



Welcome to the 8th NanoSustain Newsletter

Dear Readers

NanoSustain has reached month 29 and will soon enter the last half year of its project duration (1 May 2010 - 30 April 2013), so most of our research partners are busy with finalizing last experiments, assays, modeling and/or material analyses, to get the necessary data required to assess the hazard, exposure, risk and impact of selected nanomaterials (TiO₂, CNTs, ZnO and nanocellulose) and associated products, and to explore technical solutions for end-of-life phases (recycling, treatment, disposal). One of the ultimate goals of the project was to contribute to the development of sustainable nanomaterials by increasing our current understanding of their hazard, exposure and release behavior along the whole life cycle, with special focus on the end-of-life phase.

On **pages 2-4** we introduce again two additional NanoSustain partner organizations, i.e. Nanologica AB (NLAB), a Swedish SME from Stockholm, who specialize in the developing, characterizing and commercializing of specific nano-scale materials, and the EC Joint Research Centre - Institute for Environment and Sustainability in Ispra/Italy, which is a customer-driven provider of scientific and technical expertise supporting the implementation and monitoring of EU policies in fields such as fate and effects of contaminants in air, water and soil systems, with the aim to achieve sustainable solutions.

On **pages 5-8**, you will find a short update of the work done so far within the various work packages. In **WP1** (project management & scientific coordination), two Webex-based online progress meetings have been organized on the 18 June 2012 and 10 September 2012, to discuss and monitor the progress of work among all partners and to identify new action points. The 6th and penultimate regular project meeting is presently scheduled to take place in Frankfurt/Germany, on the 8-9 November 2012.

WP2 has succeeded to further develop the final structure and content of the project specific material database and new data is now continuously fed into this web-based repository. We have tried to bring the final design in line with other ongoing project databases of the European Nanosafety cluster and to link it at the same time with files containing more detailed analytical and test data uploaded to the partner intranet on the project website. Also the project-specific literature database has been further updated by including studies on the environmental fate and transport of nanomaterials.

In **WP3**, most animal experiments have been finalized, but some pc characterization and comet analyses of the samples and specimens produced are still ongoing. In addition, two major deliverable reports on the behaviour of nanoparticles in complex matrices (D3.2) and on hazard characterization (D3.3) have been drafted and will be soon finalized and uploaded to the partner intranet and to SESAM, the EC online reporting tool. The main focus of work done in **WP4** was on developing different exposure models to provide the data needed to estimate the potential release of nanomaterials in the environment, which in turn is required to assess the exposure to final products during the whole life cycle (synthesis, use, recycling & disposal). Also a guideline for the precautionary design and improved recyclability of engineered nanomaterials was finished and its applicability to the nanomaterials selected within NanoSustain will now be assessed.

In **WP5**, which deals with the exploration of technical solutions for recycling, treatment and disposal, most of the experimental work has been finished or is in its final stage producing many samples and data to be now analyzed, evaluated and prepared for their dissemination and the final reporting. **WP6** gives some examples on the dissemination and exploitation of project results by the various project partners.

On **page 9** we present some news on forthcoming events in the field of nanosafety and technology that may interest our readers, including again the announcement of the program of the NanoSustain autumn school on new methods for nanoparticle characterization, taking place from 17-18 September at the Kaunas University of Technology, Lithuania.

Again, I hope you may find some issues in our Newsletter that may inspire your own work!

Best wishes

Rudolf Reuther

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Spotlight on NLAB

Founded in August 2004 as a spin-off from the Structural Chemistry Division at Stockholm University, Sweden, Nanologica (NLAB) specializes in the development of nanostructured materials. Nanologica is capable of fully



NANOLOGICATM
ENGINEERED NANOMATERIALS

characterizing material properties associated with the produced particles through techniques such as X-ray-crystallography, Transmission and Scanning Electron Microscopy, various spectroscopies, Thermo gravimetric analysis, and nitrogen and water Porosimetry, amongst others. Nanologica actively participates in various research projects at both national and international levels. Dendrimers, Orchid, NanoSustain and Nanovalid are a few of the FP7 projects in which Nanologica is a key partner.

