor.ourourke@nano.org.uk



- A poster on glass recycling and CNT composite incineration was presented at the European Aerosol Conference, Manchester, September 4th-9th, 2011.



NATIONAL RESEARCH CENTRE
FOR THE WORKING ENVIRONMENT

- In connection with the presentation of the Danish project NanoKem, NanoSustain was presented by project partner, Anne Thoustrup Saber for the Danish Coatings and Adhesives Association (NANOKEM dissemination event). The dissemination event took place at DI's Konferencecenter, Nyborg, Denmark on 9th September 2011.
- Nanosustain results "Applicability of Current Strategies, Methodologies and Tools to Nanomaterials Risk Assessment", were also presented at 13th EuChemMS International Conference on Chemistry and the Environment, ICCE 2011, Zurich (11-15 September 2011).
- Further on the 25th of October 2011, NanoSustain was presented by Ismo Koponen who was invited to the Workshop: "Testmethoden zur Freisetzung von Pigment-Nanopartikeln", in Dresden, Germany with a talk entitled 'Comparison of dust released from wall and wood coatings' (invited invitation).



- D.G. Rickerby and A.N. Skouloudis, Applicability of Current Strategies, "Methodologies and Tools to Nanomaterials Risk Assessment", 13th EuChemMS International Conference on Chemistry and the Environment, ICCE 2011, Zurich, 11-15 September 2011.
- D.G. Rickerby and A.N. Skouloudis, "Industrial Environmental Risk Assessment for Nanomaterials", 6th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials, Royal Society, London, 19-21 September 2011.



4th NanoSustain Consortium Meeting

Venice, 23rd-25th November 2011

The NanoSustain consortium will have the 4th regular project meeting on 23-25 November 2011, in Mestre/Venice, Italy, which is indicating the midterm of the project. Main focus will be to discuss the work and compliance with the work plan, results achieved and their dissemination/exploitation, and the preparation of the 1st Periodic Report.

EU FP7 Large Scale Projects NanoValid and MARINA get started!

The Catholic University of the Sacred Heart (Universita Cattolica del Sacre Cuore) Rome, Italy

On the 15th-17th November 2011, the EU FP7 large-scale integrating projects MARINA (Managing risks of nanomaterials) and NanoValid (Development of reference methods for hazard identification, risk assessment and LCA of engineered nanomaterials) will have their kick-off meetings in Rome, with a joint meeting on the 18th November 2011.

For further information on the projects please contact:

MARINA: Lang Tran lang.tran@iom-world.org

NanoValid: Rudolf Reuther rudolf.reuther@enas-online.com

Prior to these meetings the NanoSafety Cluster will be gathering on 15th November. The first half of the day will focus on the Nanosafety research vision 2015-2020 paper and on the status of the work of the fourteen strategic agenda's working groups. During the latter half we will concentrate on the NanoSafety Cluster's structure and organisation.



Latest NanoFATE Newsletter is now available

The latest Newsletter from NanoFATE is available for download from www.nanofate.eu. Highly interactive with our website, the Newsletter gives details of major results from our first year and introduces the young scientists working on the project. Coming soon on our site will be outcomes of a CLUSTER meeting organised by NanoFATE with Ennsatox and NanoReTox in Sept. 2011 to discuss the environmental fate and ecotoxicology of engineered nanoparticles.

For further information on NanoFATE please contact Claus Svendsen, CEH, UK csv@ceh.ac.uk



Joint NanoImpactNet-QNano conference, 27th-29th February 2012, University College Dublin

From theory to practice – development, training and enabling nanosafety and health research

The first call for abstracts closes on 5th November 2011

Sessions include:

- (1) **Materials for the Future**
- (2) **Eco-Hazard Assessment**
- (3) **From Production to Exposure**
- (4) **Beyond non-specific Hazards**
- (5) **Characterisation *in situ* following exposure**
- (6) **Stakeholder needs and Risk Assessment**

The conference is followed by two training schools on Modelling (1st March) and Good Laboratory Practice (2nd March). Full details on <http://www.nanoimpactnet.eu/> or write to darren.hart@hospvd.ch

NordMiljö AB (NOMI) is the project coordinator and mainly responsible for the operational management, administration and S/T coordination of the planned work, including progress control and reporting to the Commission.

The **Institute of Nanotechnology (IoN)** will be responsible as WP6 leader for the dissemination and exploitation of the project results through a regular newsletter, training workshops, and dissemination events. In addition, the IoN will also be providing coordination support.

Veneto Nanotech (VN) will lead WP2, build up the necessary project-specific database and ensure validation and access of already existing relevant data, and of newly generated data, to all project partners.

The **National Research Centre for the Working Environment (NCRWE)** is responsible as WP3 leader for the production of after-production materials for further testing, for producing human exposure data and for the toxicological testing of the materials in animals

Universität Bremen (UniHB) is the leader of WP4 and responsible for the Life Cycle Assessment on selected nanomaterials and nanoproducts and the development and operationalization of criteria and guiding principles for precautionary design of engineered nanomaterials.

The Technical Research Centre of Finland (VTT) will develop as WP5 leader innovative solutions for recycling, final treatment and disposal of selected nanotechnology-based materials and products, and carry out appropriate ecotoxicology studies

The **Joint Research Centre (JRC)** will help to fill knowledge gaps related to the behaviour of the selected manufactured nanomaterials in ecosystems. This will contribute to the development and implementation of testing methods and assessment of the distribution, transport, transformation and fate of selected nanomaterials, and their effects on human health and the environment.

Kaunas University of Technology (KTU) will participate in the physico-chemical characterization and analysis of the selected test nanomaterials and products, and will develop and test an analytical method appropriate to detect and quantify engineered nanoparticles in various environmental matrices.

National Institute for Research & Development in Microtechnologies (IMT) will participate in the physico-chemical characterization and analysis of the selected test materials and products, and in the development and design of new material & product properties and applications, or in new material synthesis for novel applications.

Nanologica AB (NLAB) will provide the CNT-composite materials and associated materials data, contribute to their physical-chemical characterization, and support the exploration of treatment and disposal technologies.

Nanogate (NGAG) will provide a ready-to-use nano-ZnO based test material and associated product data and contribute to the technical exploration and design of new solutions for sustainable use, recycling and final treatment of the provided test material.

UPM-Kymmene (UPM) will supply nano-fibres (nanocellulose) and associated product data, and contribute to the design and exploration of technical solutions for their recycling and final treatment.