In the NanoSustain project, NLAB has been active in characterizing various nanoparticles. NLAB activities include surface area measurements using nitrogen adsorption, as well as Thermo gravimetric analysis of the particles in order to measure their decomposition temperatures. As part of the project, NLAB will also conduct inter-laboratory characterization on the basis of Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM) and particle size analysis.

Importantly, NLAB is also working toward the development of new standard material characterization techniques and standard operational protocols (SOPs) that can be widely distributed both within the consortium, but also for further market introduction and commercialization to other producers of nanoparticles. In addition, NLAB also provides Carbon NanoTubes-composite materials and associated product data and gives corresponding technical support for the study of their final treatment and disposal in work packages.

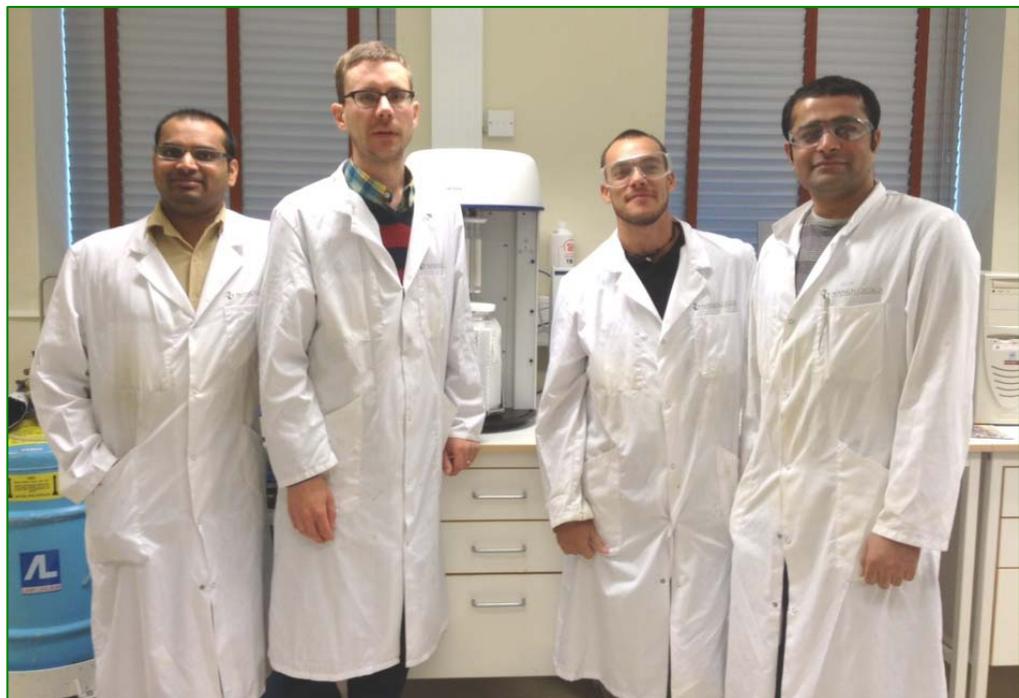


Image: Project Managers and Researchers involved in the NanoSustain and NanoValid projects working at Nanologica Laboratories.

*Left to Right: Dr. Rambabu Atluri, * Dr. Erik Nilsson* and Dr. Hanoi Labrador and Mr. Naeem Iqubal.*

(The asterisked Researchers are involved in the NanoSustain Project).



Spotlight on JRC

About JRC:

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies.



As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national. Prime objectives of the Institute for Environment and Sustainability are to investigate the level and fate of contaminants in the air, water and soil; assess the effects of these contaminants upon the environment and individuals; and promote a sustainable energy supply.

A combination of complementary expertise in the fields of environmental sciences, modelling, geomatics and remote sensing puts JRC IES in a leading position to contribute to the implementation of the European Research Area and to the achievement of a sustainable environment.

Role and main tasks in the project:

The JRC is helping to fill knowledge gaps related to the behaviour of selected manufactured nanomaterials in ecosystems. Knowledge gaps regarding the toxicity of, and exposure to, manufactured nanomaterials have been identified as critical factors for assessing their potential risks. The unusual properties of materials at the nanoscale call for a major review of existing risk assessment frameworks, methodologies and tools in order to understand the potential risk posed by these new materials both for human health and the environment. This will contribute to the development and implementation of testing methods for nanotoxicology and evaluation of the applicability and efficacy of techniques for assessing the potential toxicity and ecotoxicity of nanomaterials. Based on the gathered and newly generated data from WP2, WP3, WP4 and WP5, JRC is developing nanospecific methods for assessment of the risks due to distribution, transport, transformation and fate of selected nanomaterials, and their effects on human health and the environment, as well as risk management systems taking into account the properties of nanomaterials and related products at all stages of the life cycle.

Key senior staff:



Dr David Rickerby is a member of the JRC Institute for Environment and Sustainability, with responsibilities for developing new research strategies to prevent emerging environmental health threats, and to strengthen the capacity for policy support in this area. His activities include technology foresight studies and the evaluation of environmental and health risks of new technological development. He has carried out research on sensors for environmental monitoring and is currently developing future research programmes on benefits and risks of innovative environmental nanotechnologies. He is a member of the OECD Working Party on Manufactured Nanomaterials, Steering Group 9 on the Environmentally Sustainable Use of Nanotechnology.

Dr Andreas Skouloudis works in the IES with the role of coordinating the JRC support for the Environment and Health Action plan. His responsibilities include information technology applications for sustainable development and bioinformatics. As head of the Urban Impact Assessments sector he had responsibility for defining emission reductions for pollutants, verifying that these reductions were optimum and cost-effective and monitoring how they would affect population health. He has also coordinated several Framework Programme projects on environmental pollution and interacts closely with the European Environment Agency and the World Health Organisation.



Spotlight on JRC

JRC Dissemination Activities



Image: Andreas Skouloudis presents a paper based on results obtained by the JRC team during the NanoSustain project at the iNTeg-Risk Conference held recently in Stuttgart



Partner Spotlight: JRC

Image: David Rickerby meets with nanomaterials researchers at the National Materials and Technology Centre during a fact finding mission to Thailand.





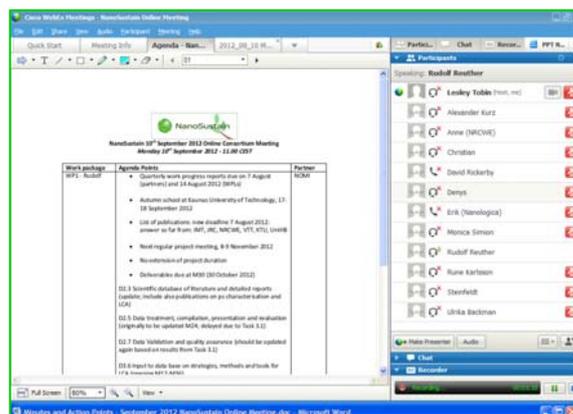
WP1: Project management

Progress meetings with NanoSustain partners

Since the last Newsletter (June 2012), NanoSustain has organized two Webex based progress online meetings among the project partners, on the 18th June and 10th September 2012 respectively, to update the current status of work and to identify critical questions and new action points.

At present, the coordinator is planning the agenda of the 6th and second last regular project meeting in Frankfurt, Germany on the 8-9 November 2012, which will be highly focused on the discussion and evaluation of the huge amount of experimental, analytical and testing data generated during the last 30 months of the project.

Image: Screenshot of online progress meeting interface between NanoSustain partners



WP2: Data gathering, generation, evaluation, and validation

Project results database and Data validation

The activity carried out in the last period concentrated on the definition of the final structure of the project results database, according to the comments of the project partners, each for his area of expertise, and taking into account the expected format of the experimental data produced.

The final structure is in line with other databases that are produced and used in other Nanosafety European projects. In addition, it includes built-in links to files that will be placed on the NanoSustain website, and that will contain more data, such as TEM images of nanoparticles, background information about toxicity data (e.g. protocols, comments), helping to better understand and interpret the data.

Currently, the database is being filled in, and only few modifications are expected to accommodate possible difficulties linked to the data format. Once the database is complete for the physical-chemical data, PP3 (NRWCE) will guide the inter-lab validation procedure with the support of other partners (KTU, IMT, Nanologica, JRC, NRCWE). The adopted strategy will address measures performed with SEM and TEM (regarding morphology and primary particle size), XRD (regarding structure), Z-potential (surface charge) and DLS (regarding particle size). Such measures will be repeated in at least three laboratories from the consortium, on a single batch of particles. The expected results are the certification of: 1. the validity of the results, and 2. the protocols.

Literature database

The next and final update of the literature database is currently being implemented and is mainly addressing the environmental fate and transport of nanomaterials. We will include also the best papers on human health and ecotoxicology, always using the selection criteria about characterisation and testing quality. Generally, we will focus only on the papers published in the last 12 months. This last batch of papers will be statistically evaluated on his own, to be able to compare the quality and distribution of papers with respect of the precedent period.



WP3: Hazard characterisation and impact assessment

During the last three months, the following work has been carried out within WP3:

- ❑ RNA purification and mRNA expression analysis from tissues from mice exposed to pure nanoparticles and sanding dusts has been finalized
- ❑ determination of DNA strand breaks in liver and lung tissue from mice exposed nanoparticles and sanding dusts is ongoing
- ❑ Sanding experiments, dustiness testing and exposure characterization has been finalized
- ❑ Physical-chemical characterization is ongoing
- ❑ Collection of data required for risk analysis of TiO₂, ZnO, CNT and nanocellulose
- ❑ Two preliminary reports have been written based on the work performed in WP3:
 - D3.2 The behaviour of nanoparticles in complex matrices
 - D3.3 Hazard characterization

WP4: Life cycle assessment and prospective technological assessment

During the last months, work in WP4 has focused firstly on the exposure modelling of engineered nanoparticles by using the life cycle perspective. Based on a literature search of existing available emission data, identification of starting points, and release quantities of nanomanufacturing and processes to environment were accomplished. Our enhanced LCA model will provide data for potential nanomaterial release in the environmental setting and is urgently needed for the exposure assessment of final products in their complete life cycle (i.e. synthesis, use, and recycling & disposal).

In cooperation with our Swiss subcontract partner we have developed different exposure models. The modelling will be performed based on a Probabilistic Material Flow Analysis (PMFA) approach. PMFA has been developed for modelling concentrations of potential contaminants in complex environmental systems. This stochastic model bases on Monte Carlo (MC) and Bayesian concepts and includes sensitivity and uncertainty/variability calculations to generate predicted environmental concentrations (PEC). It should be used in cases determined by a distinct lack of model data. Model input parameters in this exposure-modelling framework cover contaminant material production use and application in products (consumption), environmental release and fate kinetics during the whole life cycle of the target substances and products containing them.

Secondly, we have finished a guideline for precautionary design and improved recyclability of engineered nanomaterials. This developed comprehensive approach is derived from several qualitative and semi-qualitative approaches to risk assessment and to criticality of materials, and is supplemented with environmental impact categories of Life Cycle Assessment. This concept includes precautionary risk aspects, resource aspects, and environmental impact categories. In a next step, the applicability of this approach for the precautionary design and for improved recyclability of engineered nanomaterials on the selected nanomaterials is checked.



WP5: Development of innovative solutions for recycling and final treatment

A lot of the experimental work in WP 5 is being finalised in order to have enough time for analysis of the results and reporting before the end of the project. The preliminary results from the large scale compost tests of nanocellulose at VTT have generated some promising results, but still some analysis of the results are needed to draw the final conclusions. The incineration of CNT composite is a challenging task and also the analysis of the fuel and ash requires special knowledge. In order to be able to track low amounts of CNT from the ash, RAMAN analyses have been carried out at the Kaunas Technical University (KTU). The National Institute for Research and Development in Microtechnologies (IMT) is generating some interesting data while modelling the transport of nanoparticles released in various environmental media. In the near future a lot of data analysis and reporting will take place. Also publications will be prepared on the results achieved.

WP6: Dissemination and exploitation of results

NRCWE Dissemination—Conference presentations

NRCWE researchers presented NanoSustain by giving two presentations at ISMFs annual topical conference, 24th May 2012 (Årsmøde on nanomaterialer, Danish). National Museum, Copenhagen, Denmark:

Title of presentation by Keld Alstrup Jensen: NanoSafer – A control-banding tool for self-evaluation of the potential risk level.

Title of presentation by Anne Thoustrup Saber: Brug af nanopartikler i maling: Hvad betyder det for vores sundhed? (Danish).

NRCWE Dissemination activities:

NRCWE was the organizer of a 3/4 day workshop at the course: "Environmental and Human Health Risk Assessment of Chemicals", June 13th, 2012: Nanoparticles in the paint and Lacquer industry. Title of workshop: How is risk assessment done in real life? The theme of the workshop was toxic effects of nanoparticles when part of a paint matrix. The lectures and group work was based on results obtained in NANOKEM and NANOSUSTAIN (Number of university students ~20)

Presentation at the conference "SAFETY ISSUES AND REGULATORY CHALLENGES OF NANOMATERIALS", CIC biomaGUNE. San Sebastián (Spain), 3rd/4th May 2012 (www.leitat.org/nanoLCA). Title of presentation by Håkan Wallin: In vivo dose-response model for ENP.

Presentation at the conference "NANOTECH 2012" in Santa Clara. Title of presentation by Keld Alstrup Jensen: From application of nanofilm surface coatings to demolition of nanocomposites – Are they sources of airborne nano-exposure? <http://www.techconnectworld.com/Nanotech2012/sym/program.html#TU2.13> (NRCWE: PM=1)

VTT Dissemination—Poster Presentations:

Lyyränen, J, Hokkinen, J, Backman, U, Auvinen, A and Jokiniemi, J: Particle characterisation from reducing CI-process producing Cu and Cu-CNT like nanoparticles - safety issues to consider for scale-up. Poster presentation at the 2012 European Aerosol Conference (EAC), Sep 2-7 2012, Granada, Spain

Lyyränen, J, Hokkinen, J, Backman, U, Auvinen, A, Jokiniemi, J and Kurz, A: Particle characterisation during melting of nanoparticle containing coated and uncoated window glass. Poster presentation at the 2012 European Aerosol Conference (EAC), Sep 2-7 2012, Granada, Spain



WP6: Dissemination and exploitation of results

JRC Dissemination —Conference Presentations

David Rickerby made an invited presentation on “Nanotechnology for Sustainable Manufacturing: Opportunities and Risks” at the American Chemical Society Meeting and Exposition in San Diego (25-29 March). A chapter on the same topic will appear in a book entitled "Green Nanotechnology and the Environment" to be published by ACS early next year

Andreas Skouloudis presented a paper on “Industrial Environmental Risk Assessment for Nanomaterials” at the 4th iNTeg-Risk Conference in Stuttgart (6-8 May). iNTeg-Risk is a large-scale integrating project aimed at improving the management of emerging risks, related to new technologies in European industry. The aim of the project is to improve early recognition and monitoring of emerging risks and decrease reaction times if major accidents involving emerging risks occur.

David Rickerby presented a paper on “Assessment of the Environmental risks of Nanomaterials throughout the Product Life Cycle” at the 6th SETAC World Congress in Berlin (20-24 May). This was a collaborative paper with two other NanoSustain partners, integrating the work of JRC on nanomaterials risk assessment with work by VTT and NRCWE on release of nanoparticles during recycling of zinc oxide coated glass and during sanding of paints containing titanium dioxide.

David Rickerby made a plenary presentation on “Potential Contribution of Nanotechnology to Sustainable Manufacturing” at the 9th International Nanotechnology Symposium in Dresden (12-13 June). An overview was given of some nanotechnology enabled innovations with particular emphasis on their implications for long term sustainability.

David Rickerby made a presentation on “Current Approaches for Environmental Risk Assessment of Nanomaterials” at theACHEMA 30th World Exhibition-Congress on Chemical Engineering, Environmental Protection and Biotechnology in Frankfurt (15-19 June). The applicability of risk assessment methodologies and tools was evaluated and ways of dealing with the current uncertainties and unknowns regarding nanomaterial properties were outlined.

NanoSafety Cluster Meeting

The next NanoSafety Cluster meeting will be held on Saturday 27th October 2012 (13:00-16:00) in Helsinki, at the Scandic Hotel Marski.

The Strategic Research Agenda will be discussed in the meeting.





Forthcoming Events

NanoSustain Autumn School, Kaunas University of Technology, Lithuania

The EU FP7 NanoSustain project (2010-2013) is organizing an Autumn school on "New methods for nanoparticle characterization", at the Research Center for Microsystems and Nanotechnology of the Kaunas University of Technology, on 17-18 September 2012. This training event will focus on emerging new trends in the rapidly growing field of nanoparticle measurement and characterization and is addressing mainly young researchers (PhD students, postdocs, etc.). It will provide an interactive learning environment with method demonstrations and highlighting best practices and new approaches in the physicochemical characterization/measurement/imaging also in relation to EHS aspects.

The Final Programme:

Day 1: 17th September, 2012

Venue: Park Inn by Radisson Kaunas Hotel , K. Donelaicio Str. 27, LT-44240 Kaunas, Lithuania

TIME	ITEM	PRESENTER(S)
12.00 – 13.00	Registration	
13.00 – 13.30	Opening and introduction into the autumn school	Valentinas Snitka, RCMN-KTU, Lithuania
Invited presentations (20 min.) and discussions (10 min.)		
13.30 – 14.00	Introduction to Scanning Probe Microscopy and Raman Spectromicroscopy: the state-of-the-art	Valentinas Snitka, RCMN-KTU, Lithuania
14.00 – 14.30	Some aspects of material characterization through the Nanosustain project	Denys Naumenko, RCMN-KTU, Lithuania
14.30 – 15.00	Coffee break	
15.00 – 15.30	Nanomaterials synthesis and characterization	Roberto Hanoi, NLAB, Sweden
15.30 – 16.00	Relationship between material properties and hazards	Ismo Koponen, NRCWE, Denmark
16.00 – 16.30	Classification of cellulose nanofibrils and suitable methods for their characterization	Jari Vartiainen, VTT, Finland
16.30 – 17.00	Coffee break	
17.00 – 18.00	Panel discussion	All Participants
18.00 – 19.00	Visit to the RCMN-KTU labs	
19.30 – 21.00	All participants: city walk through the old part of Kaunas followed by social dinner.	

Day 2: 18th September, 2012

Venue: Research Center for Microsystems and Nanotechnology, Kaunas University of Technology, Student str. 65, LT-51369, Kaunas, Lithuania

Training session introducing into Raman and SMP characterization methodology	
9.00 – 11.00	Raman and SPM characterization of inorganic materials (nanoparticles, nanotubes)
11.00 – 11.30	Coffee break
11.30 – 13.30	Raman characterization of biological objects (proteins, tissues)
13.30 – 14.00	Evaluation of results and final discussion
14.00	End of school: Each participant will be given a certificate of attendance from the Kaunas Technical University



Forthcoming Events

□ *Nanosafety Workshop at Imagine Nano 2013*

The European FP7 project "Health Impact of Engineered Metal and Metal Oxide Nanoparticles" (HINAMOX) will organise a workshop on Nano Safety at the ImagineNano Conference to be held in Bilbao, 23-26 April 2013.

http://www.imagenano.com/INDUSTRY/Industry_Imaginenano.php?p=IS



□ *The 9th International Nanotechnology Conference on Communication and Cooperation*

The 9th International Nanotechnology Conference on Communication and Cooperation will be held in Berlin on 14-17 May 2013. The European Commission is one of the organizers and leading European, Japanese and US policy makers and technologists will participate. A special session will be organized on the economical and societal implications of nanotechnology.

<http://www.inc9.de/index.php?id=home>



□ *The 2013 Materials Research Society Spring Meeting*



The 2013 Materials Research Society Spring Meeting will be held in San Francisco on 1-5 April 2013. It will include a symposium on Nanotechnology and Sustainability. Among topics that the symposium will cover are green design and recyclability of nanomaterials and devices

<http://www.mrs.org/s13-cfp-z/>



[NanoFATE](#) (Nanoparticle Fate Assessment and Toxicity in the Environment) is now entering its third year.

[Work has progressed well](#) and NanoFATE is now moving from the initial phase of characterizing particles, their fate and environmental hazard in standard systems to working in environmentally realistic media and concentrations.

We have also started outreach to a broader range of stakeholders, with a [popular science feature article in International Innovation](#). Our upcoming ["plain English" Newsletter](#) will explain the ins and outs of a highly integrative, transdisciplinary research endeavour.



- **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)** is responsible as WP6 leader for the dissemination and exploitation of the project results through a regular newsletter, training workshops, and dissemination events. 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.

